

# Package ‘Sleuth2’

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**Title** Data Sets from Ramsey and Schafer's ``Statistical Sleuth (2nd Ed)''

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**Description** Data sets from Ramsey, F.L. and Schafer, D.W. (2002), ``The  
Statistical Sleuth: A Course in Methods of Data Analysis (2nd  
ed)'', Duxbury.

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**VignetteBuilder** knitr

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Sleuth2-package      *The R Sleuth2 package*

---

**Description**

Data sets from Ramsey and Schafer's "Statistical Sleuth (2nd ed)"

**Details**

This package contains a variety of datasets. For a complete list, use `library(help="Sleuth2")` or `Sleuth2Manual()`.

**Author(s)**

Original by F.L. Ramsey and D.W. Schafer

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case0101      *Motivation and Creativity*

---

**Description**

Data from an experiment concerning the effects of intrinsic and extrinsic motivation on creativity. Subjects with considerable experience in creative writing were randomly assigned to one of two treatment groups.

**Usage**

`case0101`

**Format**

A data frame with 47 observations on the following 2 variables.

Score    creativity score

Treatment    factor denoting the treatment group

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Amabile, T. (1985). Motivation and Creativity: Effects of Motivational Orientation on Creative Writers, *Journal of Personality and Social Psychology* **48**(2): 393–399.

**Examples**

```
str(case0101)
boxplot(Score~Treatment, case0101)
```

---

case0102

*Sex Discrimination in Employment*

---

**Description**

The data are the beginning salaries for all 32 male and all 61 female skilled, entry-level clerical employees hired by a bank between 1969 and 1977.

**Usage**

```
case0102
```

**Format**

A data frame with 93 observations on the following 2 variables.

Salary starting salaries (in US\$)

Sex sex of the clerical employee

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Roberts, H.V. (1979). Harris Trust and Savings Bank: An Analysis of Employee Compensation, *Report 7946*, Center for Mathematical Studies in Business and Economics, University of Chicago Graduate School of Business.

**See Also**

[case1202](#)

**Examples**

```
str(case0102)
boxplot(Salary~Sex, case0102)
```

---

`case0201`*Bumpus's Data on Natural Selection (Humerus)*

---

**Description**

As evidence in support of natural selection, Bumpus presented measurements on house sparrows brought to the Anatomical Laboratory of Brown University after an uncommonly severe winter storm. Some of these birds had survived and some had perished. Bumpus asked whether those that perished did so because they lacked physical characteristics enabling them to withstand the intensity of that particular instance of selective elimination. The data are on the humerus (arm bone) lengths for the 24 adult male sparrows that perished and for the 35 adult males that survived.

**Usage**`case0201`**Format**

A data frame with 59 observations on the following 2 variables.

Humerus Humerus length of adult male sparrows (in inches)

Status factor variable indicating whether the sparrow perished or survived in a winter storm

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**See Also**

[ex0221](#), [ex2016](#)

**Examples**

```
str(case0201)
with(subset(case0201, Status=="Perished"), stem(Humerus, scale=10))
with(subset(case0201, Status=="Survived"), stem(Humerus))
```

---

case0202

*Anatomical Abnormalities Associated with Schizophrenia*

---

### Description

Are any physiological indicators associated with schizophrenia? In a 1990 article, researchers reported the results of a study that controlled for genetic and socioeconomic differences by examining 15 pairs of monozygotic twins, where one of the twins was schizophrenic and the other was not. The researchers used magnetic resonance imaging to measure the volumes (in  $\text{cm}^3$ ) of several regions and subregions of the twins' brains.

### Usage

case0202

### Format

A data frame with 15 observations on the following 2 variables.

Unaffected volume of left hippocampus of unaffected twin (in  $\text{cm}^3$ )

Affected volume of left hippocampus of affected twin (in  $\text{cm}^3$ )

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

Suddath, R.L., Christison, G.W., Torrey, E.F., Casanova, M.F. and Weinberger, D.R. (1990). Anatomical Abnormalities in the Brains of Monozygotic Twins Discordant for Schizophrenia, *New England Journal of Medicine* **322**(12): 789–794.

### Examples

```
str(case0202)
with(case0202, stem(Unaffected-Affected, scale=2))
```



---

`case0301`*Cloud Seeding*

---

**Description**

Does dropping silver iodide onto clouds increase the amount of rainfall they produce? In a randomized experiment, researchers measured the volume of rainfall in a target area (in acre-feet) on 26 suitable days in which the clouds were seeded and on 26 suitable days in which the clouds were not seeded.

**Usage**`case0301`**Format**

A data frame with 52 observations on the following 2 variables.

`Rainfall` the volume of rainfall in the target area (in acre-feet)

`Treatment` a factor with levels "Unseeded" and "Seeded" indicating whether the clouds were unseeded or seeded.

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Simpson, J., Olsen, A., and Eden, J. (1975). A Bayesian Analysis of a Multiplicative Treatment Effect in Weather Modification. *Technometrics* **17**: 161–166.

**Examples**

```
str(case0301)
boxplot(Rainfall ~ Treatment, case0301)
boxplot(log(Rainfall) ~ Treatment, case0301)
library(lattice)
bwplot(Treatment ~ log(Rainfall), case0301)
bwplot(log(Rainfall) ~ Treatment, case0301)
```

---

case0302

*Agent Orange*

---

### Description

In 1987, researchers measured the TCDD concentration in blood samples from 646 U.S. veterans of the Vietnam War and from 97 U.S. veterans who did not serve in Vietnam. TCDD is a carcinogenic dioxin in the herbicide called Agent Orange, which was used to clear jungle hiding areas by the U.S. military in the Vietnam War between 1962 and 1970.

### Usage

```
data(case0302)
```

### Format

A data frame with 743 observations on the following 2 variables.

Dioxin the concentration of TCDD, in parts per trillion

Veteran factor variable with two levels, "Vietnam" and "Other", to indicate the type of veteran

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

Centers for Disease Control Veterans Health Studies: Serum 2,3,7,8-Tetraclorodibenzo-p-dioxin Levels in U.S. Army Vietnam-era Veterans. *Journal of the American Medical Association* **260**: 1249–1254.

### Examples

```
str(case0302)
boxplot(Dioxin ~ Veteran, case0302)
t.test(Dioxin ~ Veteran, case0302)
## To examine results with largest dioxin omitted
t.test(Dioxin ~ Veteran, case0302, subset=(Dioxin < 40))
```

---

case0401	<i>Space Shuttle</i>
----------	----------------------

---

**Description**

The number of space shuttle O-ring incidents for 4 space shuttle launches when the air temperatures was below 65 degrees F and for 20 space shuttle launches when the air temperature was above 65 degrees F.

**Usage**

case0401

**Format**

A data frame with 24 observations on the following 2 variables.

Incidents the number of O-ring incidents

Launch factor variable with two levels—"Cool" and "Warm"

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Feynman, R.P. (1988). *What do You Care What Other People Think?* W. W. Norton.

**See Also**

[ex2011](#), [ex2223](#)

**Examples**

```
str(case0401)
stem(subset(case0401, Launch=="Cool", Incidents, drop=TRUE))
stem(subset(case0401, Launch=="Warm", Incidents, drop=TRUE))
```

---

case0402

*Cognitive Load*

---

### Description

Educational researchers randomly assigned 28 ninth-year students in Australia to receive coordinate geometry training in one of two ways: a conventional way and a modified way. After the training, the students were asked to solve a coordinate geometry problem. The time to complete the problem was recorded, but five students in the “conventional” group did not complete the solution in the five minute allotted time.

### Usage

case0402

### Format

A data frame with 28 observations on the following 3 variables.

Time the time (in seconds) that the student worked on the problem

Treatmt factor variable with two levels—“Modified” and “Conventional”

Censor 1 if the individual did not complete the problem in 5 minutes, 0 if they did

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

Sweller, J., Chandler, P., Tierney, P. and Cooper, M. (1990). Cognitive Load as a Factor in the Structuring of Technical Material, *Journal of Experimental Psychology General* **119**(2): 176–192.

### Examples

```
str(case0402)
stem(subset(case0402, Treatmt=="Conventional", Time, drop=TRUE))
stem(subset(case0402, Treatmt=="Modified", Time, drop=TRUE))
wilcox.test(Time ~ Treatmt, case0402)
```

---

case0501

*Diet Restriction and Longevity*


---

### Description

Female mice were randomly assigned to six treatment groups to investigate whether restricting dietary intake increases life expectancy. Diet treatments were:

1. "NP"—mice ate unlimited amount of nonpurified, standard diet
2. "N/N85"—mice fed normally before and after weaning. After weaning, ration was controlled at 85 kcal/wk
3. "N/R50"—normal diet before weaning and reduced calorie diet (50 kcal/wk) after weaning
4. "R/R50"—reduced calorie diet of 50 kcal/wk both before and after weaning
5. "N/R50 lopro"—normal diet before weaning, restricted diet (50 kcal/wk) after weaning and dietary protein content decreased with advancing age
6. "N/R40"—normal diet before weaning and reduced diet (40 Kcal/wk) after weaning.

### Usage

```
case0501
```

### Format

A data frame with 349 observations on the following 2 variables.

Lifetime the lifetime of the mice (in months)

Diet factor variable with six levels—"NP", "N/N85", "lopro", "N/R50", "R/R50" and "N/R40"

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

Weindruch, R., Walford, R.L., Fligiel, S. and Guthrie D. (1986). The Retardation of Aging in Mice by Dietary Restriction: Longevity, Cancer, Immunity and Lifetime Energy Intake, *Journal of Nutrition* **116**(4):641–54.

### Examples

```
str(case0501)
boxplot(Lifetime~Diet, width=c(rep(.8,6)), data=case0501,
        xlab="Diet", ylab="Lifetime in months")
summary(subset(case0501, Diet=="NP", Lifetime))
```

---

 case0502

*The Spock Conspiracy Trial*


---

### Description

In 1968, Dr. Benjamin Spock was tried in Boston on charges of conspiring to violate the Selective Service Act by encouraging young men to resist being drafted into military service for Vietnam. The defence in the case challenged the method of jury selection claiming that women were underrepresented. Boston juries are selected in three stages. First 300 names are selected at random from the City Directory, then a venire of 30 or more jurors is selected from the initial list of 300 and finally, an actual jury is selected from the venire in a nonrandom process allowing each side to exclude certain jurors. There was one woman on the venire and no women on the final list. The defence argued that the judge in the trial had a history of venires in which women were systematically underrepresented and compared the judge's recent venires with the venires of six other Boston area district judges.

### Usage

```
case0502
```

### Format

A data frame with 46 observations on the following 2 variables.

Percent is the percent of women on the venire's of the Spock trial judge and 6 other Boston area judges

Judge a factor with levels "Spock's", "A", "B", "C", "D", "E" and "F"

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

Zeisel, H. and Kalven, H. Jr. (1972). Parking Tickets and Missing Women: Statistics and the Law in Tanur, J.M. et al. (eds.) *Statistics: A Guide to the Unknown*, Holden-Day.

### Examples

```
str(case0502)
boxplot(Percent~Judge, data=case0502,
        xlab="Judge",ylab="Percentage of Women")
percent.spocks <- subset(case0502, Judge == "Spock's", Percent)
percent.others <- subset(case0502, Judge != "Spock's", Percent)
t.test( percent.spocks,percent.others)
summary(aov(Percent~Judge, case0502, subset = Judge != "Spock's"))
```

```
#as in Display 5.10
summary(aov(Percent~Judge, case0502))
```

---

case0601

*Discrimination Against the Handicapped*


---

## Description

Study explores how physical handicaps affect people's perception of employment qualifications. Researchers prepared 5 videotaped job interviews using actors with a script designed to reflect an interview with an applicant of average qualifications. The 5 tapes differed only in that the applicant appeared with a different handicap in each one. Seventy undergraduate students were randomly assigned to view the tapes and rate the qualification of the applicant on a 0-10 point scale.

## Usage

```
case0601
```

## Format

A data frame with 70 observations on the following 2 variables.

Score is the score each student gave to the applicant

Handicap is a factor variable with 5 levels—"None", "Amputee", "Crutches", "Hearing" and "Wheelchair"

## Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

## References

Cesare, S.J., Tannenbaum, R.J. and Dalessio, A. (1990). Interviewers' Decisions Related to Applicant Handicap Type and Rater Empathy, *Human Performance* **3**(3): 157–171.

## Examples

```
str(case0601)
boxplot(Score~Handicap, data=case0601, ylab="Score")
aov.handicap <- aov(Score ~ Handicap, case0601)
summary(aov.handicap)
TukeyHSD(aov.handicap)

#Calculate confidence interval for linear combination
#(wheelchair+crutches)/2 - (amputee+hearing)/2 as in Display 6.4
mean.handicaps <- with(case0601, tapply(Score, Handicap, mean))
var.handicaps <- with(case0601, tapply(Score, Handicap, var))
```

```

n <- 14
s.pooled <- sqrt(sum((n-1)*var.handicaps)/sum((n-1)*5))

## either
cr.wh <- mean.handicaps["Wheelchair"] + mean.handicaps["Crutches"]
am.he <- mean.handicaps["Amputee"] + mean.handicaps["Hearing"]
g <- cr.wh/2 - am.he/2
## or
contr <- c(0, -1, 1, -1, 1)/2
g <- sum(contr * mean.handicaps)

se.g <- s.pooled * sqrt(sum(contr^2)/n)
t.65 <- qt(.975, 65)
## ci
g + c(-1,1) * t.65 * se.g

```

---

case0602

---

*Mate Preference of Platyfish*


---

### Description

Do female Platyfish prefer male Platyfish with yellow swordtails? A.L. Basolo proposed and tested a selection model in which females have a pre-existing bias for a male trait even before the males possess it. Six pairs of males were surgically given artificial, plastic swordtails—one pair received a bright yellow sword, the other a transparent sword. Females were given the opportunity to engage in courtship activity with either of the males. Of the total time spent by each female engaged in courtship during a 20 minute observation period, the percentages of time spent with the yellow-sword male were recorded.

### Usage

```
case0602
```

### Format

A data frame with 84 observations on the following 3 variables.

Proportion The proportion of courtship time spent by 84 females with the yellow-sword males

Pair Factor variable with 6 levels—"Pair 1", "Pair 2", "Pair 3", "Pair 4", "Pair 5" and "Pair 6"

Length Body size of the males

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.



## References

Basolo, A.L. (1990). Female Preference Predates the Evolution of the Sword in Swordtail Fish, *Science* **250**: 808–810.

## Examples

```
str(case0602)
boxplot(Proportion~Pair, case0602, ylab="Proportion")

#as in Display 6.5
summary(aov(Proportion~Pair, case0602))

n.fish <- with(case0602, tapply(Proportion, Pair, length))
av.fish <- with(case0602, tapply(Proportion, Pair, mean))
sd.fish <- with(case0602, tapply(Proportion, Pair, sd))
male.body.size <- with(case0602, tapply(Length, Pair, unique))
mean.body <- mean(male.body.size)
table.fish <- data.frame(n.fish, round(av.fish*100,2),
                        round(sd.fish*100,2), male.body.size,
                        2*(male.body.size-mean.body))
names(table.fish) <- c("n", "average", "sd", "male.body.size", "coefficient")
s.pooled <- with(table.fish, round(sqrt(sum(sd^2*(n-1))/sum(n-1)),2))
g <- with(table.fish, sum(average*coefficient))
se.g <- with(table.fish, round(s.pooled*sqrt(sum(coefficient^2/n)),2))
g/se.g
```

---

case0701

*The Big Bang*

---

## Description

Hubble's initial data on 24 nebulae outside the Milky Way.

## Usage

case0701

## Format

A data frame with 24 observations on the following 2 variables.

Velocity recession velocity (in kilometres per second)

Distance distance from earth (in magaparsec)

## Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Hubble, E. (1929). A Relation Between Distance and Radial Velocity Among Extragalactic Nebulae, *Proceedings of the National Academy of Science* **15**: 168–173.

**See Also**

[ex0727](#)

**Examples**

```
str(case0701)
plot(case0701)
```

---

case0702

*Meat Processing and pH*

---

**Description**

A certain kind of meat processing may begin once the pH in postmortem muscle of a steer carcass has decreased sufficiently. To estimate the timepoint at which pH has dropped sufficiently, 10 steer carcasses were assigned to be measured for pH at one of five times after slaughter.

**Usage**

```
case0702
```

**Format**

A data frame with 10 observations on the following 2 variables.

Time time after slaughter (hours)

pH pH level in postmortem muscle

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Schwenke, J.R. and Milliken, G.A. (1991). On the Calibration Problem Extended to Nonlinear Models, *Biometrics* **47**(2): 563–574.

**See Also**

[ex0816](#)

**Examples**

```
str(case0702)
plot(case0702)
```

---

case0801	<i>Island Area and Number of Species</i>
----------	--

---

**Description**

The data are the numbers of reptile and amphibian species and the island areas for seven islands in the West Indies.

**Usage**

```
case0801
```

**Format**

A data frame with 7 observations on the following 2 variables.

Area area of island (in square miles)

Species number of reptile and amphibian species on island

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**Examples**

```
str(case0801)
plot(case0801)
```

---

case0802	<i>Breakdown Times for Insulating Fluid under different Voltage</i>
----------	---

---

**Description**

In an industrial laboratory, under uniform conditions, batches of electrical insulating fluid were subjected to constant voltages until the insulating property of the fluids broke down. Seven different voltage levels were studied and the measured responses were the times until breakdown.

**Usage**

```
case0802
```

**Format**

A data frame with 76 observations on the following 3 variables.

Time times until breakdown (in minutes)

Voltage voltage applied (in kV)

Group factor variable (group number)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**Examples**

```
str(case0802)
plot(log(Time)~Voltage, case0802)
```

---

case0901

*Effects of Light on Meadowfoam Flowering*

---

**Description**

Meadowfoam is a small plant found growing in moist meadows of the US Pacific Northwest. Researchers reported the results from one study in a series designed to find out how to elevate meadowfoam production to a profitable crop. In a controlled growth chamber, they focused on the effects of two light-related factors: light intensity and the timing of the onset of the light treatment.

**Usage**

```
case0901
```

**Format**

A data frame with 24 observations on the following 3 variables.

Flowers average number of flowers per meadowfoam plant

Time time light intensity regiments started

Intens light intensity (in  $\mu\text{mol}/\text{m}^2/\text{sec}$ )

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**Examples**

```
str(case0901)
plot(Flowers~Intens, case0901, pch= ifelse(Time=="Early", 19, 21))
```

---

`case0902`*Why Do Some Mammals Have Large Brains for Their Size?*

---

**Description**

The data are the average values of brain weight, body weight, gestation lengths (length of pregnancy) and litter size for 96 species of mammals.

**Usage**`case0902`**Format**

A data frame with 96 observations on the following 5 variables.

Species species

Brain average brain weight (in grams)

Body average body weight (in kilograms)

Gestation gestation period (in days)

Litter average litter size

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**See Also**

[case0902](#)

**Examples**

```
str(case0902)
pairs(log(Brain)~log(Body)+log(Litter)+Gestation, case0902)
```

---

`case1001`*Galileo's Data on the Motion of Falling Bodies*

---

**Description**

In 1609 Galileo proved mathematically that the trajectory of a body falling with a horizontal velocity component is a parabola. His search for an experimental setting in which horizontal motion was not affected appreciably (to study inertia) let him to construct a certain apparatus. The data comes from one of his experiments.

**Usage**`case1001`**Format**

A data frame with 7 observations on the following 2 variables.

Distance horizontal distances (in punti)

Height initial height (in punti)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**Examples**

```
str(case1001)
plot(Distance ~ Height, case1001)
```

---

`case1002`*The Energy Costs of Echolocation by Bats*

---

**Description**

The data are on in-flight energy expenditure and body mass from 20 energy studies on three types of flying vertebrates: echolocating bats, non-echolocating bats and non-echolocating birds.

**Usage**`case1002`

**Format**

A data frame with 20 observations on the following 4 variables.

Species species

Mass mass (in grams)

Type a factor with 3 levels indicating the type of flying vertebrate

Energy in-flight energy expenditure (in W)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Speakman, J.R. and Racey, P.A. (1991). No cost of Echolocation for Bats in Flight, *Nature* **350**: 421–423.

**Examples**

```
str(case1002)

plot(log(Energy)~log(Mass), case1002,
     pch = ifelse(Type=="echolocating bats", 19,
                  ifelse(Type=="non-echolocating birds", 21, 24)))

plot(Energy~Mass, case1002, log="xy",
     xlab = "Body Mass (g) (log scale)",
     ylab = "Energy Expenditure (W) (log scale)",
     pch = ifelse(Type=="echolocating bats", 19,
                  ifelse(Type=="non-echolocating birds", 21, 24)))
legend(7, 50, pch=c(24, 21, 19),
      c("Non-echolocating bats", "Non-echolocating birds", "Echolocating bats"))

library(lattice)
yticks <- c(1,2,5,10,20,50)
xticks <- c(10,20,50,100,200,500)
xyplot(Energy ~ Mass, case1002, groups=Type,
      scales = list(log=TRUE, y=list(at=yticks), x=list(at=xticks)),
      ylab = "Energy Expenditure (W) (log scale)",
      xlab = "Body Mass (g) (log scale)",
      auto.key = list(x = 0.2, y = 0.9, corner = c(0, 1), border = TRUE))
```

---

 case1101

*Alcohol Metabolism in Men and Women*


---

**Description**

These data were collected on 18 women and 14 men to investigate a certain theory on why women exhibit a lower tolerance for alcohol and develop alcohol-related liver disease more readily than men.

**Usage**

case1101

**Format**

A data frame with 32 observations on the following 5 variables.

Subject subject number in the study

Metabol first-pass metabolism of alcohol in the stomach (in mmol/liter-hour)

Gastric gastric alcohol dehydrogenase activity in the stomach (in  $\mu\text{mol}/\text{min}/\text{g}$  of tissue)

Sex sex of the subject

Alcohol whether the subject is alcoholic or not

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**Examples**

```
str(case1101)

plot(Metabol~Gastric, case1101,
     pch=ifelse(Sex=="Female", 19, 21),
     col=ifelse(Alcohol=="Alcoholic", "red", "green"))
legend(1,12, pch=c(19,21,19,21), col=c("green","green", "red", "red"),
      c("Non-alcoholic Females", "Non-alcoholic Males",
        "Alcoholic Females", "Alcoholic Males"))

library(lattice)
xyplot(Metabol~Gastric|Sex*Alcohol, case1101)
xyplot(Metabol~Gastric, case1101, groups=Sex:Alcohol,
      auto.key=list(x=0.2, y=0.8, corner=c(0,0), border=TRUE))
```



---

`case1102`*The Blood–Brain Barrier*

---

**Description**

The human brain is protected from bacteria and toxins, which course through the blood–stream, by a single layer of cells called the blood–brain barrier. These data come from an experiment (on rats, which possess a similar barrier) to study a method of disrupting the barrier by infusing a solution of concentrated sugars.

**Usage**`case1102`**Format**

A data frame with 34 observations on the following 9 variables.

Brain Brain tumor count (per gm)

Liver Liver count (per gm)

Time Sacrifice time (in hours)

Treat Treatment received

Days Days post inoculation

Sex Sex of the rat

Weight Initial weight (in grams)

Loss Weight loss (in grams)

Tumor Tumor weight (in  $10^{-4}$  grams)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**Examples**

```
str(case1102)
```

```
plot(Brain/Liver ~ Time, case1102, log="xy", pch=ifelse(Treat=="BD", 19,21))  
legend(10,0.1, pch=c(19,21), c("Saline control", "Barrier disruption"))
```

---

`case1201`*State Average SAT Scores*

---

**Description**

Data on the average SAT scores for US states in 1982 and possible associated factors.

**Usage**`case1201`**Format**

A data frame with 50 observations on the following 8 variables.

State US state

SAT state averages of the total SAT (verbal + quantitative) scores

Takers the percentage of the total eligible students (high school seniors) in the state who took the exam

Income the median income of families of test-takers (in hundreds of dollars)

Years the average number of years that the test-takers had formal studies in social sciences, natural sciences and humanities

Public the percentage of the test-takers who attended public secondary schools

Expend the total state expenditure on secondary schools (in hundreds of dollars per student)

Rank the median percentile ranking of the test-takers within their secondary school classes

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**Examples**

```
str(case1201)
pairs(SAT~Rank+Years+Income+Public+Expend, case1201)
```

---

case1202

*Sex discrimination in Employment*

---

### Description

Data on employees from one job category (skilled, entry-level clerical) of a bank that was sued for sex discrimination. The data are on 32 male and 61 female employees, hired between 1965 and 1975.

### Usage

case1202

### Format

A data frame with 93 observations on the following 7 variables.

Bsal Annual salary at time of hire

Sal77 Salary as of March 1975

Sex Sex of employee

Senior Seniority (months since first hired)

Age Age of employee (in months)

Educ Education (in years)

Exper Work experience prior to employment with the bank (months)

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

Roberts, H.V. (1979). Harris Trust and Savings Bank: An Analysis of Employee Compensation, *Report 7946*, Center for Mathematical Studies in Business and Economics, University of Chicago Graduate School of Business.

### See Also

[case0102](#)

### Examples

```
str(case1202)
pairs(Sal77~Bsal+Senior+Age+Exper, case1202)
```

---

 case1301

*Seaweed Grazers*


---

### Description

To study the influence of ocean grazers on regeneration rates of seaweed in the intertidal zone, a researcher scraped rock plots free of seaweed and observed the degree of regeneration when certain types of seaweed-grazing animals were denied access. The grazers were limpets (L), small fishes (f) and large fishes (F). Each plot received one of six treatments named by which grazers were allowed access. In addition, the researcher applied the treatments in eight blocks of 12 plots each. Within each block she randomly assigned treatments to plots. The blocks covered a wide range of tidal conditions.

### Usage

```
case1301
```

### Format

A data frame with 96 observations on the following 3 variables.

Cover percent of regenerated seaweed cover

Block a factor with levels "B1", "B2", "B3", "B4", "B5", "B6", "B7" and "B8"

Treat a factor indicating treatment, with levels "C", "f", "ff", "L", "Lf" and "Lff"

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

Olson, A. (1993). Evolutionary and Ecological Interactions Affecting Seaweeds, Ph.D. Thesis. Oregon State University.

### Examples

```
str(case1301)

# full two-way model with interactions
fitfull <- aov(Cover ~ Treat*Block, case1301)
# Residual plot indicates a transformation might help
plot(fitfull)

# Log of seaweed "regeneration ratio"
y <- with(case1301, log(Cover/(100-Cover)))
# Full two-way model with interactions
fitfull <- aov(y~Treat*Block, case1301)
```

```

# No problems indicated by residual plot
plot(fitfull)
# Note that interactions are not statistically significant
anova(fitfull)
# Additive model (no interactions)
fitadditive <- aov(y ~ Treat + Block, case1301)

# Make indicator variables for presence of limpets, small fish, and large fish
lmp <- with(case1301, ifelse(Treat %in% c("L", "Lf", "Lff"), 1, 0))
sml <- with(case1301, ifelse(Treat %in% c("f", "ff", "Lf", "Lff"), 1, 0))
big <- with(case1301, ifelse(Treat %in% c("ff", "Lff"), 1, 0))

fitsimple <- lm(y ~ Block + lmp + sml + big, case1301)
# Model with main effects of 3 "presence" factors seems ok.
anova(fitsimple, fitadditive)
summary(fitsimple, cor=FALSE)

```

---

case1302

*Pygmalion Effect*


---

## Description

One company of soldiers in each of 10 platoons was assigned to a Pygmalion treatment group, with remaining companies in the platoon assigned to a control group. Leaders of the Pygmalion platoons were told their soldiers had done particularly well on a battery of tests which were, in fact, non-existent. In this randomised block experiment, platoons are experimental units, companies are blocks, and average Practical Specialty test score for soldiers in a platoon is the response. The researchers wished to see if the platoon response was affected by the artificially-induced expectations of the platoon leader.

## Usage

```
case1302
```

## Format

A data frame with 29 observations on the following 3 variables.

Company a factor indicating company identification, with levels "C1", "C2", ..., "C10"

Treat a factor indicating treatment with two levels, "Pygmalion" and "Control"

Score average score on practical specialty test of all soldiers in the platoon

## Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

## References

Eden, D. (1990). Pygmalion Without Interpersonal Contrast Effects: Whole Groups Gain from Raising Manager Expectations, *Journal of Applied Psychology* **75**(4): 395–398.

## Examples

```
str(case1302)

# two-way model with interactions
fitfull <- aov(Score ~ Company*Treat, case1302)
# No problems are indicated by residual plot
plot(fitfull)
# Interaction terms are not statistically significant
anova(fitfull)
# Additive model, with "treatment contrast" for treatment:
fitadditive <- aov(Score ~ Company + Treat, case1302)
# Interpret treatment effect as coefficient of Treat
anova(fitadditive)
```

---

case1401

*Chimp Learning Times*

---

## Description

Researchers taught each of 4 chimps to learn 10 words in American sign language and recorded the learning time for each word for each chimp. They wished to describe chimp differences and word differences.

## Usage

```
case1401
```

## Format

A data frame with 40 observations on the following 3 variables.

Minutes learning time in minutes

Chimp a factor indicating chimp, with four levels "Booe", "Cindy", "Bruno" and "Theima"

Sign a factor indicating word taught, with 10 levels

## Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

## References

Fouts, R.S. (1973). Acquisition and Testing of Gestural Signs in Four Young Chimpanzees, *Science* **180**: 978-980.

**Examples**

```

str(case1401)

fitadditive <- aov(Minutes ~ Chimp + Sign, case1401)
# Residual plot indicates a transformation may help
plot(fitadditive)

fitadditive <- aov(log(Minutes) ~ Chimp + Sign, case1401)
# No problems are indicated by residual plot
plot(fitadditive)
anova(fitadditive)

# Tukey multiple comparisons of sign differences
mcSign <- TukeyHSD(fitadditive, "Sign")
mcSign
plot(mcSign)
mcChimp <- TukeyHSD(fitadditive, "Chimp")
mcChimp
par(cex=.7)
plot(mcChimp)

```

---

case1402

*Effect of Ozone, SO<sub>2</sub> and Drought on Soybean Yield*


---

**Description**

In a completely randomized design with a 2x3x5 factorial treatment structure, researchers randomly assigned one of 30 treatment combinations to open-topped growing chambers, in which two soybean cultivars were planted. The responses for each chamber were the yields of the two types of soybean.

**Usage**

```
case1402
```

**Format**

A data frame with 30 observations on the following 5 variables.

Stress a factor indicating treatment, with two levels "Well-watered" and "Stressed"

SO<sub>2</sub> a quantitative treatment with three levels 0, 0.02 and 0.06

O<sub>3</sub> a quantitative treatment with five levels 0.02, 0.05, 0.07, 0.08 and 0.10

Forrest the yield of the Forrest cultivar of soybean (in kg/ha)

William the yield of the Williams cultivar of soybean (in kg/ha)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

## References

Heggestad, H.E. and Lesser, V.M. (1990). Effects of Chronic Doses of Sulfur Dioxide, Ozone, and Drought on Yields and Growth of Soybeans Under Field Conditions, *Journal of Environmental Quality* **19**: 488–495.

## Examples

```
str(case1402)

plot(Forrest ~ O3, case1402, log="y", pch=ifelse(Stress=="Stressed",19,21))
plot(Forrest ~ SO2, case1402, log="y", pch=ifelse(Stress=="Stressed",19,21))

fitbig <- lm(log(Forrest) ~ O3*SO2*Stress, case1402)
# Residual plot does not indicate any problem.
plot(fitbig)
# The 3-factor interaction is not statistically significant.
anova(fitbig)
# Drop the three-factor interaction
fit2 <- update(fitbig, ~ . - O3:SO2:Stress)
anova(fit2)

fitadditive <- lm(log(Forrest) ~ O3 + SO2 + Stress, case1402)
summary(fitadditive)
```

---

case1501

*Logging and Water Quality*

---

## Description

Data from an observational study of nitrate levels measured at three week intervals for five years in two watersheds. One of the watersheds was undisturbed and the other had been logged with a patchwork pattern.

## Usage

```
case1501
```

## Format

A data frame with 88 observations on the following 3 variables.

Week week after the start of the study

Patch residual nitrate level in the logged watershed (ppm) (see Display 15.3 of Statistical Sleuth)

Nocut residual nitrate level in the undisturbed watershed (ppm)

## Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.



## References

Harr, R.D., Friderksen, R.L., and Rothacher, J. (1979). Changes in Streamflow Following Timber Harvests in Southwestern Oregon, USDA/USFS Research Paper PNW-249, Pacific NW Forest and Range Experiment Station, Portland, Oregon.

## Examples

```
str(case1501)

par(mfrow=c(2,1)) # Make 2 plots on one page
plot(Nocut ~ Week, case1501)
plot(Patch ~ Week, case1501)
par(mfrow=c(1,1))
lag.plot(case1501$Nocut,do.lines=FALSE)
lag.plot(case1501$Patch,do.lines=FALSE)

# Compute pooled estimate of first autocorrelation coefficient
# First auto covariance, Nocut
ac1nocut <- acf(case1501$Nocut,lag.max=1,type="covariance",plot=FALSE)$acf[2]
n <- length(case1501$Nocut)
# Zeroth autocovariance for Nocut
ac0nocut <- var(case1501$Nocut[2:n])*(n-2)/(n-1)
# First auto covariance, Patch
ac1patch <- acf(case1501$Patch,lag.max=1,type="covariance",plot=FALSE)$acf[2]
# Zeroth autocovariance for PATCH
ac0patch <- var(case1501$Patch [2:n])*(n-2)/(n-1)

ac1pool <- (ac1nocut + ac1patch)/2
ac0pool <- (ac0nocut + ac0patch)/2

acorr1 <- ac1pool/ac0pool
acorr1 # Pooled estimate of first lag serial coefficient
```

---

case1502

*Global Warming*

---

## Description

The data are the temperatures (in degrees Celsius) averaged for the northern hemisphere over a full year, for years 1880 to 1987. The 108-year average temperature has been subtracted, so each observation is the temperature difference from the series average.

## Usage

case1502

**Format**

A data frame with 108 observations on the following 2 variables.

Year year in which yearly average temperature was computed, from 1880 to 1987

Temp northern hemisphere temperature minus the 108-year average (degrees Celsius)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Jones, P.D. (1988). Hemispheric Surface Air Temperature Variations—Recent Trends Plus an Update to 1987, *Journal of Climatology* **1**: 654–660.

**Examples**

```
str(case1502)

# Residuals from regression fit, ignoring autocorrelation
resids <- lm(Temp ~ Year, case1502)$res
# PACF plot shows evidence of 1st order auto correlation
acf(resids,type="partial")
# 1st autocorrelation coef.
acorr1 <- acf(resids,type="correlation",plot=FALSE)$acf[2]

# Fit regression with filtered response and explanatory variables:
n <- length(case1502$Temp)
y <- with(case1502, Temp [2:n] - acorr1* Temp [1:(n-1)])
x <- with(case1502, Year [2:n] - acorr1* Year [1:(n-1)])
fit <- lm(y ~ x)
summary(fit) # Interpret coefficient of x as coefficient of Year
```

---

case1601

*Sites of Short- and Long-Term Memory*

---

**Description**

Researchers taught 18 monkeys to distinguish each of 100 pairs of objects, 20 pairs each at 16, 12, 8, 4, and 2 weeks prior to a treatment. After this training, they blocked access to the hippocampal formation in 11 of the monkeys. All monkeys were then tested on their ability to distinguish the objects. The five-dimensional response for each monkey is the number of correct objects distinguished among those taught at 16, 12, 8, 4, and 2 weeks prior to treatment.

**Usage**

case1601

**Format**

A data frame with 18 observations on the following 7 variables.

Monkey Monkey name

Treatment a treatment factor with levels "Control" and "Treated"

Week2 percentage of 20 objects taught 2 weeks prior to treatment that were correctly distinguished in the test

Week4 percentage of 20 objects taught 4 weeks prior to treatment that were correctly distinguished in the test

Week8 percentage of 20 objects taught 8 weeks prior to treatment that were correctly distinguished in the test

Week12 percentage of 20 objects taught 12 weeks prior to treatment that were correctly distinguished in the test

Week16 percentage of 20 objects taught 16 weeks prior to treatment that were correctly distinguished in the test

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Sola-Morgan, S. M. and Squire, L. R. (1990). The Primate Hippocampal Formation: Evidence for a Time-limited Role in Memory Storage, *Science* **250**: 288–290.

**Examples**

```
str(case1601)

# short-term response
short <- with(case1601, (Week2 + Week4)/2)
# long-term response
long <- with(case1601, (Week8 + Week12 + Week16)/3)
# Multivariate analysis of variance
mfit <- manova(cbind(short,long) ~ Treatment, case1601)
summary(mfit)
```

---

case1602

*Oat Bran and Cholesterol*

---

**Description**

In a randomized, double-blind, crossover experiment, researchers randomly assigned 20 volunteer hospital employees to either a low-fiber or low-fiber treatment group. The subjects followed the diets for six weeks. After two weeks on their normal diet, all patients crossed over to the other treatment group for another six weeks. The total serum cholesterol (in mg/dl) was measured on each patient before the first treatment, at the end of the first six week treatment, and at the end of the second six week treatment.

**Usage**

```
case1602
```

**Format**

A data frame with 20 observations on the following 4 variables.

Baseline total serum cholesterol before treatment

Hifiber total serum cholesterol after the high fiber diet

Lofiber total serum cholesterol after the low fiber diet

Order factor to identify order of treatment, with two levels "HL" and "LH"

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Swain, J.F., Rouse, I.L., Curley, C.B., and Sacks, F.M. (1990). Comparison of the Effects of Oat Bran and Low-fiber Wheat on Serum Lipoprotein Levels and Blood Pressure, *New England Journal of Medicine* **320**: 1746–1747.

**Examples**

```
str(case1602)

subjects <- 1:20
ordersubjects <- order(case1602$Baseline)
plot(1:20, case1602$Baseline[ordersubjects], pch=24,
     xlab="Subjects (Ordered According to Baseline Cholesterol)",
     ylab="Total Serum Cholesterol (mg/dl)")
points(1:20, case1602$Lofiber[ordersubjects], pch=19, col=5)
points(1:20, case1602$Hifiber[ordersubjects], pch=21, col=3)
legend(1,245,legend=c("Baseline","After Low Fiber Diet","After High Fiber Diet"),
      pch=c(24,19,21),col=c(1,5,3))

diff <- with(case1602, Hifiber-Lofiber)
plot(subjects, diff, pch=ifelse(case1602$Order=="HL",19,21))
abline(h=0)
t.test(diff ~ Order, case1602) # Test for order of treatment effect
t.test(diff) # Test for treatment effect
```

---

 case1701

---

*Magnetic Force on Printer Rods*


---

**Description**

Engineers manipulated three factors (with 3, 2, and 4 levels each) in the construction and operation of printer rods, to see if they influenced the magnetic force around the rod.

**Usage**

case1701

**Format**

A data frame with 44 observations on the following 14 variables.

Name	Description
L1, L2, ..., L11	the magnetic force at each of the equally-spaced positions 1, 2, ..., 11 on the printer rod
Current	electric current passing through the rod, with three levels "0", "250" and "500" (milliamperes)
Configur	a factor identifying the configuration, with two levels "0" and "1"
Material	a factor identifying the type of metal from which the rod was made, with four levels "1", "2", "3" and "4"

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**Examples**

```
str(case1701)

pca <- princomp(case1701[,1:11])
summary(pca)
# The first 3 principal components account for 99.7% of the variation
screeplot(pca)
# The loadings suggest the following meaningful summaries...
loadings(pca)

overallaverage <- with(case1701, (L1 + L2 + L3 + L4 + L5 + L6 + L7 + L8 + L9 + L10 + L11)/11)
rightleftdiff <- with(case1701, (L9 + L10 + L11)/3 - (L1 + L2 + L3)/3)
middleleftdiff <- with(case1701, L6 - (L1 + L2)/2)

# Note 4 clusters and 1 outlier
pairs(cbind(overallaverage, rightleftdiff, middleleftdiff))

fit1 <- lm(overallaverage ~ Current*Configur*Material, case1701)
anova(fit1)
```

---

case1702

*Love and Marriage*

---

### Description

Thirty couples participated in a study of love and marriage. Wives and husbands responded separately to four questions:

1. What is the level of passionate love you feel for your spouse?
2. What is the level of passionate love your spouse feels for you?
3. What is the level of compassionate love you feel for your spouse?
4. What is the level of compassionate love your spouse feels for you?

Each response was recorded on a five-point scale: 1=None, 2=Very Little, 3=Some, 4=A Great Deal and 5=A Tremendous Amount.

### Usage

case1702

### Format

A data frame with 30 observations on the following 9 variables.

Couple couple identification number

Hps level of passionate love husband feels for spouse

Wps level of passionate love wife feels for spouse

Hcs level of compassionate love husband feels for spouse

Wcs level of compassionate love wife feels for spouse

Hpy level of passionate love husband perceives spouse to have for him

Wpy level of passionate love wife perceives spouse to have for her

Hcy level of compassionate love husband perceives spouse to have for him

Wcy level of compassionate love husband perceives spouse to have for her

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

Johnson, R.A. and Wichern, D.W. (1988). *Applied Multivariate Statistical Analysis (2nd ed)*, Prentice-Hall.

**Examples**

```
str(case1702)

# feelings about spouse
tospouse <- with(case1702, cbind(Hps, Wps, Hcs, Wcs))
# perceived feelings from spouse
fromspouse <- with(case1702, cbind(Hpy, Wpy, Hcy, Wcy))
cca <- cancel(tospouse,fromspouse)
# Examine loadings of first canonical variables:
par(mfrow=c(2,1))
barplot(cca$xcoef[,1], ylab="first 'to spouse' loadings",
        names=c("Hps","Wps","Hcs","Wcs"))
barplot(cca$ycoef[,1], ylab="first 'from spouse' loadings",
        names=c("Hpy","Wpy","Hcy","Wcy"))

# The first canonical variable for 'to spouse' is mostly Hcs
# The first canonical variable for 'fom spouse' is mostly Hcy

can.to <- tospouse
can.from <- fromspouse
can.to.1 <- can.to[,1] # first canonical variable
can.from.1 <- can.from[,1] # first canonical variable
pairs(cbind(can.to.1, case1702$Hcs, can.from.1, case1702$Hcy),
      labels=c("1st cv 'to'", "husband's compassionate", "1st cv
              'from'", "husband's perceived compassionate"))
```

---

case1902

*Death Penalty and Race*


---

**Description**

Lawyers collected data on convicted black murderers in the state of Georgia to see whether convicted black murderers whose victim was white were more likely to receive the death penalty than those whose victim was black, after accounting for aggravation level of the murder. They categorized murders into 6 progressively more serious types. Category 1 comprises barroom brawls, liquor-induced arguments lovers' quarrels, and similar crimes. Category 6 includes the most vicious, cruel, cold-blooded, unprovoked crimes.

**Usage**

```
case1902
```

**Format**

A data frame with 12 observations on the following 4 variables.

**Aggravation** the aggravation level of the crime, a factor with levels "1", "2", "3", "4", "5" and "6"

**Victim** a factor indicating race of murder victim, with levels "White" and "Black"

Death number in the aggravation and victim category who received the death penalty

Nodeath number in the aggravation and victim category who did not receive the death penalty

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

Woodworth, G.C. (1989). Statistics and the Death Penalty, *Stats 2*: 9–12.

### Examples

```
str(case1902)

# Add smidgeon to denominator because of zeros
empiricalodds <- with(case1902, Death/(Nodeath + .5))
plot(empiricalodds ~ as.numeric(Aggravation), case1902, log="y",
     pch=ifelse(Victim=="White", 21, 19),
     xlab="Aggravation Level of the Murder", ylab="Odds of Death Penalty")
legend(3.8, .02, legend=c("White Victim Murderers", "Black Victim Murderers"), pch=c(21, 19))

fitbig <- glm(cbind(Death, Nodeath) ~ Aggravation*Victim, case1902, family=binomial)
# No evidence of overdispersion; no statistically significant evidence
# of interactive effect
anova(fitbig, test="Chisq")
fitlinear <- glm(cbind(Death, Nodeath) ~ Aggravation + Victim, case1902, family=binomial)
summary(fitlinear)

# Mantel Haenszel Test, as an alternative
table1902 <- with(case1902, rbind(Death, Nodeath))
dim(table1902) <- c(2, 2, 6)
mantelhaen.test(table1902)
```

---

case2001

*Survival in the Donner Party*

---

### Description

This data frame contains the ages and sexes of the adult (over 15 years) survivors and nonsurvivors of the Donner party.

### Usage

case2001



**Format**

A data frame with 45 observations on the following 3 variables.

Age Age of person

Sex Sex of person

Status Whether the person survived or died

**Details**

In 1846 the Donner and Reed families left Springfield, Illinois, for California by covered wagon. In July, the Donner Party, as it became known, reached Fort Bridger, Wyoming. There its leaders decided to attempt a new and untested route to the Sacramento Valley. Having reached its full size of 87 people and 20 wagons, the party was delayed by a difficult crossing of the Wasatch Range and again in the crossing of the desert west of the Great Salt Lake. The group became stranded in the eastern Sierra Nevada mountains when the region was hit by heavy snows in late October. By the time the last survivor was rescued on April 21, 1847, 40 of the 87 members had died from famine and exposure to extreme cold.

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Grayson, D.K. (1990). Donner Party Deaths: A Demographic Assessment, *Journal of Anthropological Research* **46**: 223–242.

**See Also**

[ex1918](#)

**Examples**

```
str(case2001)
```

---

case2002

*Birdkeeping and Lung Cancer*

---

**Description**

A 1972–1981 health survey in The Hague, Netherlands, discovered an association between keeping pet birds and increased risk of lung cancer. To investigate birdkeeping as a risk factor, researchers conducted a *case–control* study of patients in 1985 at four hospitals in The Hague (population 450,000). They identified 49 cases of lung cancer among the patients who were registered with a general practice, who were age 65 or younger and who had resided in the city since 1965. They also selected 98 controls from a population of residents having the same general age structure.

**Usage**

case2002

**Format**

A data frame with 147 observations on the following 7 variables.

LC Whether subject has lung cancer

FM Sex of subject

SS Socioeconomic status, determined by occupation of the household's principal wage earner

BK Indicator for birdkeeping (caged birds in the home for more than 6 consecutive months from 5 to 14 years before diagnosis (cases) or examination (control))

AG Age of subject (in years)

YR Years of smoking prior to diagnosis or examination

CD Average rate of smoking (in cigarettes per day)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Holst, P.A., Kromhout, D. and Brand, R. (1988). For Debate: Pet Birds as an Independent Risk Factor for Lung Cancer, *British Medical Journal* **297**: 13–21.

**Examples**

```
str(case2002)
```

---

case2101

*Island Size and Bird Extinctions*

---

**Description**

In a study of the Krunnit Islands archipelago, researchers presented results of extensive bird surveys taken over four decades. They visited each island several times, cataloguing species. If a species was found on a specific island in 1949, it was considered to be at risk of extinction for the next survey of the island in 1959. If it was not found in 1959, it was counted as an “extinction”, even though it might reappear later. This data frame contains data on island size, number of species at risk to become extinct and number of extinctions.

**Usage**

case2101

**Format**

A data frame with 18 observations on the following 4 variables.

Island Name of Island

Area Area of Island

Atrisk Number of species at risk

Extinct Number of extinctions

**Details**

Scientists agree that preserving certain habitats in their natural states is necessary to slow the accelerating rate of species extinctions. But they are divided on how to construct such reserves. Given a finite amount of available land, is it better to have many small reserves or a few large one? Central to the debate on this question are observational studies of what has happened in island archipelagos, where nearly the same fauna tries to survive on islands of different sizes.

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Vaininen, R.A. and Jarvinen, O. (1977). Dynamics of Protected Bird Communities in a Finnish Archipelago, *Journal of Animal Ecology* **46**: 891–908.

**Examples**

```
str(case2101)
logit <- function(p) log(p/(1-p))
plot(logit(Extinct/Atrisk) ~ log(Area), case2101)
```

---

 case2102

---

*Moth Coloration and Natural Selection*


---

**Description**

This data was collected by J.A. Bishop. Bishop selected seven locations progressively farther from Liverpool. At each location, Bishop chose eight trees at random. Equal number of dead (frozen) light (*Typicalis*) and dark (*Carbonaria*) moths were glued to the trunks in lifelike positions. After 24 hours, a count was taken of the numbers of each morph that had been removed—presumably by predators.

**Usage**

case2102

**Format**

A data frame with 14 observations on the following 4 variables.

Morph Morph, a factor with levels "light" and "dark"

Distance Distance from Liverpool (in km)

Placed Number of moths placed

Removed Number of moths removed

**Details**

Population geneticists consider clines particularly favourable situations for investigating evolutionary phenomena. A cline is a region where two colour morphs of one species arrange themselves at opposite ends of an environmental gradient, with increasing mixtures occurring between. Such a cline exists near Liverpool, England, where a dark morph of a local moth has flourished in response to the blackening of tree trunks by air pollution from the mills. The moths are nocturnal, resting during the day on tree trunks, where their coloration acts as camouflage against predatory birds. In Liverpool, where tree trunks are blackened by smoke, a high percentage of the moths are of the dark morph. One encounters a higher percentage of the typical (pepper-and-salt) morph as one travels from the city into the Welsh countryside, where tree trunks are lighter. J.A. Bishop used this cline to study the intensity of natural selection.

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Bishop, J.A. (1972). An Experimental Study of the Cline of Industrial Melanism in *Biston betularia* [Lepidoptera] Between Urban Liverpool and Rural North Wales, *Journal of Animal Ecology* **41**: 209–243.

**Examples**

```
str(case2102)
```

---

case2201

*Age and Mating Success of Male Elephants*

---

**Description**

Although male elephants are capable of reproducing by 14 to 17 years of age, your adult males are usually unsuccessful in competing with their larger elders for the attention of receptive females. Since male elephants continue to grow throughout their lifetimes, and since larger males tend to be more successful at mating, the males most likely to pass their genes to future generations are those whose characteristics enable them to live long lives. Joyce Poole studied a population of African elephants in Amboseli National Park, Kenya, for 8 years. This data frame contains the number of successful matings and ages (at the study's beginning) of 41 male elephants.

**Usage**

```
case2201
```

**Format**

A data frame with 41 observations on the following 2 variables.

Age Age of elephant at beginning of study

Matings Number of successful matings

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Poole, J.H. (1989). Mate Guarding, Reproductive Success and Female Choice in African Elephants, *Animal Behavior* **37**: 842–849.

**Examples**

```
str(case2201)
plot(case2201)
```

---

case2202

*Characteristics Associated with Salamander Habitat*

---

**Description**

The Del Norte Salamander (*plethodon elongates*) is a small (5–7 cm) salamander found among rock rubble, rock outcrops and moss-covered talus in a narrow range of northwest California. To study the habitat characteristics of the species and particularly the tendency of these salamanders to reside in dwindling old-growth forests, researchers selected 47 sites from plausible salamander habitat in national forest and parkland. Randomly chosen grid points were searched for the presence of a site with suitable rocky habitat. At each suitable site, a 7 metre by 7 metre search are was examined for the number of salamanders it contained. This data frame contains the counts of salamanders at the sites, along with the percentage of forest canopy and age of the forest in years.

**Usage**

```
case2202
```

**Format**

A data frame with 47 observations on the following 4 variables.

Site Investigated site

Salaman Number of salamanders found in 49 m<sup>2</sup> area

PctCover Percentage of canopy cover

Forestage Forest age

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Welsh, H.H. and Lind, A.J. (1995). *Journal of Herpetology* **29**(2): 198–210.

**Examples**

```
str(case2202)
```

---

ex0112

*Fish Oil and Blood Pressure*

---

**Description**

Researchers used 7 red and 7 black playing cards to randomly assign 14 volunteer males with high blood pressure to one of two diets for four weeks: a fish oil diet and a standard oil diet. These data are the reductions in diastolic blood pressure.

**Usage**

```
ex0112
```

**Format**

A data frame with 14 observations on the following 2 variables.

BP reduction in diastolic blood pressure (in mm of mercury)

Diet factor variable indicating the diet that the subject followed

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Knapp, H.R. and FitzGerald, G.A. (1989). The Antihypertensive Effects of Fish Oil, *New England Journal of Medicine* **320**: 1037–1043.

**Examples**

```
str(ex0112)
```

---

ex0116

*Planet Distances and Order from Sun*

---

**Description**

The data are the distances from the sun (scaled so that earth=10) and the order from the sun for the 9 planets in our solar system plus the asteroid belt (treated here as the fifth body from the sun).

**Usage**

```
ex0116
```

**Format**

A data frame with 10 observations on the following 3 variables.

Planet name of body (planet or asteroid belt)

Order order from sun

Distance distance from sun (scaled so that earth's distance is 10)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**Examples**

```
str(ex0116)
```

---

ex0211

*Lifetimes of Guinea Pigs*

---

### Description

The data are survival times (in days) of guinea pigs that were randomly assigned either to a control group or to a treatment group that received a dose of tubercle bacilli.

### Usage

ex0211

### Format

A data frame with 122 observations on the following 2 variables.

Lifetime survival time of guinea pig (in days)

Group a factor with levels "bacilli" and "control", indicating the group to which the guinea pig was assigned

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

Doksum, K. (1974). Empirical Probability Plots and Statistical Inference for Nonlinear Models in the Two-sample Case, *Annals of Statistics* **2**: 267–277.

### Examples

```
str(ex0211)
```

---

ex0221

*Bumpus's Data on Natural Selection (Weight)*

---

### Description

As evidence in support of natural selection, Bumpus presented measurements on house sparrows brought to the Anatomical Laboratory of Brown University after an uncommonly severe winter storm. Some of these birds had survived and some had perished. Bumpus asked whether those that perished did so because they lacked physical characteristics enabling them to withstand the intensity of that particular instance of selective elimination. The data are on the the weights, in grams, for the 24 adult male sparrows that perished and for the 35 adult males that survived.



**Usage**

```
ex0221
```

**Format**

A data frame with 59 observations on the following 2 variables.

Weight weight of adult male sparrows (in grams)

Status factor variable indicating whether the sparrow perished or survived in a winter storm

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**See Also**

[case0201](#), [ex2016](#)

**Examples**

```
str(ex0221)
```

---

ex0222

*Cholesterol in Urban and Rural Guatemalans*

---

**Description**

This data comes from an observational study to contrast cholesterol levels in rural and urban Guatemalan Indians

**Usage**

```
ex0222
```

**Format**

A data frame with 94 observations on the following 2 variables.

Cholesterol Serum total cholesterol of individual (in mg/l)

Group a factor with levels "Rural" and "Urban" indicating to which group the individual belongs

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Tejada, C., Charm, S., Guzman, M., Mendez, J. and Kurland, G. (1964). The Blood Viscosity of Various Socioeconomic Groups in Guatemala, *American Journal of Clinical Nutrition*: 303–308.

**Examples**

```
str(ex0222)
```

---

 ex0223

---

*Speed Limits and Traffic Fatalities*


---

**Description**

The National Highway System Designation Act was signed into law in the United States on November 28, 1995. Among other things, the act abolished the federal mandate of 55 mile per hour maximum speed limits on roads in the United States and permitted states to establish their own limits. Of the 50 states (plus the District of Columbia), 32 increased their speed limits at the beginning of 1996 or sometime during 1996. These data are the percentage changes in interstate highway traffic fatalities from 1995 to 1996.

**Usage**

```
ex0223
```

**Format**

A data frame with 51 observations on the following 3 variables.

State US state

Increase a factor with levels "No" "Yes", indicating whether the state increased its speed limit

FatalitiesChange percentage change in interstate traffic fatalities between 1995 and 1996

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Report to Congress: The Effect of Increased Speed Limits in the Post-NMSL Era, National Highway Traffic Safety Administration, February, 1998; available in the reports library at <https://www-fars.nhtsa.dot.gov/>.

**Examples**

```
str(ex0223)
```

---

`ex0321`*Umpire Life Lengths*

---

**Description**

Researchers collected historical and current data on umpires to investigate their life expectancies following the collapse and death of a U.S. major league baseball umpire. They were investigating speculation that stress associated with the job posed a health risk. Data were found on 227 umpires who had died or had retired and were still living. The data set includes the dates of birth and death.

**Usage**`ex0321`**Format**

A data frame with 227 observations on the following 3 variables.

`Lifelength` observed lifetime for those umpires who had died by the time of the study or current age of those still living

`Censored` 0 for those who had died by the time of the study or 1 for those who were still living

`Expected length` length from actuarial life tables for individuals who were alive at the time the person first became an umpire

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Cohen, R.S., Kamps, C.A., Kokoska, S., Segal E.M. and Tucker, J.B.(2000). Life Expectancy of Major League Baseball Umpires, *The Physician and Sportsmedicine* **28**(5): 83–89.

**Examples**`str(ex0321)`

---

ex0323

*Solar Radiation and Skin Cancer*

---

**Description**

Data contains yearly skin cancer rates (per 100,000 people) in Connecticut from 1938 to 1972 with a code indicating those years that came two years after higher than average sunspot activity and those years that came two years after lower than average sunspot activity.

**Usage**

ex0323

**Format**

A data frame with 35 observations on the following 3 variables.

Year year

Rate skin cancer rate per 100,000 people

Sunspot a factor with levels "High" and "Low"

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Andrews, D.F. and Herzberg, A.M. (1985). *Data: A Collection of Problems from many Fields for the Student and Research Worker*, Springer-Verlag.

**Examples**

```
str(ex0323)
```

---

ex0327

*Life Expectancy and Per Capita Income*

---

**Description**

Life expectancy and per capita income for 20 industrialized countries and 9 petroleum exporting countries. Note that there is a missing value for South Africa.

**Usage**

ex0327

**Format**

A data frame with 29 observations on the following 4 variables.

Country a character vector indicating the country

Life life expectancy (years)

Income income in 1974 (U.S. dollars)

Type factor variable with levels "Industrialized" and "Petroleum"

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Leinhardt, S. and Wasserman, S.S. (1979). Teaching Regression: An Exploratory Approach, *The American Statistician* **33**(4): 196–203.

**Examples**

```
str(ex0327)
```

---

ex0328

*Pollen Removal*

---

**Description**

As part of a study to investigate reproductive strategies in plants, biologists recorded the time spent at sources of pollen and the proportions of pollen removed by bumblebee queens and honeybee workers pollinating a species of lily.

**Usage**

```
ex0328
```

**Format**

A data frame with 47 observations on the following 3 variables.

Removed proportion of pollen removed

Duration duration of visit (in seconds)

Bee factor variable with levels "Queen" and "Worker"

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Harder, L.D. and Thompson, J.D. (1989). Evolutionary Options for Maximizing Pollen Dispersal of Animal-pollinated Plants, *American Naturalist* **133**: 323–344.

**Examples**

```
str(ex0328)
```

---

ex0331

*Iron Supplementation*

---

**Description**

A randomized experiment was performed on mice to determine whether two forms of iron are retained differently. If one type is retained especially well it may be more useful as a dietary supplement for humans.

**Usage**

```
ex0331
```

**Format**

A data frame with 36 observations on the following 2 variables.

Iron percentage of iron retained in each mouse

Supplement factor variable with levels "Fe3" and "Fe4"

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Rice, J. (1987). *Mathematical Statistics and Data Analysis*, Wadsworth.

**Examples**

```
str(ex0331)
```

---

ex0332

*College Tuition*

---

**Description**

Tuition in dollars of 20 private and 20 public U.S. colleges and universities for 1993–1994.

**Usage**

ex0332

**Format**

A data frame with 20 observations on the following 3 variables.

Private tuition in dollars of 20 private schools

PubIn tuition in dollars of 20 public schools (in-state tuition)

PubOut tuition in dollars of 20 public schools (out-of-state tuition)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

*1995 U.S. News and World Report's Guide to America's Best Colleges.*

**Examples**

```
str(ex0332)
```

---

ex0333

*Brain Size and Litter Size*

---

**Description**

Relative brain weights for 51 species of mammal whose average litter size is less than 2 and for 45 species of mammal whose average litter size is greater than or equal to 2.

**Usage**

ex0333

**Format**

A data frame with 96 observations on the following 2 variables.

Brainsize relative brain sizes (1000 \* Brain weight/Body weight) for 96 species of mammals

Littersize factor variable with levels "Small" and "Large"

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Sacher, G.A. and Staffeldt, E.F. (1974). Relation of Gestation Time to Brain Weight for Placental Mammals: Implications for the Theory of Vertebrate Growth, *American Naturalist* **108**: 593–613.

**See Also**

[case0902](#)

**Examples**

```
str(ex0333)
```

---

ex0428

*Darwin's Data*

---

**Description**

Plant heights (inches) for 15 pairs of plants of the same age, one of which was grown from a seed from a cross-fertilized flower and the other of which was grown from a seed from a self-fertilized flower.

**Usage**

```
ex0428
```

**Format**

A data frame with 15 observations on the following 2 variables.

Cross height (inches) of cross-fertilized plant

Self height (inches) of self-fertilized plant

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.



**References**

Andrews, D.F. and Herzberg, A.M. (1985). *Data: A Collection of Problems from many Fields for the Student and Research Worker*, Springer-Verlag.

**Examples**

```
str(ex0428)
```

---

ex0429

*Exercise and Walking Time*

---

**Description**

Can active exercise shorten the time it takes an infant to walk alone? Twelve, one week old, male infants from white, middle-class families were randomly allocated to one of two treatment groups. Those in the active-exercise group received stimulation of the walking reflexes during four 3 minute sessions each day from the beginning of the second through the end of the eighth week. Those in the other group received no stimulation.

**Usage**

```
ex0429
```

**Format**

A data frame with 12 observations on the following 2 variables.

Age age (months) at which infants first walked alone

Exercise a factor with levels "Active" and "None"

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Zelazo, P.R. (1972). Walking in the Newborn, *Science* **176**: 314–315.

**Examples**

```
str(ex0429)
```

---

`ex0430`*Sunlight Protection Factor*

---

**Description**

Tolerance to sunlight (in minutes) for 13 patients prior to and after treatment with a sunscreen.

**Usage**`ex0430`**Format**

A data frame with 13 observations on the following 2 variables.

Control tolerance to sunlight (minutes) prior to sunscreen application

Sunscreen tolerance to sunlight (minutes) after sunscreen application

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Fusaro, R.M. and Johnson, J.A. (1974). Sunlight Protection for Erythropoietic Protoporphyrin Patients, *Journal of the American Medical Association* **229**(11): 1420.

**Examples**`str(ex0430)`

---

`ex0431`*Effect of Group Therapy on Survival of Breast Cancer Patients*

---

**Description**

Researchers randomly assigned metastatic breast cancer patients to either a control group or a group that received weekly 90 minute sessions of group therapy and self-hypnosis, to see whether the latter treatment improved the patients' quality of life.

**Usage**`ex0431`

**Format**

A data frame with 58 observations on the following 3 variables.

Survival months of survival after beginning of study

Group a factor with levels "Control" and "Therapy"

Censor 0 if entire lifetime observed, 1 if patient known to have lived at least 122 months

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Spiegel, D., Bloom, J.R., Kraemer, H.C. and Gottheil, E. (1989). Effect of Psychosocial Treatment on Survival of Patients with Metastatic Breast Cancer, *Lancet* **334**(8668): 888–891.

**Examples**

```
str(ex0431)
```

---

 ex0432

---

*Therapeutic Marijuana*


---

**Description**

To investigate the capacity of marijuana to reduce the side effects of cancer chemotherapy, researchers performed a double-blind, randomized, crossover trial. Fifteen cancer patients on chemotherapy were randomly assigned to receive either a marijuana treatment or a placebo treatment after their first three sessions of chemotherapy. They were then crossed over to the opposite treatment for their next 3 sessions.

**Usage**

```
ex0432
```

**Format**

A data frame with 15 observations on the following 3 variables.

Subject subject number 1–15

Marijuana total number of vomiting and retching episodes under marijuana treatment

Placebo total number of vomiting and retching episodes under placebo treatment

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Chang, A.E., Shiling, D.J., Stillman, R.C., Goldberg, N.H., Seipp, C.A., Barofsky, I., Simon, R.M. and Rosenberg, S.A. (1979). Delta-9-Tetrahydrocannabinol as an Antiemetic in Cancer Patients Receiving High Dose Methotrexate, *Annals of Internal Medicine* **91**(6): 819–824.

**Examples**

str(ex0432)

---

ex0518

*Fatty Acid*

---

**Description**

A randomized experiment was performed to estimate the effect of a certain fatty acid CPFA on the level of a certain protein in rat livers.

**Usage**

ex0518

**Format**

A data frame with 30 observations on the following 4 variables.

Protein levels of protein (x 10) found in rat livers

Treatment a factor with levels "Control", "CPFA50", "CPFA150", "CPFA300", "CPFA450" and "CPFA600"

Day a factor with levels "Day1", "Day2", "Day3", "Day4" and "Day5"

Group a factor with levels "Group1", "Group2", ..., "Group10"; the observed levels of the Treatment and Day interaction

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**Examples**

str(ex0518)

---

ex0523

*Was Tyrannosaurus Rex Warm-Blooded?*

---

### Description

Data frame with measurements of oxygen isotopic composition of vertebrate bone phosphate (per mil deviations from SMOW) in 12 bones of a single Tyrannosaurus rex specimen

### Usage

ex0523

### Format

A data frame with 52 observations on the following 2 variables.

Oxygen oxygen isotopic composition

Bonegrp a factor with levels "Bone1", "Bone2", ..., "Bone12"

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

Barrick, R.E. and Showers, W.J. (1994). Thermophysiology of *Tyrannosaurus rex*: Evidence from Oxygen Isotopes, *Science* **265**(5169): 222–224.

### See Also

[ex1120](#)

### Examples

`str(ex0523)`

---

ex0524

*Vegetarians and Zinc: An Observational Study*

---

### Description

Previous studies suggest that vegetarians may not receive enough zinc in their diets and the zinc requirement is especially important during pregnancy. Twenty-three women were monitored: twelve vegetarians who were pregnant, six nonvegetarians who were pregnant, and five vegetarians who were not pregnant. Is there any evidence that pregnant vegetarians tend to have lower zinc levels than pregnant nonvegetarians?

### Usage

ex0524

### Format

A data frame with 23 observations on the following 2 variables.

Zinc levels of Zinc ( $\mu\text{g/g}$ ) in the hair of women

Group a factor with levels "PregNonVeg", "PregVeg" and "NonPregVeg"

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

King, J.C., Stein, T. and Doyle, M. (1981). Effect of Vegetarianism on the Zinc Status of Pregnant Women, *American Journal of Clinical Nutrition* **34**(6): 1049–1055.

### Examples

str(ex0524)

---

ex0621

*Failure Times of Bearings*

---

### Description

Data consist of times to fatigue failure (in units of millions of cycles) for 10 high-speed turbine engine bearings made from five different compounds.

### Usage

ex0621

**Format**

A data frame with 50 observations on the following 2 variables.

Time failure times of bearings (millions of cycles)

Compound a factor with levels "I", "II", "III", "IV" and "V"

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

McCool, J.I. (1979). Analysis of Single Classification Experiments Based on Censored Samples from the Two-parameter Weibull Distribution, *Journal of Statistical Planning and Inference* **3**(1): 39–68.

**Examples**

```
str(ex0621)
```

---

 ex0622

---

*A Biological Basis for Homosexuality*


---

**Description**

Is there a physiological basis for sexual preference? Researchers measured the volumes of four cell groups in the interstitial nuclei of the anterior hypothalamus in postmortem tissue from 41 subjects at autopsy from seven metropolitan hospitals in New York and California.

**Usage**

```
ex0622
```

**Format**

A data frame with 41 observations on the following 2 variables.

Volume volumes of INAH3 ( $1000 \times \text{mm}^3$ ) cell clusters from 41 humans

Group a factor with levels

"Group1"	heterosexual male with AIDS death
"Group2"	heterosexual male with Non-AIDS death
"Group3"	homosexual male with AIDS death
"Group4"	heterosexual female with AIDS death
"Group5"	heterosexual female with Non-AIDS death

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

LeVay, S. (1991). A Difference in Hypothalamic Structure Between Heterosexual and Homosexual Men, *Science* **253**(5023): 1034–1037.

**Examples**

```
str(ex0622)
```

---

ex0723

*Old Faithful*

---

**Description**

Old Faithful Geyser in Yellowstone National Park, Wyoming, derives its name and its considerable fame from the regularity (and beauty) of its eruptions. As they do with most geysers in the park, rangers post the predicted times of eruptions on signs nearby and people gather beforehand to witness the show. R.A. Hutchinson, a park geologist, collected measurements of the eruption durations ( $X$ , in minutes) and the subsequent intervals before the next eruption ( $Y$ , in minutes) over an 8-day period.

**Usage**

```
ex0723
```

**Format**

A data frame with 107 observations on the following 3 variables.

Date date of observation (August 1 to August 8, 1978)

Interval length of interval before the next eruption (in minutes)

Duration duration of eruption (in minutes)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Weisberg, S. (1985). *Applied Linear Regression*, John Wiley & Sons, New York, p. 231.

**Examples**

```
str(ex0723)
```



---

`ex0724`*Crab Claw Size and Force*

---

**Description**

As part of a study of the effects of predatory intertidal crab species on snail populations, researchers measured the mean closing forces and the propodus heights of the claws on several crabs of three species.

**Usage**`ex0724`**Format**

A data frame with 38 observations on the following 3 variables.

Force closing strength of claw of the crab

Height propodus height of claw of the crab

Species species to which the crab belongs

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Yamada, S.B. and Boulding, E.G. (1992). Shell-breaking Efficiency of Predatory Crabs Influences the Distribution of an Intertidal Snail, Technical Report, Zoology Department, Oregon State University.

**Examples**`str(ex0724)`

---

ex0726

*Decline in Male Births*

---

### Description

The data are on the proportion of male births in Denmark, The Netherlands, Canada and the United States for a number of years. Notice that the proportions for Canada and the United States are only provided for the years 1970 to 1990, while Denmark and The Netherlands have data listed for 1950 to 1994.

### Usage

ex0726

### Format

A data frame with 45 observations on the following 5 variables.

Year year of observation

Denmark male birth rate of Denmark for given year

Netherlands male birth rate of The Netherlands for given year

Canada male birth rate of Canada for given year

Usa male birth rate of the United States for given year

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

Davis, D.L., Gottlieb, M.B. and Stampnitzky, J.R. (1998). Reduced ratio of male to female births in several industrial countries, *Journal of the American Medical Association* **279**(13): 1018–1023.

### Examples

str(ex0726)

---

`ex0727`*The Big Bang II*

---

**Description**

These data are measured distances and recession velocities for 10 clusters of nebulae, much farther from earth than the nebulae reported in [case0701](#).

**Usage**`ex0727`**Format**

A data frame with 10 observations on the following 2 variables.

Cluster name of the cluster of nebulae

Distance distance from earth (in million parsec)

Velocity recession velocity (in kilometres per second)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Hubble, E. and Humason, M. (1931). The Velocity–Distance Relation Among Extra–galactic Nebulae, *Astrophysics Journal* **74**: 43–50.

**See Also**

[case0701](#)

**Examples**

```
str(ex0727)
```

---

`ex0728`*Number of Stories and Building Height*

---

**Description**

The *1994 World Almanac* reports heights and number of stories for notable tall buildings in North America. The data in this data frame are a random sample of size 60 of those for which dates of completion were available.

**Usage**`ex0728`**Format**

A data frame with 60 observations on the following 3 variables.

Year year of completion

Height height of building

Stories number of stories of building

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**Examples**`str(ex0728)`

---

`ex0729`*Male Displays*

---

**Description**

Black wheatears are small birds in Spain and Morocco. Males of the species demonstrate an exaggerated sexual display by carrying many heavy stones to nesting cavities. This 35-gram bird transports, on average, 3.1 kg of stones per nesting season! Different males carry somewhat different sized stones, prompting a study on whether larger stones may be a signal of higher health status. Soler et al. calculated the average stone mass (g) carried by each of 21 male black wheatears, along with T-cell response measurements reflecting their immune systems' strengths.

**Usage**`ex0729`

**Format**

A data frame with 21 observations on the following 2 variables.

Mass average mass of stones carried by bird (in g)

Tcell T-cell response measurement (in mm)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Soler, M., Martín-Vivaldi, M., Marín J. and Møller, A. (1999). Weight lifting and health status in the black wheatears, *Behavioral Ecology* **10**(3): 281–286.

**Examples**

```
str(ex0729)
```

---

 ex0730

*Brain Activity in Violin and String Players*

---

**Description**

Studies over the past two decades have shown that activity can effect the reorganisation of the human central nervous system. For example, it is known that the part of the brain associated with activity of a finger or limb is taken over for other purposes in individuals whose limb or finger has been lost. In one study, psychologists used magnetic source imaging (MSI) to measure neuronal activity in the brains of nine string players (six violinists, two cellists and one guitarist) and six controls who had never played a musical instrument, when the thumb and fifth finger of the left hand were exposed to mild stimulation. The researchers felt that stringed instrument players, who use the fingers of their left hand extensively, might show different behaviour—as a result of this extensive physical activity—than individuals who did not play stringed instruments.

**Usage**

```
ex0730
```

**Format**

A data frame with 15 observations on the following 2 variables.

Years years that the individual has been playing

Activity neuronal activity index

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Elbert, T., Pantev, C., Wienbruch, C., Rockstroh, B. and Taub E. (1995). Increased cortical representation of the fingers of the left hand in string players, *Science* **270**(5234): 305–307.

**Examples**

```
str(ex0730)
```

---

ex0816

*Meat Processing*

---

**Description**

The data in [case0702](#) are a subset of the complete data on postmortum pH in 12 steer carcasses.

**Usage**

```
ex0816
```

**Format**

A data frame with 12 observations on the following 2 variables.

Time time after slaughter (hours)

pH pH level in postmortem muscle

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Schwenke, J.R. and Milliken, G.A. (1991). On the Calibration Problem Extended to Nonlinear Models, *Biometrics* **47**(2): 563–574.

**See Also**

[case0702](#)

**Examples**

```
str(ex0816)
```

---

`ex0817`*Biological Pest Control*

---

**Description**

In a study of the effectiveness of biological control of the exotic weed tansy ragwort, researchers manipulated the exposure to the ragwort flea beetle on 15 plots that had been planted with a high density of ragwort. Harvesting the plots the next season, they measured the average dry mass of ragwort remaining (grams/plant) and the flea beetle load (beetles/gram of ragwort dry mass) to see if the ragwort plants in plots with high flea beetle loads were smaller as a result of herbivory by the beetles.

**Usage**`ex0817`**Format**

A data frame with 15 observations on the following 2 variables.

Load flea beetle load (in beetles/gram of ragwort dry mass)

Mass dry mass of ragwort weed

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

McEvoy, P. and Cox, C. (1991). Successful Biological Control of Ragwort, *Senecio jacobaea*, by introducing insects in Oregon, *Ecological Applications* **1**(4): 430–442.

**Examples**`str(ex0817)`

---

`ex0818`*Chernobyl Fallout*

---

**Description**

One of the most dangerous contaminants deposited over European countries following the Chernobyl accident in April 1986 was radioactive cesium. To study cesium transfer from contaminated soil to plants, researchers collected soil samples and samples of mushroom mycelia from 17 wooded locations in Umbria, Central Italy, from August 1986 to November 1989. The data are measured concentrations (Bq/kg) of cesium in the soil and in the mushrooms.

**Usage**`ex0818`**Format**

A data frame with 17 observations on the following 2 variables.

Mushroom Cesium concentrations in mushrooms (in Bq/kg)

Soil Cesium concentrations in soil (in Bq/kg)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Borio, R., Chiocchini, S., Cicioni, R., Degli Esposti, P., Rongoni, A., Sabatini, P., Scampoli, P., Antonini, A. and Salvadori, P. (1991). Uptake of Radiocesium by Mushrooms, *Science of the Total Environment* **106**(3): 183–190.

**Examples**`str(ex0818)`



---

`ex0820`*Election Fraud*

---

**Description**

The data are observations on the difference between Democratic and Republican vote counts, by (a) absentee ballot and (b) voting machine, for 21 elections in Philadelphia's senatorial districts over the last 10 years.

**Usage**`ex0820`**Format**

A data frame with 21 observations on the following 2 variables.

Absentee Democratic minus Republican vote count by absentee ballot

Machines Democratic minus Republican vote count by voting machine

**Details**

In a special election to fill a Pennsylvania State Senate seat in 1993, the Democrat, William Stinson, received 19,127 machine-counted votes and the Republican, Bruce Marks, received 19,691. In addition, there were 1,391 absentee ballots for Stinson and 366 absentee ballots for Marks, so that the total tally showed Stinson the winner by 461 votes. The large disparity between the machine-counted and absentee votes, and the resulting reversal of the outcome due to the absentee ballots caused some concern about possible illegal influence on the absentee votes. To see whether the discrepancy in absentee votes was larger than could be explained by chance, an econometrician considered the data given in this data frame (read from a graph in *The New York Times*, 11 April 1994).

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**See Also**[ex1115](#)**Examples**`str(ex0820)`

---

ex0822

*Ecosystem Decay*

---

**Description**

Data are the number of butterfly species in 16 islands of forest of various sizes in otherwise cleared areas in Brazil.

**Usage**

`ex0822`

**Format**

A data frame with 16 observations on the following 2 variables.

Area area (ha) of forest patch

Species number of butterfly species

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Lovejoy, T.E., Rankin, J.M., Bierregaard, Jr., R.O., Brown, Jr., K.S., Emmons, L.H. and van der Voort, M. (1984). Ecosystem decay of Amazon forest remnants in Nitecki, M.H. (ed.) *Extinctions*, University of Chicago Press.

**Examples**

`str(ex0822)`

---

ex0823

*Wine Consumption and Heart Disease*

---

**Description**

The data are the average wine consumption rates (in liters per person per year) and number of ischemic heart disease deaths (per 1000 men aged 55 to 64 years) for 18 industrialized countries.

**Usage**

`data(ex0823)`

**Format**

A data frame with 18 observations on the following 3 variables.

Country a character vector indicating the country

Wine consumption of wine (liters per person per year)

Mortality heart disease mortality rate (deaths per 1,000)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

St. Leger A.S., Cochrane, A.L. and Moore, F. (1979). Factors Associated with Cardiac Mortality in Developed Countries with Particular Reference to the Consumption of Wine, *Lancet*: 1017–1020.

**Examples**

```
str(ex0823)
```

---

ex0824

*Respiratory Rates for Children*

---

**Description**

A high respiratory rate is a potential diagnostic indicator of respiratory infection in children. To judge whether a respiratory rate is “high” however, a physician must have a clear picture of the distribution of normal rates. To this end, Italian researchers measured the respiratory rates of 618 children between the ages of 15 days and 3 years.

**Usage**

```
ex0824
```

**Format**

A data frame with 618 observations on the following 2 variables.

Age age in months of child

Rate respiratory rate (breaths per minute)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Rusconi, F., Castagneto, M., Porta, N., Gagliardi, L., Leo, G., Pellegatta, A., Razon, S. and Braga, M. (1994). Reference Values for Respiratory Rate in the First 3 Years of Life, *Pediatrics* **94**(3): 350–355.

**Examples**

```
str(ex0824)
```

---

ex0825

*The Dramatic U.S. Presidential Election of 2000*

---

**Description**

Data set shows the number of votes for Buchanan and Bush in all 67 counties in Florida during the U.S. presidential election of November 7, 2000.

**Usage**

```
ex0825
```

**Format**

A data frame with 67 observations on the following 3 variables.

County a character vector indicating the county

Buchanan2000 votes cast for P. Buchanan

Bush2000 votes cast for G.W. Bush

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**See Also**

[ex1222](#)

**Examples**

```
str(ex0825)
```

---

ex0914

*Pace of Life and Heart Disease*

---

### Description

In four regions of the US (Northeast, Midwest, South and West), in three different sized metropolitan regions, researchers measured indicators of pace of life.

### Usage

ex0914

### Format

A data frame with 36 observations on the following 4 variables.

Bank bank clerk speed

Walk pedestrian walking speed

Talk postal clerk talking speed

Heart age adjusted death rate due to heart disease

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

Levine, R.V. (1990). The Pace of Life, *American Scientist* **78**: 450–459.

### Examples

```
str(ex0914)
```

---

ex0915

*Rainfall and Corn Yield*

---

### Description

Data on corn yield and rainfall in six U.S. corn-producing states (Iowa, Nebraska, Illinois, Indiana, Missouri and Ohio), recorded for each year from 1890 to 1927.

### Usage

ex0915

**Format**

Year year of observation (1890–1927)

Yield average corn yield for the six states (in bu/acre)

Rainfall average rainfall in the six states (in in/year)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Ezekiel, M. and Fox, K.A. (1959). *Methods of Correlation and Regression Analysis*, John Wiley & Sons, New York.

**Examples**

```
str(ex0915)
```

---

 ex0918

*Speed of Evolution*


---

**Description**

Researchers studied the development of a fly (*Drosophila subobscura*) that had been accidentally introduced from the Old World into North America around 1980.

**Usage**

```
ex0918
```

**Format**

A data frame with 21 observations on the following 8 variables.

Continent a factor with levels "NA" and "EU"

Latitude latitude (degrees)

Females average wing size ( $10^3 \times \log$  mm) of female flies on log scale

SE.F standard error of wing size ( $10^3 \times \log$  mm) of female flies on log scale

Males average wing size ( $10^3 \times \log$  mm) of male flies on log scale

SE.M standard error of wing size ( $10^3 \times \log$  mm) of male flies on log scale

Ratio average basal length to wing size ratios of female flies

SE.R standard error of average basal length to wing size ratio of female flies

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Huey, R.B., Gilchrist, G.W., Carlson, M.L., Berrigan, D. and Serra, L. (2000). Rapid Evolution of a Geographic Cline in Size in an Introduced Fly, *Science* **287**(5451): 308–309.

**Examples**

```
str(ex0918)
```

---

ex0920

*Winning Speeds at the Kentucky Derby*

---

**Description**

Data set contains the year of the Kentucky Derby, the winning horse, the condition of the track and the average speed of the winner for years 1896–2000.

**Usage**

```
ex0920
```

**Format**

A data frame with 105 observations on the following 4 variables.

Year year of Kentucky Derby

Winner a character vector with the name of the winning horse

Condition a factor with levels "fast", "good" and "slow"

Speed average speed of the winner (feet per second)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

<https://www.kentuckyderby.com/>

**Examples**

```
str(ex0920)
```

---

ex1014

*Toxic Effects of Copper and Zinc*

---

**Description**

Researchers randomly allocated 25 beakers containing minnow larvae to receive one of 25 treatment combinations of 5 levels of zinc and 5 levels of copper.

**Usage**

ex1014

**Format**

A data frame with 25 observations on the following 3 variables.

Copper amount of copper received (in ppm)

Zinc amount of zinc received (in ppm)

Protein protein in minnow larvae exposed to copper and zinc ( $\mu\text{g}/\text{larva}$ )

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Ryan, D.A., Hubert, J.J., Carter, E.M., Sprague, J.B. and Parrott, J. (1992). A Reduced-Rank Multivariate Regression Approach to Aquatic Joint Toxicity Experiments, *Biometrics* **48**(1): 155–162.

**Examples**

str(ex1014)

---

ex1026

*Thinning of Ozone Layer*

---

**Description**

Depletion of the ozone layer allows the most damaging ultraviolet radiation to reach the Earth's surface. To measure the relationship, researchers sampled the ocean column at various depths at 17 locations around Antarctica during the austral spring of 1990.



**Usage**

ex1026

**Format**

A data frame with 17 observations on the following 3 variables.

Inhibit percent inhibition of primary phytoplankton production in water

UVB UVB exposure

Surface a factor with levels "Deep" and "Surface"

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Smith, R.C., Prézelin, B.B., Baker, K.S., Bidigare, R.R., Boucher, N.P., Coley, T., Karentz, D., MacIntyre, S., Matlick, H.A., Menzies, D., Ondrusek, M., Wan, Z. and Waters, K.J. (1992). Ozone Depletion: Ultraviolet Radiation and Phytoplankton Biology in Antarctic Waters, *Science* **255**(5047): 952–959.

**Examples**

str(ex1026)

---

ex1027

*Factors Affecting Extinction*

---

**Description**

Data are measurements on breeding pairs of land-bird species collected from 16 islands around Britain over the course of several decades. For each species, the data set contains an average time of extinction on those islands where it appeared, the average number of nesting pairs, the size of the species and the migratory status of the species.

**Usage**

ex1027

**Format**

A data frame with 62 observations on the following 5 variables.

Species a character vector indicating the species

Time average extinction time in years

Pairs average number of nesting pairs

Size a factor with levels "L" and "S"

Status a factor with levels "M" and "R"

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Pimm, S.L., Jones, H.L., and Diamond, J. (1988). On the Risk of Extinction, *American Naturalist* **132**(6): 757–785.

**Examples**

```
str(ex1027)
```

---

ex1028

*El Nino and Hurricanes*

---

**Description**

Data set with the numbers of Atlantic Basin tropical storms and hurricanes for each year from 1950–1997. The variable storm index is an index of overall intensity of hurricane season. Also listed are whether the year was a cold, warm or neutral El Nino year and a variable indicating whether West Africa was wet or dry that year.

**Usage**

```
ex1028
```

**Format**

A data frame with 48 observations on the following 7 variables.

Year year

ElNino a factor with levels "cold", "neutral" and "warm"

Temperature numeric variable with values -1 if ElNino is "cold", 0 if "neutral" and 1 if "warm"

WestAfrica numeric variable indicating whether West Africa was wet (1) or dry (0)

Storms number of storms

Hurricanes number of hurricanes

StormIndex index of overall intensity of hurricane season

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Data were gathered by William Gray of Colorado State University and reported on USA Today weather page: <http://www.usatoday.com/weather/whurnum.htm>

**Examples**

```
str(ex1028)
```

---

ex1029

*Wage and Race*

---

**Description**

Data set contains weekly wages in 1987 for a sample of 25,632 males between the age of 18 and 70 who worked full-time along with their years of education, years of experience, indicator variable for whether they were black, indicator variable for whether they worked in or near a city, and a code for the region in the US where they worked.

**Usage**

```
ex1029
```

**Format**

A data frame with 25631 observations on the following 6 variables.

Wage weekly wage in dollars

Education education in years

Experience experience in years

Black a factor with levels "Yes" and "No"; indicator for whether the person is black

SMSA a factor with levels "Yes" and "No"; indicator for whether the person worked in or near a city

Region a factor with levels "MW", "NE", "S" and "W"

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Bierens, H.J. and Ginther, D.K. (2001). Integrated Conditional Moment Testing of Quantile Regression Models, *Empirical Economics* **26**(1): 307–324

<http://econ.la.psu.edu/~hbierens/QUANTILE.PDF>

<http://econ.la.psu.edu/~hbierens/MEDIAN.HTM>

**Examples**

```
str(ex1029)
```

---

ex1115

*Election Fraud*

---

**Description**

The data are observations on the difference between Democratic and Republican vote counts, by (a) absentee ballot and (b) voting machine, for 22 elections in Philadelphia's senatorial districts over the last 10 years.

**Usage**

```
ex1115
```

**Format**

A data frame with 22 observations on the following 2 variables.

Absentee Democratic minus Republican vote count by absentee ballot

Machines Democratic minus Republican vote count by voting machine

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**See Also**

[ex0820](#)

**Examples**

```
str(ex1115)
```

---

ex1120

*Was Tyrannosaurus Rex Warm-Blooded?*

---

### Description

Data are the isotopic composition of structural bone carbonate ( $X$ ) and the isotopic composition of the coexisting calcite cements ( $Y$ ) in 18 bone samples from a specimen of the dinosaur *Tyrannosaurus rex*. Evidence that the mean of  $Y$  is positively associated with  $X$  was used in an argument that the metabolic rate of this dinosaur resembled warm-blooded more than cold-blooded animals.

### Usage

ex1120

### Format

A data frame with 18 observations on the following 2 variables.

Carbonat isotopic composition of bone carbonate

Calcite isotopic composition of calcite cements

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

Barrick, R.E. and Showers, W.J. (1994). Thermophysiology of *Tyrannosaurus rex*: Evidence from Oxygen Isotopes, *Science* **265**(5169): 222–224.

### See Also

[ex0523](#)

### Examples

`str(ex1120)`

---

ex1122

*Deforestation and Debt*

---

**Description**

It has been theorized that developing countries cut down their forests to pay off foreign debt. Data are debt, deforestation, and population from 11 Latin American nations.

**Usage**

ex1122

**Format**

A data frame with 11 observations on the following 4 variables.

Country a character vector indicating the country

Debt debt (millions of dollars)

Deforest deforestation (thousands of ha)

Pop population (thousands of people)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Gullison, R.R. and Losos, E.C. (1992). The Role of Foreign Debt in Deforestation in Latin America, *Conservation Biology* 7(1): 140–7.

**Examples**

str(ex1122)

---

ex1123

*Air Pollution and Mortality*

---

**Description**

Does pollution kill people? Data in one early study designed to explore this issue from 5 Standard Metropolitan Statistical Areas in the U.S between 1959–1961.

**Usage**

ex1123

**Format**

A data frame with 60 observations on the following 7 variables.

City a character vector indicating the city

Mort total age-adjusted mortality from all causes

Precip mean annual precipitation (inches)

Educ median number of school years completed for persons 25 years or older

Nonwhite percentage of population that is nonwhite

NOx relative pollution potential of oxides of nitrogen

SO2 relative pollution potential of sulfur dioxide

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

McDonald, G.C. and Ayers, J.A. (1978). Some Applications of the “Chernoff Faces”: A Technique for Graphically Representing Multivariate Data in Wang, P.C.C. (ed.) *Graphical Representation of Multivariate Data*, Academic Press.

**See Also**

[ex1217](#)

**Examples**

```
str(ex1123)
```

---

ex1124

*Natal Dispersal Distances of Mammals*

---

**Description**

An assessment of the factors affecting dispersal distances is important for understanding population spread, recolonization and gene flow which are central issues for conservation of many vertebrate species. Researchers gathered data on body weight, diet type and maximum natal dispersal distance for various animals.

**Usage**

```
ex1124
```

**Format**

A data frame with 64 observations on the following 4 variables.

Species a character vector indicating the species

Bodymass bodymass (kg)

Maxdist maximum dispersal distance (km)

Type a factor with levels "Carnivore", "Herbivore" and "Omnivore"

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Sutherland, G.D., Harestad, A.S., Price, K. and Lertzman, K.P. (2000). Scaling of Natal Dispersal Distances in Terrestrial Birds and Mammals, *Conservation Ecology* **4**(1): 16.

**Examples**

```
str(ex1124)
```

---

ex1217

*Pollution and Mortality*

---

**Description**

Complete data set for problem introduced in [ex1123](#). Data from early study designed to explore the relationship between air pollution and mortality.

**Usage**

```
ex1217
```

**Format**

A data frame with 60 observations on the following 17 variables.

City a character vector indicating the city

Mort total age-adjusted mortality from all causes

Precip mean annual precipitation (inches)

Humidity percent relative humidity (annual average at 1:00pm)

Jantemp mean January temperature (degrees F)

Julytemp mean July temperature (degrees F)

Over65 percentage of the population aged 65 years or over



House population per household  
 Educ median number of school years completed for persons 25 years or older  
 Sound percentage of the housing that is sound with all facilities  
 Density population density (in persons per square mile of urbanized area)  
 Nonwhite percentage of population that is nonwhite  
 Whitecol percentage of employment in white collar occupations  
 Poor percentage of households with annual income under \$3,000 in 1960  
 HC relative pollution potential of hydrocarbons  
 NOx relative pollution potential of oxides of nitrogen  
 SO2 relative pollution potential of sulfur dioxide

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

McDonald, G.C. and Ayers, J.A. (1978). Some Applications of the “Chernoff Faces”: A Technique for Graphically Representing Multivariate Data in Wang, P.C.C. (ed.) *Graphical Representation of Multivariate Data*, Academic Press.

### See Also

[ex1123](#)

### Examples

`str(ex1217)`

---

ex1220

*Galapagos Islands*

---

### Description

The number of species on an island is known to be related to the island’s area. Of interest is what other variables are also related to the number of species, after island area is accounted for, and whether the answer differs for native and non native species.

### Usage

ex1220

**Format**

A data frame with 30 observations on the following 8 variables.

Island a character vector indicating the island

Total total number of observed species

Native number of native species

Area area (km<sup>2</sup>)

Elev elevation (m)

DistNear distance from nearest island (km)

DistSC distance from Santa Cruz (km)

AreaNear area of nearest island (km<sup>2</sup>)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Johnson, M.P. and Raven, P.H. (1973). Species Number and Endemism: The Galapagos Archipelago Revisited, *Science* **179**(4076): 893–895.

**Examples**

```
str(ex1220)
```

---

ex1221

*River Nitrogen*

---

**Description**

The rise in abundance of algae in coastal waters is thought to be due to increases in nutrients such as nitrate and other forms of nitrogen. Researchers gathered data to gauge the evidence that nitrates in the discharges of rivers around the world are associated with human population density.

**Usage**

```
ex1221
```

**Format**

A data frame with 42 observations on the following 11 variables.

River a character vector indicating the river

Country a factor variable with 26 levels

Discharge the estimated annual average discharge of the river into an ocean ( $\text{m}^3$  per second)

Runoff estimated annual average runoff from the watershed ( $\text{liters}/(\text{sec} \times \text{km}^2)$ )

Area watershed area ( $\text{km}^2$ )

Density density of people ( $\text{people}/\text{km}^2$ )

NO3 nitrate concentration ( $\mu\text{M}/\text{l}$ )

Export nitrate export (product of runoff times nitrate concentration)

Dep deposition (proportional to product of nitrate precipitation times precipitation)

NPrec nitrate precipitation ( $\mu\text{mol NO}_3/(\text{sec} \times \text{km}^2)$ )

Prec precipitation ( $\text{cm}/\text{year}$ )

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Cole, J.L., Peierls, B.L., Caraco, N.F. and Pace, M.L. (1993). Nitrogen Loading of Rivers as a Human-driven Process, in McDonnell, M.J. and Pickett, S.T.A. (eds.) *Humans as Components of Ecosystems: The Ecology of Subtle Human Effects and Populated Areas*, Springer-Verlag.

**Examples**

```
str(ex1221)
```

---

ex1222

*Bush Gore Ballot Controversy*

---

**Description**

This data set contains the vote counts by county in Florida for Buchanan and for four other presidential candidates in 2000, along with the total vote counts in 2000, the presidential vote counts for three presidential candidates in 1996, the vote count for Buchanan in his only other campaign in Florida—the 1996 Republican primary, the registration in Buchanan’s Reform party and the total political party registration in the county.

**Usage**

ex1222

**Format**

A data frame with 67 observations on the following 13 variables.

County a character vector indicating the county  
Buchanan2000 votes cast for Buchanan in 2000 presidential election  
Gore2000 votes cast for Gore in 2000 presidential election  
Bush2000 votes cast for Bush in 2000 presidential election  
Nader2000 votes cast for Nader in 2000 presidential election  
Browne2000 votes cast for Browne in 2000 presidential election  
Total2000 total votes cast in 2000 presidential election  
Clinton96 votes cast for Clinton in 1996 presidential election  
Dole96 votes cast for Dole in 1996 presidential election  
Perot96 votes cast for Perot in 1996 presidential election  
Buchanan96p votes cast for Buchanan in 1996 Republican primary  
ReformReg the registration in Buchanan's Reform party  
TotalReg the total political party registration

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**See Also**

[ex0825](#)

**Examples**

```
str(ex1222)
```

---

ex1317

*Dinosaur Extinctions—An Observational Study*

---

**Description**

About 65 million years ago, the dinosaurs suffered a mass extinction virtually overnight (in geologic time). Among many clues, one that all scientists regard as crucial is a layer of iridium-rich dust that was deposited over much of the earth at that time. The theory is that an event like a volcanic eruption or meteor impact caused a massive dust cloud that blanketed the earth for years killing off animals and their food sources. Dataset has Iridium depths by type of deposit.

**Usage**

ex1317

**Format**

A data frame with 28 observations on the following 3 variables.

Iridium Iridium in samples (ppt)

Strata a factor with levels "Limestone" and "Shale"

Depth a factor with six levels: "1", "2", ..., "6"

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Alvarez, W. and Asaro, F. (1990). What Caused the Mass Extinction? An Extraterrestrial Impact, *Scientific American* **263**(4): 76–84.

Courtillot, E. (1990). What Caused the Mass Extinction? A Volcanic Eruption. *Scientific American* **263**(4): 85–92.

**Examples**

```
str(ex1317)
```

---

 ex1319

---

*Nature—Nurture*


---

**Description**

A 1989 study investigated the effect of heredity and environment on intelligence. Data are the IQ scores for adopted children whose biological and adoptive parents were categorized either in the highest or the lowest socioeconomic status category.

**Usage**

```
ex1319
```

**Format**

A data frame with 38 observations on the following 3 variables.

IQ IQ scores of adopted children

Adoptive a factor with levels "High" and "Low"; the socioeconomic status of the adoptive parents

Biologic a factor with levels "High" and "Low"; the socioeconomic status of the biological parents

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Capron, C. and Duyme, M. (1991). Children's IQ's and SES of Biological and Adoptive Parents in a Balanced Cross-fostering Study, *European Bulletin of Cognitive Psychology* **11**(3): 323–348.

**See Also**

[ex1605](#)

**Examples**

`str(ex1319)`

---

ex1320

*Gender Differences in Performance on Mathematics Achievement Tests*

---

**Description**

Data set on 861 ACT Assessment Mathematics Usage Test scores from 1987. The test was given to a sample of high school seniors who met one of three profiles of high school mathematics course work: (a) Algebra I only; (b) two Algebra courses and Geometry; and (c) two Algebra courses, Geometry, Trigonometry, Advanced Mathematics and Beginning Calculus.

These data were generated from summary statistics for one particular form of the test as reported by Doolittle (1989).

**Usage**

`ex1320`

**Format**

A data frame with 861 observations on the following 3 variables.

Sex a factor with levels "female" and "male"

Background a factor with levels "a", "b" and "c"

Score ACT mathematics test score

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Doolittle, A.E. (1989). Gender Differences in Performance on Mathematics Achievement Items, *Applied Measurement in Education* **2**(2): 161–177.

**Examples**

```
str(ex1320)
```

---

ex1414

*Blood Brain Barrier*

---

**Description**

Researchers designed an experiment to investigate how delivery of brain cancer antibody is influenced by tumor size, antibody molecular weight, blood-brain barrier disruption, and delivery route.

**Usage**

```
ex1414
```

**Format**

A data frame with 36 observations on the following 6 variables.

Agent a factor with levels "AIB", "DEX7" and "MTX"

Treatment a factor with levels "BD" and "NS"

Route a factor with levels "IA" and "IV"

Days days after inoculation

BAT concentration of antibody in the part of the brain around the tumor

LH concentration of antibody in the unaffected part of the brain

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Barnett, P.A., Roman-Goldstain, S., Ramsey, F., McCormick, C.I., Sexton, G., Szumowski, J. and Neuwelt, E.A. (1995). Differential Permeability and Quantitative MR Imaging of a Human Lung Carcinoma Brain Xenograft in the Nude Rat, *American Journal of Pathology* **146**(2): 436–449.

**See Also**

[ex1415](#)

**Examples**

```
str(ex1414)
```

---

ex1415

*Second Replicate of the Barrier Disruption Study*

---

### Description

Researchers designed an experiment to investigate how delivery of brain cancer antibody is influenced by tumor size, antibody molecular weight, blood-brain barrier disruption, and delivery route. The data for the first replicate of this study is in [ex1414](#). This is the second replicate for the study.

### Usage

ex1415

### Format

A data frame with 36 observations on the following 6 variables.

Agent a factor with levels "AIB", "DEX7" and "MTX"

Treatment a factor with levels "BD" and "NS"

Route a factor with levels "IA" and "IV"

Days days after inoculation

BAT concentration of antibody in the part of the brain around the tumor

LH concentration of antibody in the unaffected part of the brain

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

Barnett, P.A., Roman-Goldstain, S., Ramsey, F., McCormick, C.I., Sexton, G., Szumowski, J. and Neuwelt, E.A. (1995). Differential Permeability and Quantitative MR Imaging of a Human Lung Carcinoma Brain Xenograft in the Nude Rat, *American Journal of Pathology* **146**(2): 436–449.

### See Also

[ex1414](#)

### Examples

`str(ex1415)`



---

ex1417

*Tennessee Corn Yield Trials*

---

**Description**

Corn yield trials were performed at four locations in Tennessee in 1999. Data shows the average yields for six hybrids at each of four locations.

**Usage**

ex1417

**Format**

A data frame with 30 observations on the following 3 variables.

Location a factor with five levels: "Ames.irr", "Ames.un", "Crossvill", "Knoxville" and "Milan"

Hybrid a factor with six levels: "AsgrowRX799", "Beck5912W", "Cargill17821", "FFR739W", "NorthrupKing" and "Pioneer"

Yield average yield (bushels per acre)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

University of Tennessee Agricultural Experiment Station.

**Examples**

```
str(ex1417)
```

---

ex1509

*Sunspot Counts for 1749–1948*

---

**Description**

Time series data set of annual counts of sunspots.

**Usage**

ex1509

**Format**

A data frame with 200 observations on the following 2 variables.

Year year

Spots number of sunspots

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Waldmeier, M. (1961). *The Sunspot Activity in the Years 1610–1960*, Federal Observatory, Zurich.

**Examples**

```
str(ex1509)
```

---

ex1512

*Melanoma and Sunspot Activity—An Observational Study*

---

**Description**

Several factors suggest that the incidence of melanoma is related to solar radiation. Data has the age-adjusted melanoma incidence among males from Connecticut Tumor Registry, 1936–1972.

**Usage**

```
ex1512
```

**Format**

A data frame with 37 observations on the following 3 variables.

Year year

Melanoma male melanoma incidence in number of cases per 100,000 population

Sunspot sunspot relative number

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Houghton, A., Munster, E.W. and Viola, M.V. (1978). Increased Incidence of Malignant Melanoma After Peaks of Sunspot Activity, *Lancet*: 759–760.

**Examples**

```
str(ex1512)
```

---

ex1513

*Lynx Trappings and Sunspots*

---

**Description**

Data on the annual numbers of lynx trapped in the Mackenzie River district of northwest Canada from 1821–1934.

**Usage**

```
ex1513
```

**Format**

A data frame with 114 observations on the following 3 variables.

Year year

Lynx number of lynx trapped

Spots number of sunspots

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Elston, C. and Nicholson, M. (1942). The Ten Year Cycle in Numbers of the Lynx in Canada, *Journal of Animal Ecology* **11**(2): 215–244.

**Examples**

```
str(ex1513)
```

---

ex1514

*Trends in Firearm and Motor Vehicle Deaths in the U.S.*

---

**Description**

Data shows the number of deaths due to firearms and the number of deaths due to motor vehicle accidents in the United States between 1968 and 1993.

**Usage**

ex1514

**Format**

A data frame with 26 observations on the following 3 variables.

Year year

FirearmDeaths deaths due to firearms (in thousands per year)

MotorVehicleDeaths deaths due to motor vehicles (in thousands per year)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Data read from a Centers for Disease Control and Prevention graph reported in *The Oregonian*, June 17, 1997.

**Examples**

```
str(ex1514)
```

---

ex1515

*S&P 500*

---

**Description**

Data on the value of a \$1 U.S. stock investment in 1871 at the end of each year, based on the Standard and Poor (S&P) 500 Composite stock index.

**Usage**

ex1515

**Format**

A data frame with 129 observations on the following 2 variables.

Year year

SPReturn S&P composite stock index (\$)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**Examples**

```
str(ex1515)
```

---

ex1605

*Nature—Nurture*

---

**Description**

Data are a subset from an observational, longitudinal, study on adopted children. Is child's intelligence related to intelligence of the biological mother and the intelligence of the adoptive mother?

**Usage**

```
ex1605
```

**Format**

A data frame with 62 observations on the following 6 variables.

AMED adoptive mother's years of education

BMIQ biological mother's score on IQ test

Age2IQ IQ of child at age 2

Age4IQ IQ of child at age 4

Age8IQ IQ of child at age 8

Age13IQ IQ of child at age 13

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Skodak, M. and Skeels, H.M. (1949). A Final Follow-up Study of One Hundred Adopted Children, *Journal of Genetic Psychology* **75**: 85–125.

**See Also**[ex1319](#)**Examples**`str(ex1605)`

---

`ex1611`*Religious Competition*

---

**Description**

Adam Smith, in *Wealth of Nations*, observed that even religious monopolies become weak when they are not challenged by competition. Data to illustrate this point is from 21 countries in which the percentages of Catholics in the populations varied from a low 1.2% to a high 97.6%.

**Usage**`ex1611`**Format**

A data frame with 21 observations on the following 4 variables.

Country a character vector indicating the country

PctCath percent Catholics in the population

P2PRatio priest to parishioner ratio

PctIndig percent clergy indigenous

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Gill, A.J. (1994). Rendering unto Caesar? Religious Competition and Catholic Political Strategy in Latin America, 1962–79, *American Journal of Political Science* **38**(2): 403–425.

**Examples**`str(ex1611)`

---

ex1612

*Wastewater*

---

**Description**

Samples of effluent were divided and sent to two laboratories for testing. Data are measurements of biochemical oxygen demand and suspended solid measurements obtained for 2 sample splits from the two laboratories.

**Usage**

ex1612

**Format**

A data frame with 11 observations on the following 4 variables.

ComBOD biochemical oxygen demand measurements from commercial laboratory

ComSS suspended solids measurements from commercial laboratory

StaBOD biochemical oxygen demand measurements from state laboratory

StaSS suspended solids measurements from state laboratory

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Johnson, R.A. and Wichern, D.W. (1988). *Applied Multivariate Statistical Analysis*, Prentice-Hall.

**Examples**

`str(ex1612)`

---

ex1613

*Flea Beetle Distinction*

---

**Description**

Data are the measurements from two very similar species of flea beetle.

**Usage**

ex1613

**Format**

A data frame with 36 observations on the following 3 variables.

Jnt1 measurement of first joint in micrometers

Jnt2 measurement of second joint in micrometers

Species a factor with levels "conc" and "heik"

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Lubischew, A.A. (1962). On the Use of Discriminant Functions in Taxonomy, *Biometrics* **18**: 455–477.

**Examples**

```
str(ex1613)
```

---

 ex1614

---

*Pschoimmunology*


---

**Description**

Recent studies in the field of psychoimmunology suggest a link exists between behavioral events and the functioning of one's immune system. Data shows the results of a study on 12 subjects who were monitored during three distinct activities. The first activity consisted of neutral activity such as reporting tasks. During the second activity, subjects listened to audiotape exercises relating to images of heaviness, warmth in the body, relaxation, suggestions to remember happy events, etc. The third activity included a nonaudio tape follow up stimulus consisting of continued relaxation as in activity 2 and a verbal discussion of the positive aspects of the audiotape.

**Usage**

```
ex1614
```

**Format**

A data frame with 12 observations on the following 3 variables.

PhaseA Interleukin-1 levels (counts per minute) from blood samples taken during activity A

PhaseB Interleukin-1 levels (counts per minute) from blood samples taken during activity B

PhaseC Interleukin-1 levels (counts per minute) from blood samples taken during activity C



**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Keppel, W. (1993). Effects of Behavioral Stimuli on Plasma Interleukin-1 Activity in Humans at Rest, *Journal of Clinical Psychology* **49**(6): 777–785.

**Examples**

```
str(ex1614)
```

---

 ex1615

---

*Trends in SAT Scores*


---

**Description**

Data shows a partial listing of a data set with ratios of average math to average verbal SAT scores in the United States and the District of Columbia for 1989 and 1996–1999.

**Usage**

```
ex1615
```

**Format**

A data frame with 51 observations on the following 6 variables.

State a character vector indicating the state

M/V: 89 average MATH SAT scores divided by average VERBAL SAT score in 1989

M/V: 96 average MATH SAT scores divided by average VERBAL SAT score in 1996

M/V: 97 average MATH SAT scores divided by average VERBAL SAT score in 1997

M/V: 98 average MATH SAT scores divided by average VERBAL SAT score in 1998

M/V: 99 average MATH SAT scores divided by average VERBAL SAT score in 1999

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**Examples**

```
str(ex1615)
```

---

ex1708

*Pig Fat*

---

**Description**

Actual pig fat and measurements of pig fat from magnetic resonance images at 13 locations for 12 pigs.

**Usage**

ex1708

**Format**

A data frame with 12 observations on the following 14 variables.

Fat actual pig fat (in percent)

M1 magnetic resonance image at location 1

M2 magnetic resonance image at location 2

M3 magnetic resonance image at location 3

M4 magnetic resonance image at location 4

M5 magnetic resonance image at location 5

M6 magnetic resonance image at location 6

M7 magnetic resonance image at location 7

M8 magnetic resonance image at location 8

M9 magnetic resonance image at location 9

M10 magnetic resonance image at location 10

M11 magnetic resonance image at location 11

M12 magnetic resonance image at location 12

M13 magnetic resonance image at location 13

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Glasbey, C.A and Fowler, P.A. (1992). Regression Models Fitted Using Conditional Independence to Estimate Pig Fatness from Magnetic Resonance Images, *The Statistician* **41**(2): 179–184.

**Examples**

str(ex1708)

---

ex1713

*Church Distinctiveness*

---

### **Description**

Data show measures that differ among denominations of American Protestant and Catholic churches.

### **Usage**

ex1713

### **Format**

A data frame with 18 observations on the following 6 variables.

Denomination a character vector indicating the church denomination

Distinct distinctiveness (strictness of discipline on a seven point scale)

Attend average percentage of weeks that individuals attended a church meeting (% weekly)

NonChurch average number of secular organisations to which members belong

StrongPct average percentage of members that describe themselves as being strong church members (%)

AnnInc average income of members (US\$)

### **Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### **References**

Iannaccone, L.R. (1994). Why Strict Churches Are Strong, *American Journal of Sociology* **99**(5): 1180–1211.

### **Examples**

str(ex1713)

---

ex1714

*Insurance*

---

### Description

In the 1970's the U.S. Commission on Civil Rights investigated charges that insurance companies were attempting to redefine Chicago "neighborhoods" in order to cancel existing homeowner insurance policies or refuse to issue new ones. Dataset has data on homeowner and residential fire insurance policy issuances from 47 zip codes in the Chicago area.

### Usage

ex1714

### Format

A data frame with 47 observations on the following 8 variables.

Zip last 2 digits of zip code

Fire fires per 1000 housing units

Theft thefts per 1000 population

Age percentage of housing units built prior to 1940

Income median family income

Race percentage minority

Vo1 number of new policies per 100 housing units

Invo1 number of FAIR plan policies and renewals per 100 housing units

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

Andrews, D.F. and Herzberg, A.M. (1985). *Data: A Collection of Problems from many Fields for the Student and Research Worker*, Springer-Verlag.

### Examples

`str(ex1714)`

---

ex1914	<i>Mantel-Haenszel Test for Censored survival Times: Lymphoma and Radiation Data</i>
--------	--

---

**Description**

Survival times for two groups of lymphoma patients.

**Usage**

ex1914

**Format**

A data frame with 34 observations on the following 4 variables.

Months months after diagnosis

Group a factor with levels "no" and "radiation"

Survived number of patients known to survive beyond this month

Died number of patients known to die after this many months

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Neuwelt, E.A., Goldman, D.L., Dahlborg, S.A., Crossen, J., Ramsey, F., Roman-Goldstein, S., Brazier, R. and Dana, B. (1991). Primary CNS Lymphoma Treated with Osmotic Blood-brain Barrier Disruption: Prolonged Survival and Preservation of Cognitive Function, *Journal of Clinical Oncology* **9**(9): 1580–1590.

**Examples**

str(ex1914)

---

ex1916

*Vitamin C and Colds*

---

### Description

Fictitious data set based on results of an experiment where subjects were randomly divided into two groups and given a placebo or vitamin c to take during the cold season. At the end of the cold season, the subjects were interviewed by a physician who determined whether they had or had not suffered a cold during the period. Skeptics interviewed the 800 subjects to determine who knew and who did not know to which group they had been assigned. Vitamin C has a bitter taste and those familiar with it could recognize whether their pills contained it.

### Usage

ex1916

### Format

A data frame with 4 observations on the following 4 variables.

Knew a factor with levels "no" and "yes"

Treatment a factor with levels "placebo" and "vitC"

Cold number of people who got a cold

NoCold number of people who did not get a cold

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### Examples

```
str(ex1916)
```

---

ex1917

*Alcohol Consumption and Breast Cancer—A Retrospective Study*

---

### Description

Dataset from a study which investigated the added risk of breast cancer due to alcohol consumption. A sample of confirmed breast cancer patients were compared with a sample of cancer free women who were close in age and from the same neighborhood as the cases. Data was collected on the alcohol consumption and body mass of both sets of women.

**Usage**

```
ex1917
```

**Format**

A data frame with 6 observations on the following 4 variables.

Bodymass a factor with levels "high", "low" and "medium"

Drinking a factor with levels "high" and "low"

Cases number of women with breast cancer

Controls number of women without breast cancer

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Rosenberg, L., Palmer, J.R., Miller, D.R., Clarke, E.A. and Shapiro, S. (1990). A Case-Control Study of Alcoholic Beverage Consumption and Breast Cancer, *American Journal of Epidemiology* **131**(1): 6–14.

**Examples**

```
str(ex1917)
```

---

ex1918

*The Donner Party*

---

**Description**

In 1846 the Donner party became stranded while crossing the Sierra Nevada Mountains near Lake Tahoe. The data frame has the counts for male and female survivors for six age groups.

**Usage**

```
ex1918
```

**Format**

A data frame with 12 observations on the following 4 variables.

Age a factor with six levels: "15-19", "20-29", "30-39", "40-49", "50-59" and "60-69"

Sex a factor with levels "female" and "male"

Lived number that lived

Died number that died

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Grayson, D.K. (1990). Donner Party Deaths: A Demographic Assessment, *Journal of Anthropological Research* **46**: 223–242.

**See Also**

[case2001](#)

**Examples**

`str(ex1918)`

---

ex1919

*Tire-Related Fatal Accidents and Ford Sports Utility Vehicles*

---

**Description**

Data shows the numbers of compact sports utility vehicles involved in fatal accidents in the U.S. between 1995 and 1999, categorized according to travel speed, make of car (Ford or other), and cause of accident (tire-related or other).

**Usage**

`ex1919`

**Format**

A data frame with 8 observations on the following 4 variables.

Speed a factor with levels "0-40", "41-55", "56-65" and ">65"

Make a factor with levels "Ford" and "Other"

Other cause of accident was other than tire-related

Tire cause of accident was tire-related

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**See Also**

[ex2018](#)



**Examples**

```
str(ex1919)
```

---

ex2011

*Space Shuttle*

---

**Description**

This data frame contains the launch temperatures (degrees Fahrenheit) and an indicator of O-ring failures for 24 space shuttle launches prior to the space shuttle *Challenger* disaster of January 28, 1986.

**Usage**

```
ex2011
```

**Format**

A data frame with 24 observations on the following 2 variables.

Temp Launch temperature (in degrees Fahrenheit)

Failure Indicator of O-ring failure

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**See Also**

[case0401](#), [ex2223](#)

**Examples**

```
str(ex2011)
```

---

ex2012

*Muscular Dystrophy*

---

### Description

Duchenne Muscular Dystrophy (DMD) is a genetically transmitted disease, passed from a mother to her children. Boys with the disease usually die at a young age; but affected girls usually do not suffer symptoms, may unknowingly carry the disease and may pass it to their offspring. It is believed that about 1 in 3,300 women are DMD carriers. A woman might suspect she is a carrier when a related male child develops the disease. Doctors must rely on some kind of test to detect the presence of the disease. This data frame contains data on two enzymes in the blood, creatine kinase (CK) and hemopexin (H) for 38 known DMD carriers and 82 women who are not carriers. It is desired to use these data to obtain an equation for indicating whether a women is a likely carrier.

### Usage

ex2012

### Format

A data frame with 120 observations on the following 3 variables.

Group Indicator whether the woman has DMD ("Case") or not ("Control")

CK Creatine kinase reading

H Hemopexin reading

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

Andrews, D.F. and Herzberg, A.M. (1985). *Data: A Collection of Problems From Many Fields For The Student And Research Worker*, Springer-Verlag, New York.

### Examples

str(ex2012)

---

`ex2015`*Spotted Owl Habitat*

---

**Description**

A study examined the association between nesting locations of the Northern Spotted Owl and availability of mature forests. Wildlife biologists identified 30 nest sites. The researchers selected 30 other sites at random coordinates in the same forest. On the basis of aerial photographs, the percentage of mature forest (older than 80 years) was measured in various rings around each of the 60 sites.

**Usage**`ex2015`**Format**

A data frame with 60 observations on the following 8 variables.

Site Site, a factor with levels "Random" and "Nest"

PctRing1 Percentage of mature forest in ring with outer radius 0.91 km

PctRing2 Percentage of mature forest in ring with outer radius 1.18 km

PctRing3 Percentage of mature forest in ring with outer radius 1.40 km

PctRing4 Percentage of mature forest in ring with outer radius 1.60 km

PctRing5 Percentage of mature forest in ring with outer radius 1.77 km

PctRing6 Percentage of mature forest in ring with outer radius 2.41 km

PctRing7 Percentage of mature forest in ring with outer radius 3.38 km

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Ripple W.J., Johnson, D.H., Thershey, K.T. and Meslow E.C. (1991). Old-growth and Mature Forests Near Spotted Owl Nests in Western Oregon, *Journal of Wildlife Management* **55**(2): 316–318.

**Examples**`str(ex2015)`

---

ex2016

*Bumpus Natural Selection Data*

---

### Description

Hermon Bumpus analysed various characteristics of some house sparrows that were found on the ground after a severe winter storm in 1898. Some of the sparrows survived and some perished. This data set contains the survival status, age, the length from tip of beak to tip of tail (in mm), the alar extent (length from tip to tip of the extended wings, in mm), the weight in grams, the length of the head in mm, the length of the humerus (arm bone, in inches), the length of the femur (thigh bones, in inches), the length of the tibio–tarsus (leg bone, in inches), the breadth of the skull in inches and the length of the sternum in inches.

### Usage

ex2016

### Format

A data frame with 87 observations on the following 11 variables.

Status Survival status, factor with levels "Perished" and "Survived"

AG Age, factor with levels "adult" and "juvenile"

TL total length (in mm)

AE alar extent (in mm)

WT weight (in grams)

BH length of beak and head (in mm)

HL length of humerus (in inches)

FL length of femur (in inches)

TT length of tibio–tarsus (in inches)

SK width of skull (in inches)

KL length of keel of sternum (in inches)

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### See Also

[case0201](#), [ex0221](#)

### Examples

`str(ex2016)`

---

ex2017

*Catholic stance*

---

### Description

The Catholic church has explicitly opposed authoritarian rule in some (but not all) Latin American countries. Although such action could be explained as a desire to counter repression or to increase the quality of life of its parishioners, A.J. Gill supplies evidence that the underlying reason may be competition from evangelical Protestant denominations. He compiled the data given in this data frame.

### Usage

ex2017

### Format

A data frame with 12 observations on the following 5 variables.

Stance Catholic church stance, factor with levels "Pro" and "Anti"

Country Latin American country

PQLI Physical Quality of Life Index in the mid-1970s; Average of live expectancy at age 1, infant mortality and literacy at age 15+.

Repress Average civil rights score for the period of authoritarian rule until 1979

Compete Percentage increase of competitive religious groups during the period 1900–1970

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

Gill, A.J. (1994). Rendering unto Caesar? Religious Competition and Catholic Strategy in Latin America, 1962–1979, *American Journal of Political Science* **38**(2): 403–425.

### Examples

str(ex2017)

---

ex2018

*Fatal Car Accidents Involving Tire Failures on Ford Explorers*

---

### Description

This data frame contains data on 1995 and later model compact sports utility vehicles involved in fatal accidents in the United States between 1995 and 1999, excluding those that were struck by another car and excluding accidents that, according to police reports, involved alcohol.

### Usage

ex2018

### Format

A data frame with 2321 observations on the following 4 variables.

Make Type of sports utility vehicle, factor with levels "Other" and "Ford"

Vehicle.age Vehicle age (in years); surrogate for age of tires

Passengers Number of passengers

Cause Cause of fatal accident, factor with levels "Not\_Tire" and "Tire"

### Details

The Ford Explorer is a popular sports utility vehicle made in the United States and sold throughout the world. Early in its production concern arose over a potential accident risk associated with tires of the prescribed size when the vehicle was carrying heavy loads, but the risk was thought to be acceptable if a low tire pressure was recommended. The problem was apparently exacerbated by a particular type of Firestone tire that was overly prone to separation, especially in warm temperatures. This type of tire was a common one used on Explorers in model years 1995 and later. By the end of 1999 more than 30 lawsuits had been filed over accidents that were thought to be associated with this problem. U.S. federal data on fatal car accidents were analysed at that time, showing that the odds of a fatal accident being associated with tire failure were three times as great for Explorers as for other sports utility vehicles.

Additional data from 1999 and additional variables may be used to further explore the odds ratio. It is of interest to see whether the odds that a fatal accident is tire-related depend on whether the vehicle is a Ford, after accounting for age of the car and number of passengers. Since the Ford tire problem may be due to the load carried, there is some interest in seeing whether the odds associated with a Ford depend on the number of passengers.

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**See Also**[ex1919](#)**Examples**`str(ex2018)`

ex2115

*Belief Accessibility***Description**

The study the effect of *context questions* prior to *target questions*, researchers conducted a poll involving 1,054 subjects selected randomly from the Chicago phone directory. To include possibly unlisted phones, selected numbers were randomly altered in the last position. This data frame contains the responses to one of the questions asked concerning continuing U.S. aid to the Nicaraguan Contra rebels. Eight different versions of the interview were given, representing all possible combinations of three factors at each of two levels. The experimental factors were Context, Mode and Level.

Context refers to the type of context questions preceding the question about Nicaraguan aid. Some subjects received a context question about Vietnam, designed to elicit reticence about having the U.S. become involved in another foreign war in a third-world country. The other context question was about Cuba, designed to elicit anti-communist sentiments.

Mode refers to whether the target question immediately followed the context question or whether there were other questions scattered in between.

Level refers to two versions of the context question. In the "high" level the question was worded to elicit a higher level of agreement than in the "low" level wording.

**Usage**

ex2115

**Format**

A data frame with 8 observations on the following 5 variables.

Context Factor referring to the context of the question preceding the target question about U.S. aid to the Nicaraguan Contra rebels

Mode Factor with levels "not" and "scattered", "scattered" is used if the target question was not asked directly after the context question

Level Factor with levels "low" and "high", refers to the wording of the question

M Number of people interviewed

Percent Percentage in favour of Contra aid

### Details

Increasingly, politicians look to public opinion surveys to shape their public stances. Does this represent the ultimate in democracy? Or are seemingly scientific polls being rigged by the manner of questioning? Psychologists believe that opinions—expressed as answers to questions—are usually generated at the time the question is asked. Answers are based on a quick sampling of relevant beliefs held by the subject, rather than a systematic canvas of all such beliefs. Furthermore, this sampling of beliefs tends to overrepresent whatever beliefs happen to be most accessible at the time the question is asked. This aspect of delivering opinions can be abused by the pollster. Here, for example, is one sequence of questions:

- (1) “Do you believe the Bill of Rights protects personal freedom?”
- (2) “Are you in favor of a ban on handguns?”

Here is another:

- (1) “Do you think something should be done to reduce violent crime?”
- (2) “Are you in favor of a ban on handguns?”

The proportion of yes answers to question 2 may be quite different depending on which question 1 is asked first.

### Source

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

### References

Tourangeau, R., Rasinski, K.A., Bradburn, N. and D’Andrade, R. (1989). Belief Accessibility and Context Effects in Attitude Measurement, *Journal of Experimental Social Psychology* **25**: 401–421.

### Examples

str(ex2115)

---

ex2116

*Aflatoxicol and Liver Tumors in Trout*

---

### Description

An experiment at the Marine/Freshwater Biomedical Sciences Center at Oregon State University investigated the carcinogenic effects of aflatoxicol, a metabolite of Aflatoxin B1, which is a toxic by-product produced by a mold that infects cottonseed meal, peanuts and grains. Twenty tanks of rainbow trout embryos were exposed to one of five doses of Aflatoxicol for one hour. The data represent the numbers of fish in each tank and the numbers of these that had liver tumours after one year.



**Usage**

```
ex2116
```

**Format**

A data frame with 20 observations on the following 3 variables.

Dose Dose (in ppm)

Tumor Number of trout with liver tumours

Total Number of trout in tank

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**Examples**

```
str(ex2116)
```

---

ex2117

*Effect of Stress During Conception on Odds of a Male Birth*

---

**Description**

The probability of a male birth in humans is about .51. It has previously been noticed that lower proportions of male births are observed when offspring is conceived at times of exposure to smog, floods or earthquakes. Danish researchers hypothesised that sources of stress associated with severe life events may also have some bearing on the sex ratio. To investigate this theory they obtained the sexes of all 3,072 children who were born in Denmark between 1 January 1980 and 31 December 1992 to women who experienced the following kind of severe life events in the year of the birth or the year prior to the birth: death or admission to hospital for cancer or heart attack of their partner or of their other children. They also obtained sexes on a sample of 20,337 births to mothers who did not experience these life stress episodes. This data frame contains the data that were collected. Noticed that for one group the exposure is listed as taking place during the first trimester of pregnancy. The rationale for this is that the stress associated with the cancer or heart attack of a family member may well have started before the recorded time of death or hospital admission.

**Usage**

```
ex2117
```

**Format**

A data frame with 5 observations on the following 4 variables.

Group Indicator for groups to which mothers belong

Time Indicator for time at which severe life event occurred

Number Number of births

PctBoys Percentage of boys born

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Hansen, D., Møller, H. and Olsen, J. (1999). Severe Periconceptional Life Events and the Sex Ratio in Offspring: Follow Up Study based on Five National Registers, *British Medical Journal* **319**(7209): 548–549.

**Examples**

```
str(ex2117)
```

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ex2118

*HIV and Circumcision*

---

**Description**

Researchers in Kenya identified a cohort of more than 1,000 prostitutes who were known to be a major reservoir of sexually transmitted diseases in 1985. It was determined that more than 85% of them were infected with human immunodeficiency virus (HIV) in February, 1986. The researchers identified men who acquired a sexually-transmitted disease from this group of women after the men sought treatment at a free clinic. The data frame contains data on the subset of those men who did not test positive for HIV on their first visit and who agreed to participate in the study. The men are categorised according to whether they later tested positive for HIV during the study period, whether they had one or multiple sexual contacts with the prostitutes and whether they were circumcised.

**Usage**

ex2118

**Format**

A data frame with 4 observations on the following 5 variables.

Contact Whether men had single or multiple contact with prostitutes

Circumcised Whether the men are circumcised, factor with levels "no" and "yes"

HIV Number of men that tested positive for HIV

Number Number of men

NoHIV Number of men that did not test positive for HIV (should be Number-HIV)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Cameron, D.W., D'Costa, L.J., Maitha, G.M., Cheang, M., Piot, P., Simonsen, J.N., Ronald, A.R., Gakinya, M.N., Ndinya-Achola, J.O., Brunham, R.C. and Plummer, F. A. (1989). Female to Male Transmission of Human Immunodeficiency Virus Type I: Risk Factors for Seroconversion in Men, *The Lancet* **334**(8660): 403–407.

**Examples**

```
str(ex2118)
```

---

ex2119

*Meta-Analysis of Breast Cancer and Lactation Studies*

---

**Description**

This data frame gives the results of 10 separate case-control studies on the association of breast cancer and whether a woman had breast-fed children.

**Usage**

```
ex2119
```

**Format**

A data frame with 20 observations on the following 4 variables.

Study Factor indicating the study from which data was taken

Lactate Whether women had breast-fed children (lactated)

Cancer Number of women with breast cancer

NoCancer Number of women without breast cancer

**Details**

Meta-analysis refers to the analysis of analyses. When the main results of studies can be cast into  $2 \times 2$  tables of counts, it is natural to combine individual odds ratios with a logistic regression model that includes a factor to account for different odds from the different studies. In addition, the odds ratio itself might differ slightly among studies because of different effects on different populations or different research techniques. One approach for dealing with this is to suppose an underlying common odds ratio and to model between-study variability as extra-binomial variation.

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Data gathered from various sources by Karolyn Kolassa as part of a Master's project, Oregon State University.

**Examples**

```
str(ex2119)
```

---

ex22.20

*Cancer Death of Atomic Bomb Survivors*

---

**Description**

The data in this data frame are the number of cancer deaths among survivors of the atomic bombs dropped on Japan during World War II, categorised by time (years) after the bomb that death occurred and the amount of radiation exposure that the survivors received from the blast (Data from D.A. Pierce, personal communication.) Also listed in each cell is the *person-years at risk*, in 100s. This is the sum total of all years spent by all persons in the category.

**Usage**

```
ex22.20
```

**Format**

A data frame with 42 observations on the following 4 variables.

Exposure Estimated exposure to radiation (in rads)

Years Years after exposure, factor with 7 levels

Deaths Number of cancer deaths

Risk Person-years at risk (in 100s)

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**Examples**

```
str(ex22.20)
```

---

ex2216

*Murder–Suicides by Deliberate Plane Crash*

---

**Description**

Some sociologists suspect that highly publicised suicides may trigger additional suicides. In one investigation of this hypothesis, D.P. Phillips collected information about 17 airplane crashes that were known (because of notes left behind) to be murder–suicides. For each of these crashes, Phillips reported an index of the news coverage (circulation of nine newspapers devoting space to the crash multiplied by length of coverage) and the number of multiple-fatality plane crashes during the week following the publicised crash. This data frame contains the collected data.

**Usage**

```
ex2216
```

**Format**

A data frame with 17 observations on the following 2 variables.

Index Index for the amount of newspaper coverage given the murder–suicide

Crashes Multiple-fatality crashes in the week following a murder–suicide by plane crash

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Phillips, D.P. (1978). Airplane Accident Fatalities Increase Just After Newspaper Stories About Murder and Suicide, *Science* **201**: 748–750.

**Examples**

```
str(ex2216)
```

---

`ex2222`*Emulating Jane Austen's Writing Style*

---

**Description**

When she died in 1817, the English novelist Jane Austen had not yet finished the novel *Sanditon*, but she did leave notes on how she intended to conclude the book. The novel was completed by a ghost writer, who attempted to emulate Austen's style. In 1978, a researcher reported counts of some words found in chapters of books written by Austen and in chapters written by the emulator. These data are given in this data frame.

**Usage**`ex2222`**Format**

A data frame with 24 observations on the following 3 variables.

Count Number of occurrences of a word in various chapters of books written by Jane Austen and the ghost writer

Book Title of books used

Word Words used

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Morton, A.Q. (1978). *Literary Detection: How to Prove Authorship and Fraud in Literature and Documents*, Charles Scribner's Sons, New York.

**Examples**`str(ex2222)`

---

ex2223                      *Space Shuttle O-Ring Failures*

---

**Description**

On January 27, 1986, the night before the space shuttle *Challenger* exploded, an engineer recommended to the National Aeronautics and Space Administration (NASA) that the shuttle not be launched in the cold weather. The forecasted temperature for the *Challenger* launch was 31 degrees Fahrenheit—the coldest launch ever. After an intense 3-hour telephone conference, officials decided to proceed with the launch. This data frame contains the launch temperatures and the number of O-ring problems in 24 shuttle launches prior to the *Challenger*.

**Usage**

ex2223

**Format**

A data frame with 24 observations on the following 2 variables.

Temp Launch temperatures (in degrees Fahrenheit)

Incident Numbers of O-ring incidents

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**See Also**

[case0401](#), [ex2011](#)

**Examples**

```
str(ex2223)
```

---

ex2224                      *Valve Failure in Nuclear Reactors*

---

**Description**

This data frame contains data on characteristics and numbers of *failures* observed in valve types from one pressurised water reactor.

**Usage**

ex2224

**Format**

A data frame with 90 observations on the following 7 variables.

System System, factor with 5 levels

Operator Operator type, factor with 4 levels

Valve Valve type, factor with 6 levels

Size Head size, factor with 3 levels (less than 2 inches, 2–10 inches and 10–30 inches)

Mode Operation mode, factor with 2 levels

Failures Number of failures observed

Time Lengths of observation time

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Moore, L.M. and Beckman, R.J. (1988). Appropriate One-Sided Tolerance Bounds on the Number of Failures using Poisson Regression, *Technometrics* **30**: 283–290.

**Examples**

```
str(ex2224)
```

---

ex2225

*Body Size and Reproductive Success in a Population of Male Bullfrogs*

---

**Description**

As an example of field observation in evidence of theories of sexual selection, S.J. Arnold and M.J. Wade presented the following data set on size and number of mates observed in 38 bullfrogs.

**Usage**

```
ex2225
```

**Format**

A data frame with 38 observations on the following 2 variables.

Bodysize Body size (in mm)

Mates Number of mates



**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Arnold, S.J. and Wade, M.J. (1984). On the Measurement of Natural and Sexual Selection: Applications, *Evolution* **38**: 720–734.

**Examples**

```
str(ex2225)
```

---

 ex2414

---

*Amphibian Crisis and UV-B*


---

**Description**

Data frame contains the percentage of unsuccessful hatching from enclosures containing 150 eggs each in a study to investigate whether UV-B is responsible for low hatch rates.

**Usage**

```
ex2414
```

**Format**

A data frame with 71 observations on the following 4 variables.

Percent percentage of frog eggs failing to hatch

Treat factor variable with levels "NoFilter", "UV-BTransmitting" and "UV-BBlocking"

Location factor variable with levels "ThreeCreeks", "SparksLake", "SmallLake" and "LostLake"

Phtolyas Photolyase activity

**Source**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**References**

Blaustein, A.R., Hoffman, P.D., Hokit, D.G., Kiesecker, J.M., Walls, S.C. and Hays, J.B. (1994). UV Repair and Resistance to Solar UV-B in Amphibian Eggs: A Link to Population Declines? *Proceedings of the National Academy of Science, USA* **91**: 1791–1795.

**Examples**

```
str(ex2414)
```

---

`Sleuth2Manual`*Manual of the R Sleuth2 package*

---

**Description**

If the option “pdfviewer” is set, this command will display the PDF version of the help pages.

**Usage**

```
Sleuth2Manual()
```

**Author(s)**

Berwin A Turlach <Berwin.Turlach@gmail.com>

**References**

Ramsey, F.L. and Schafer, D.W. (2002). *The Statistical Sleuth: A Course in Methods of Data Analysis (2nd ed)*, Duxbury.

**Examples**

```
## Not run: Sleuth2Manual()
```

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