Package ‘astsa’

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Type Package

Title Applied Statistical Time Series Analysis

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Description Data sets and scripts to accompany Time Series Analysis and Its Applications: With R Examples (4th ed), by R.H. Shumway and D.S. Stoffer. Springer Texts in Statistics, 2017, <DOI:10.1007/978-3-319-52452-8>, and Time Series: A Data Analysis Approach Using R. Chapman-Hall, 2019, <ISBN: 978-0367221096>.

URL https://github.com/nickpoison/astsa,

http://www.stat.pitt.edu/stoffer/tsa4/,

http://www.stat.pitt.edu/stoffer/tsda/

License GPL-3

LazyLoad yes

LazyData yes

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`astsa-package` *Applied Statistical Time Series Analysis*

Description

Includes data and scripts to accompany *Time Series Analysis and Its Applications: With R Examples* (4th ed) by R.H. Shumway and D.S. Stoffer. Springer Texts in Statistics, 2017. Softcover ISBN: 978-3319524511; eBook ISBN 978-3319524528; DOI: 10.1007/978-3319524528, and *Time Series: A Data Analysis Approach Using R*, Chapman-Hall, 2019. ISBN: 978-0367221096.

Details

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LazyData:	yes

Author(s)

David Stoffer <stoffer@pitt.edu>

References

See the webpages for the texts: http://www.stat.pitt.edu/stoffer/tsa4/ or http://www.stat.pitt.edu/stoffer/tsda/

`acf1` *Plot and print ACF of a time series*

Description

Produces a plot (and a printout) of the sample ACF. The zero lag value of the ACF is removed.

Usage

```
acf1(series, max.lag=NULL, plot=TRUE, main=NULL, ylim=NULL,
     na.action = na.pass, ...)
```

Arguments

`series`	The data. Does not have to be a time series object.
`max.lag`	Maximum lag. Can be omitted. Defaults to $\sqrt{n}+10$ unless $n < 60$. If the series is seasonal, this will be at least 4 seasons by default.
`plot`	If TRUE (default), a graph is produced and the values are rounded and listed. If FALSE, no graph is produced and the values are listed but not rounded by the script.
`main`	Title of graphic; defaults to name of series.
`ylim`	Specify limits for the y-axis.
`na.action`	How to handle missing data; default is `na.pass`
`...`	Additional arguments passed to `acf`

Details

This is basically a wrapper for `acf()` provided in `tseries`. The zero lag (which is always 1) has been removed. The error bounds are approximate white noise bounds, $0 \pm 2/\sqrt{n}$; no other option is given.

Value

`ACF`	The sample ACF

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

Examples

```
acf1(rnorm(100))
acf1(rnorm(100), 25, main='')  # no title
```

`acf2` *Plot and print ACF and PACF of a time series*

Description

Produces a simultaneous plot (and a printout) of the sample ACF and PACF on the same scale. The zero lag value of the ACF is removed.

Usage

```
acf2(series, max.lag=NULL, plot=TRUE, main=NULL, ylim=NULL,
     na.action = na.pass, ...)
```

Arguments

`series`	The data. Does not have to be a time series object.
`max.lag`	Maximum lag. Can be omitted. Defaults to $\sqrt{n}+10$ unless $n < 60$. If the series is seasonal, this will be at least 4 seasons by default.
`plot`	If TRUE (default), a graph is produced and the values are rounded and listed. If FALSE, no graph is produced and the values are listed but not rounded by the script.
`main`	Title of graphic; defaults to name of series.
`ylim`	Specify limits for the y-axis.
`na.action`	How to handle missing data; default is `na.pass`
`...`	Additional arguments passed to `acf`

Details

This is basically a wrapper for `acf()` provided in `tseries`. The error bounds are approximate white noise bounds, $0 \pm 2/\sqrt{n}$; no other option is given.

Value

`ACF`	The sample ACF
`PACF`	The sample PACF

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

Examples

```
acf2(rnorm(100))
acf2(rnorm(100), 25, main='')  # no title
acf2(rnorm(100), plot=FALSE)[,'ACF']  # print only ACF
```

`ar1miss` *AR with Missing Values*

Description

Data used in Chapter 6

Format

The format is: Time-Series [1:100] with NA for missing values.

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

`arf` *Simulated ARFIMA*

Description

1000 simulated observations from an ARFIMA(1, 1, 0) model with $\phi = .75$ and $d = .4$.

Format

The format is: Time-Series [1:1000] from 1 to 1000: -0.0294 0.7487 -0.3386 -1.0332 -0.2627 ...

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

`arma.spec` *Spectral Density of an ARMA Model*

Description

Gives the ARMA spectrum, tests for causality, invertibility, and common zeros.

Usage

```
arma.spec(ar = 0, ma = 0, var.noise = 1, n.freq = 500, log="n", type=NULL, ...)
```

Arguments

`ar`	vector of AR parameters
`ma`	vector of MA parameters
`var.noise`	variance of the noise
`n.freq`	number of frequencies
`log`	plot spectra on a log-scale; default is 'no'
`type`	type of plot to be drawn, defaults to lines
`...`	additional arguments

Details

The basic call is `arma.spec(ar,ma)` where `ar` and `ma` are vectors containing the model parameters. Use `log="yes"` if you want the plot on a log scale. If the model is not causal or invertible an error message is given. If there are common zeros, a spectrum will be displayed and a warning will be given; e.g., `arma.spec(ar= .9,ma= -.9)` will yield a warning and the plot will be the spectrum of white noise.

Value

`freq`	frequencies - returned invisibly
`spec`	spectral ordinates - returned invisibly

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

Examples

```
arma.spec(ar = c(1, -.9), ma = .8)
```

`ARMAtoAR` *Convert ARMA Process to Infinite AR Process*

Description

Gives the π-weights in the invertible representation of an ARMA model.

Usage

```
ARMAtoAR(ar = 0, ma = 0, lag.max=20)
```

Arguments

`ar`	vector of AR coefficients
`ma`	vector of MA coefficients
`lag.max`	number of pi-weights desired

Value

A vector of coefficients.

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

Examples

```
ARMAtoAR(ar=.9, ma=.5, 10)
```

beamd *Infrasonic Signal from a Nuclear Explosion*

Description

Infrasonic signal from a nuclear explosion.

Usage

```
data(beamd)
```

Format

A data frame with 2048 observations (rows) on 3 numeric variables (columns): `sensor1`, `sensor2`, `sensor3`.

Details

This is a data frame consisting of three columns (that are not time series objects). The data are an infrasonic signal from a nuclear explosion observed at sensors on a triangular array.

References

http://www.stat.pitt.edu/stoffer/tsa4/

birth *U.S. Monthly Live Births*

Description

Monthly live births (adjusted) in thousands for the United States, 1948-1979.

Format

The format is: Time-Series [1:373] from 1948 to 1979: 295 286 300 278 272 268 308 321 313 308 ...

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

blood — *Daily Blood Work*

Description

Multiple time series of measurements made for 91 days on the three variables, log(white blood count) [WBC], log(platelet) [PLT] and hematocrit [HCT]. Missing data code is NA.

Format

The format is: mts [1:91, 1:3]

Details

This is the data set used in Chapter 6 with NA as the missing data code.

Source

Jones, R.H. (1984). Fitting multivariate models to unequally spaced data. In *Time Series Analysis of Irregularly Observed Data*, pp. 158-188. E. Parzen, ed. Lecture Notes in Statistics, 25, New York: Springer-Verlag.

References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

HCT, PLT, WBC

Examples

```
plot(blood, type="o", pch=19)
```

bnrf1ebv — *Nucleotide sequence - BNRF1 Epstein-Barr*

Description

Nucleotide sequence of the BNRF1 gene of the Epstein-Barr virus (EBV): 1=A, 2=C, 3=G, 4=T. The data are used in Chapter 7.

Format

The format is: Time-Series [1:3954] from 1 to 3954: 1 4 3 3 1 1 3 1 3 1 ...

References

http://www.stat.pitt.edu/stoffer/tsa4/

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bnrf1hvs *Nucleotide sequence - BNRF1 of Herpesvirus saimiri*

Description

Nucleotide sequence of the BNRF1 gene of the herpesvirus saimiri (HVS): 1=A, 2=C, 3=G, 4=T. The data are used in Chapter 7.

Format

The format is: Time-Series [1:3741] from 1 to 3741: 1 4 3 2 4 4 3 4 4 4 ...

References

http://www.stat.pitt.edu/stoffer/tsa4/

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cardox *Monthly Carbon Dioxide Levels at Mauna Loa*

Description

Monthly mean carbon dioxide (in ppm) measured at Mauna Loa Observatory, Hawaii. This is an update to `co2` in the datasets package.

Format

The format is: Time-Series [1:729] from March, 1958 to November 2018: 315.71 317.45 317.50 317.10 ...

Details

The carbon dioxide data measured as the mole fraction in dry air, on Mauna Loa constitute the longest record of direct measurements of CO2 in the atmosphere. They were started by C. David Keeling of the Scripps Institution of Oceanography in March of 1958 at a facility of the National Oceanic and Atmospheric Administration. NOAA started its own CO2 measurements in May of 1974, and they have run in parallel with those made by Scripps since then. Data are reported as a dry mole fraction defined as the number of molecules of carbon dioxide divided by the number of molecules of dry air multiplied by one million (ppm).

Source

https://www.esrl.noaa.gov/gmd/ccgg/trends/

References

http://www.stat.pitt.edu/stoffer/tsda/

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ccf2 *Cross Correlation*

Description

Produces a nice graphic of the sample CCF of two time series. The actual CCF values are returned invisibly.

Usage

```
ccf2(x, y, max.lag = NULL, main=NULL, ylab="CCF", na.action = na.pass, ... )
```

Arguments

`x, y`	univariate time series.
`max.lag`	maximum lag for which to calculate the CCF.
`main`	plot title - if NULL, uses x and y names.
`ylab`	vertical axis label; default is 'CCF'.
`na.action`	how to handle missing values; default is `na.pass`
`...`	additional arguments passed to `acf`

Details

This will produce a graphic of the sample `corr[x(t+lag),y(t)]` from `-max.lag` to `max.lag`. Also, the (rounded to 3 digits) values of the CCF are returned invisibly.

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

Examples

```
( ccf2(soi, rec) )   # now you see it
ccf2(soi, rec)       # now you don't
```

`chicken` *Monthly price of a pound of chicken*

Description

Poultry (chicken), Whole bird spot price, Georgia docks, US cents per pound

Usage

```
data("chicken")
```

Format

The format is: Time-Series [1:180] from August 2001 to July 2016: 65.6 66.5 65.7 64.3 63.2 ...

Source

http://www.indexmundi.com/commodities/

References

http://www.stat.pitt.edu/stoffer/tsa4/

`climhyd` *Lake Shasta inflow data*

Description

Lake Shasta inflow data This is a data frame.

Format

A data frame with 454 observations (rows) on the following 6 numeric variables (columns): `Temp`, `DewPt`, `CldCvr`, `WndSpd`, `Precip`, `Inflow`.

Details

The data are 454 months of measured values for the climatic variables: air temperature, dew point, cloud cover, wind speed, precipitation, and inflow, at Lake Shasta, California. The man-made lake is famous for the placard stating, "We don't swim in your toilet, so don't pee in our lake."

References

http://www.stat.pitt.edu/stoffer/tsa4/

cmort — *Cardiovascular Mortality from the LA Pollution study*

Description

Average weekly cardiovascular mortality in Los Angeles County; 508 six-day smoothed averages obtained by filtering daily values over the 10 year period 1970-1979.

Format

The format is: Time-Series [1:508] from 1970 to 1980: 97.8 104.6 94.4 98 95.8 ...

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

See Also

`lap`

cpg — *Hard Drive Cost per GB*

Description

Median annual cost per gigabyte (GB) of storage.

Format

The format is: Time-Series [1:29] from 1980 to 2008: 213000.00 295000.00 260000.00 175000.00 160000.00 ...

Details

The median annual cost of hard drives used in computers. The data are retail prices per GB taken from a sample of manufacturers.

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

djia — *Dow Jones Industrial Average*

Description

Daily DJIA values from April 2006 - April 2016

Format

The format is: xts [1:2518, 1:5] 11279 11343 11347 11337 11283 ...
- attr(*, "class")= chr [1:2] "xts" "zoo"
- attr(*, "dimnames")=List of 2
..$: NULL
..$: chr [1:5] "Open" "High" "Low" "Close" ...

Source

The data were obtained as follows:
`library(TTR) # install.packages('TTR') if you don't have it`
`djia = getYahooData("^DJI",start=20060420,end=20160420,freq="daily")`
Unfortunately, this does not work now.

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

econ5 — *Five Quarterly Economic Series*

Description

Data frame containing quarterly U.S. unemployment, GNP, consumption, and government and private investment, from 1948-III to 1988-II.

Usage

```
data(econ5)
```

Format

A data frame with 161 observations (rows) on the following 5 numeric variables (columns): `unemp`, `gnp`, `consum`, `govinv`, `prinv`.

Source

Young, P.C. and Pedregal, D.J. (1999). Macro-economic relativity: government spending, private investment and unemployment in the USA 1948-1998. *Structural Change and Economic Dynamics*, 10, 359-380.

References

http://www.stat.pitt.edu/stoffer/tsa4/

EM0 *EM Algorithm for Time Invariant State Space Models*

Description

Estimation of the parameters in a simple state space via the EM algorithm.

Usage

```
EM0(num, y, A, mu0, Sigma0, Phi, cQ, cR, max.iter = 50, tol = 0.01)
```

Arguments

`num`	number of observations
`y`	observation vector or time series
`A`	time-invariant observation matrix
`mu0`	initial state mean vector
`Sigma0`	initial state covariance matrix
`Phi`	state transition matrix
`cQ`	Cholesky-like decomposition of state error covariance matrix Q – see details below
`cR`	Cholesky-like decomposition of state error covariance matrix R – see details below
`max.iter`	maximum number of iterations
`tol`	relative tolerance for determining convergence

Details

Practically, the script only requires that Q or R may be reconstructed as `t(cQ)%*%(cQ)` or `t(cR)%*%(cR)`, respectively.

Value

`Phi`	Estimate of Phi
`Q`	Estimate of Q
`R`	Estimate of R
`mu0`	Estimate of initial state mean
`Sigma0`	Estimate of initial state covariance matrix
`like`	-log likelihood at each iteration
`niter`	number of iterations to convergence
`cvg`	relative tolerance at convergence

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/

`EM1` *EM Algorithm for General State Space Models*

Description

Estimation of the parameters in the general state space model via the EM algorithm. Inputs are not allowed; see the note.

Usage

```
EM1(num, y, A, mu0, Sigma0, Phi, cQ, cR, max.iter = 100, tol = 0.001)
```

Arguments

`num`	number of observations
`y`	observation vector or time series; use 0 for missing values
`A`	observation matrices, an array with `dim=c(q,p,n)`; use 0 for missing values
`mu0`	initial state mean
`Sigma0`	initial state covariance matrix
`Phi`	state transition matrix
`cQ`	Cholesky-like decomposition of state error covariance matrix Q – see details below
`cR`	R is diagonal here, so `cR = sqrt(R)` – also, see details below
`max.iter`	maximum number of iterations
`tol`	relative tolerance for determining convergence

Details

Practically, the script only requires that Q or R may be reconstructed as `t(cQ)%*%(cQ)` or `t(cR)%*%(cR)`, respectively.

Value

`Phi`	Estimate of Phi
`Q`	Estimate of Q
`R`	Estimate of R
`mu0`	Estimate of initial state mean
`Sigma0`	Estimate of initial state covariance matrix
`like`	-log likelihood at each iteration
`niter`	number of iterations to convergence
`cvg`	relative tolerance at convergence

Note

Inputs are not allowed (and hence not estimated). The script uses Ksmooth1 and everything related to inputs are set equal to zero when it is called.

It would be relatively easy to include estimates of 'Ups' and 'Gam' because conditional on the states, these are just regression coefficients. If you decide to alter EM1 to include estimates of the 'Ups' or 'Gam', feel free to notify me with a workable example and I'll include it in the next update.

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/

`EQ5` *Seismic Trace of Earthquake number 5*

Description

Seismic trace of an earthquake [two phases or arrivals along the surface, the primary wave ($t = 1, \dots, 1024$) and the shear wave ($t = 1025, \dots, 2048$)] recorded at a seismic station.

Format

The format is: Time-Series [1:2048] from 1 to 2048: 0.01749 0.01139 0.01512 0.01477 0.00651 ...

References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

eqexp

EQcount *EQ Counts*

Description

Series of annual counts of major earthquakes (magnitude 7 and above) in the world between 1900 and 2006.

Format

The format is: Time-Series [1:107] from 1900 to 2006: 13 14 8 10 16 26 ...

Source

Zucchini and MacDonald (2009). Hidden Markov Models for Time Series: An Introduction using R. CRC Press.

References

http://www.stat.pitt.edu/stoffer/tsa4/

---

eqexp *Earthquake and Explosion Seismic Series*

Description

This is a data frame of the earthquake and explosion seismic series used throughout the text.

Format

A data frame with 2048 observations (rows) on 17 variables (columns). Each column is a numeric vector.

Details

The matrix has 17 columns, the first eight are earthquakes, the second eight are explosions, and the last column is the Novaya Zemlya event of unknown origin.

The column names are: `EQ1,EQ2,...,EQ8; EX1,EX2,...,EX8; NZ`. The first 1024 observations correspond to the P wave, the second 1024 observations correspond to the S wave.

References

http://www.stat.pitt.edu/stoffer/tsa4/

EXP6 *Seismic Trace of Explosion number 6*

Description

Seismic trace of an explosion [two phases or arrivals along the surface, the primary wave ($t = 1, \ldots, 1024$) and the shear wave ($t = 1025, \ldots, 2048$)] recorded at a seismic station.

Format

The format is: Time-Series [1:2048] from 1 to 2048: -0.001837 -0.000554 -0.002284 -0.000303 -0.000721 ...

References

http://www.stat.pitt.edu/stoffer/tsa3/

See Also

eqexp

FDR *Basic False Discovery Rate*

Description

Computes the basic false discovery rate given a vector of p-values.

Usage

```
FDR(pvals, qlevel = 0.05)
```

Arguments

`pvals`	a vector of pvals on which to conduct the multiple testing
`qlevel`	the proportion of false positives desired

Value

`fdr.id`	NULL if no significant tests, or the index of the maximal p-value satisfying the FDR condition.

References

http://www.stat.berkeley.edu/~paciorek/code/fdr/fdr.R `flu` *Monthly pneumonia and influenza deaths in the U.S., 1968 to 1978.*

Description

Monthly pneumonia and influenza deaths per 10,000 people in the United States for 11 years, 1968 to 1978.

Usage

```
data(flu)
```

Format

The format is: Time-Series [1:132] from 1968 to 1979: 0.811 0.446 0.342 0.277 0.248 ...

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

`fmri` *fMRI - complete data set*

Description

Data (as a vector list) from an fMRI experiment in pain, listed by location and stimulus. The data are BOLD signals when a stimulus was applied for 32 seconds and then stopped for 32 seconds. The signal period is 64 seconds and the sampling rate was one observation every 2 seconds for 256 seconds ($n = 128$). The number of subjects under each condition varies.

Details

The LOCATIONS of the brain where the signal was measured were [1] Cortex 1: Primary Somatosensory, Contralateral, [2] Cortex 2: Primary Somatosensory, Ipsilateral, [3] Cortex 3: Secondary Somatosensory, Contralateral, [4] Cortex 4: Secondary Somatosensory, Ipsilateral, [5] Caudate, [6] Thalamus 1: Contralateral, [7] Thalamus 2: Ipsilateral, [8] Cerebellum 1: Contralateral and [9] Cerebellum 2: Ipsilateral.

The TREATMENTS or stimuli (and number of subjects in each condition) are [1] Awake-Brush (5 subjects), [2] Awake-Heat (4 subjects), [3] Awake-Shock (5 subjects), [4] Low-Brush (3 subjects), [5] Low-Heat (5 subjects), and [6] Low-Shock (4 subjects). Issue the command `summary(fmri)` for further details. In particular, awake (Awake) or mildly anesthetized (Low) subjects were subjected levels of periodic brushing (Brush), application of heat (Heat), and mild shock (Shock) effects.

As an example, `fmri$L1T6` (Location 1, Treatment 6) will show the data for the four subjects receiving the Low-Shock treatment at the Cortex 1 location; note that `fmri[[6]]` will display the same data.

References

http://www.stat.pitt.edu/stoffer/tsa4/

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fmri1 — *fMRI Data Used in Chapter 1*

Description

A data frame that consists of average fMRI BOLD signals at eight locations.

Usage

```
data(fmri1)
```

Format

The format is: mts [1:128, 1:9]

Details

Multiple time series consisting of fMRI BOLD signals at eight locations (in columns 2-9, column 1 is time period), when a stimulus was applied for 32 seconds and then stopped for 32 seconds. The signal period is 64 seconds and the sampling rate was one observation every 2 seconds for 256 seconds ($n = 128$). The columns are labeled: "time" "cort1" "cort2" "cort3" "cort4" "thal1" "thal2" "cere1" "cere2".

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

See Also

fmri

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gas — *Gas Prices*

Description

New York Harbor conventional regular gasoline weekly spot price FOB (in cents per gallon) from 2000 to mid-2010.

Format

The format is: Time-Series [1:545] from 2000 to 2010: 70.6 71 68.5 65.1 67.9 ...

Details

Pairs with series `oil`

Source

Data were obtained from the URL tonto.eia.doe.gov/dnav/pet/pet_pri_spt_s1_w.htm, but that site no longer exists.

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

See Also

`oil`

`gdp` *Quarterly U.S. GDP*

Description

Seasonally adjusted quarterly U.S. GDP from 1947(1) to 2018(3).

Format

The format is: Time-Series [1:287] from 1947 to 2018: 2033 2028 2023 2055 2086 ...

Source

https://tradingeconomics.com/united-states/gdp

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

globtemp — *Global mean land-ocean temperature deviations to 2015*

Description

Global mean land-ocean temperature deviations (from 1951-1980 average), measured in degrees centigrade, for the years 1880-2015. This was an update of `gtemp`, but `gtemp_land` and `gtemp_ocean` are the most recent updates.

Format

The format is: Time-Series [1:136] from 1880 to 2015: -0.2 -0.11 -0.1 -0.2 -0.28 -0.31 -0.3 -0.33 -0.2 -0.11 ...

Details

The data were changed after 2011, so there are discrepancies between this data set and `gtemp`. The differences are explained here: http://www1.ncdc.noaa.gov/pub/data/ghcn/v3/GHCNM-v3.2.0-FAQ.pdf.

Source

http://data.giss.nasa.gov/gistemp/graphs/

References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

`gtemp_land`, `gtemp_ocean`, `globtempl`, `gtemp`, `gtemp2`

globtempl — *Global mean land (only) temperature deviations to 2015*

Description

Global mean [land only] temperature deviations (from 1951-1980 average), measured in degrees centigrade, for the years 1880-2015. This is an update of `gtemp2`. Note the data file is `globtemp-el` not `globtemp-one`; the el stands for land. The data files `gtemp_land` and `gtemp_ocean` are the most recent updates.

Usage

```
data("globtempl")
```

Format

The format is: Time-Series [1:136] from 1880 to 2015: -0.53 -0.51 -0.41 -0.43 -0.72 -0.56 -0.7 -0.74 -0.53 -0.25 ...

Details

The data were changed after 2011, so there are discrepancies between this data set and `gtemp2`. The differences are explained here: http://www1.ncdc.noaa.gov/pub/data/ghcn/v3/GHCNM-v3.2.0-FAQ.pdf.

Source

http://data.giss.nasa.gov/gistemp/graphs/

References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

`gtemp_land`, `gtemp_ocean`, `globtemp`, `gtemp2`, `gtemp`

---

gnp *Quarterly U.S. GNP*

Description

Seasonally adjusted quarterly U.S. GNP from 1947(1) to 2002(3).

Format

The format is: Time-Series [1:223] from 1947 to 2002: 1489 1497 1500 1524 1547 ...

Source

https://research.stlouisfed.org/

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

See Also

gdp

`Grid` *A Better Add Grid to a Plot*

Description

Adds a grid to an existing plot with major and minor ticks. Works like R graphics grid() but the grid lines are are solid and gray and minor ticks are produced by default.

Usage

```
Grid(nx = NULL, ny = nx, col = gray(0.9), lty = 1, lwd = par("lwd"), equilogs = TRUE,
     minor = TRUE, nxm = 2, nym = 2, tick.ratio = 0.5, ...)
```

Arguments

`nx, ny`	number of cells of the grid in x and y direction. When NULL, as per default, the grid aligns with the tick marks on the corresponding default axis (i.e., tickmarks as computed by axTicks). When NA, no grid lines are drawn in the corresponding direction.
`col`	color of the grid lines.
`lty`	line type of the grid lines.
`lwd`	line width of the grid lines.
`equilogs`	logical, only used when log coordinates and alignment with the axis tick marks are active. Setting equilogs = FALSE in that case gives non equidistant tick aligned grid lines.
`minor`	logical with TRUE (default) adding minor ticks.
`nxm, nym`	number of intervals in which to divide the area between major tick marks on the x-axis (y-axis). If minor=TRUE, should be > 1 or no minor ticks will be drawn.
`tick.ratio`	ratio of lengths of minor tick marks to major tick marks. The length of major tick marks is retrieved from par("tck").
`...`	other graphical parameters;

Details

I combined the code for `grid()` in the graphics package and `minor.tick()` from the Hmisc package, and changed the default grid line type and color. I made this basically for instructional purposes so students don't have to watch me type for and additional 5 minutes to get a grid with solid lines and with minor ticks on a plot.

Author(s)

D.S. Stoffer

References

The code for `grid()` in R graphics and `minor.tick()` from the Hmisc package were combined.

See Also

grid

---

gtemp *Global mean land-ocean temperature deviations*

Description

This data file is old and is here only for compatibility. See globtemp and gtemp_land. The original description is: Global mean land-ocean temperature deviations (from 1951-1980 average), measured in degrees centigrade, for the years 1880-2009.

Format

The format is: Time-Series [1:130] from 1880 to 2009: -0.28 -0.21 -0.26 -0.27 -0.32 -0.32 -0.29 -0.36 -0.27 -0.17 ...

Source

http://data.giss.nasa.gov/gistemp/graphs/

References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

gtemp_land, gtemp_ocean, globtemp, globtempl, gtemp2

---

gtemp2 *Global Mean Surface Air Temperature Deviations*

Description

This data file is old and is here only for compatibility. See globtemp and gtemp_land. The original description is: Similar to gtemp but the data are based only on surface air temperature data obtained from meteorological stations. The data are temperature deviations (from 1951-1980 average), measured in degrees centigrade, for the years 1880-2009.

Usage

```
data(gtemp2)
```

Format

The format is: Time-Series [1:130] from 1880 to 2009: -0.24 -0.19 -0.14 -0.19 -0.45 -0.32 -0.42 -0.54 -0.24 -0.05 ...

Source

http://data.giss.nasa.gov/gistemp/graphs/

References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

gtemp_land, gtemp_ocean, globtemp, globtempl, gtemp

---

gtemp_land — *Global mean land temperature deviations - updated to 2017*

Description

Annual temperature anomalies (in degress centigrade) averaged over the Earth's land area from 1880 to 2017.

Format

The format is: Time-Series [1:138] from 1880 to 2017: -0.62 -0.45 -0.47 -0.62 -0.82 ...

Source

http://data.giss.nasa.gov/gistemp/graphs/

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

See Also

gtemp_ocean, globtemp, globtempl, gtemp2

gtemp_ocean — *Global mean ocean temperature deviations - updated to 2017*

Description

Annual sea surface temperature anomalies averaged over the part of the ocean that is free of ice at all times (open ocean) from 1880 to 2017.

Format

The format is: Time-Series [1:138] from 1880 to 2009: -0.05 0.01 0.00 -0.06 -0.15 ...

Source

http://data.giss.nasa.gov/gistemp/graphs/

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

See Also

gtemp_land, globtemp, globtempl, gtemp2

Hare — *Snowshoe Hare*

Description

This is one of the classic studies of predator-prey interactions, the 90-year data set is the number, in thousands, of snowshoe hare pelts purchased by the Hudson's Bay Company of Canada. While this is an indirect measure of predation, the assumption is that there is a direct relationship between the number of pelts collected and the number of hare and lynx in the wild.

Usage

```
data("Hare")
```

Format

The format is: Time-Series [1:91] from 1845 to 1935: 19.6 19.6 19.6 12 28 ...

Note

This data set pairs with Lynx. The data are in units of one thousand.

Source

http://people.whitman.edu/~hundledr/courses/M250F03/M250.html

References

http://www.stat.pitt.edu/stoffer/tsda/

See Also

Lynx

HCT *Hematocrit Levels*

Description

HCT: Measurements made for 91 days on the three variables, log(white blood count) [WBC], log(platelet) [PLT] and hematocrit [HCT]. Missing data code is 0 (zero).

Format

The format is: Time-Series [1:91] from 1 to 91: 30 30 28.5 34.5 34 32 30.5 31 33 34 ...

Details

See Examples 6.1 and 6.9 for more details.

Source

Jones, R.H. (1984). Fitting multivariate models to unequally spaced data. In *Time Series Analysis of Irregularly Observed Data*, pp. 158-188. E. Parzen, ed. Lecture Notes in Statistics, 25, New York: Springer-Verlag.

References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

blood, PLT, WBC

hor — *Hawaiian occupancy rates*

Description

Quarterly Hawaiian hotel occupancy rate (percent of rooms occupied) from 1982-I to 2015-IV

Format

The format is: Time-Series [1:136] from 1982 to 2015: 79 65.9 70.9 66.7 ...

Source

http://dbedt.hawaii.gov/economic/qser/tourism/

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

Examples

```
plot(hor, type='c')                          # plot data and
text(hor, labels=1:4, col=c(1,4,2,6), cex=.9)  # add quarter labels
#
plot(stl(hor, s.window=15))  # fit structural model
```

jj — *Johnson and Johnson Quarterly Earnings Per Share*

Description

Johnson and Johnson quarterly earnings per share, 84 quarters (21 years) measured from the first quarter of 1960 to the last quarter of 1980.

Format

The format is: Time-Series [1:84] from 1960 to 1981: 0.71 0.63 0.85 0.44 0.61 0.69 0.92 0.55 0.72 0.77 ...

Details

This data set is also included with the R distribution as `JohnsonJohnson`

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

`Kfilter0` *Kalman Filter - Time Invariant Model*

Description

Returns the filtered values for the basic time invariant state-space model; inputs are not allowed.

Usage

```
Kfilter0(num, y, A, mu0, Sigma0, Phi, cQ, cR)
```

Arguments

`num`	number of observations
`y`	data matrix, vector or time series
`A`	time-invariant observation matrix
`mu0`	initial state mean vector
`Sigma0`	initial state covariance matrix
`Phi`	state transition matrix
`cQ`	Cholesky-type decomposition of state error covariance matrix Q – see details below
`cR`	Cholesky-type decomposition of observation error covariance matrix R – see details below

Details

Practically, the script only requires that Q or R may be reconstructed as `t(cQ)%*%(cQ)` or `t(cR)%*%(cR)`, respectively.

Value

`xp`	one-step-ahead state prediction
`Pp`	mean square prediction error
`xf`	filter value of the state
`Pf`	mean square filter error
`like`	the negative of the log likelihood
`innov`	innovation series
`sig`	innovation covariances
`Kn`	last value of the gain, needed for smoothing

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/

See also http://www.stat.pitt.edu/stoffer/tsa4/chap6.htm for an explanation of the difference between levels 0, 1, and 2.

`Kfilter1` *Kalman Filter - Model may be time varying or have inputs*

Description

Returns both the predicted and filtered values for a linear state space model. Also evaluates the likelihood at the given parameter values.

Usage

```
Kfilter1(num, y, A, mu0, Sigma0, Phi, Ups, Gam, cQ, cR, input)
```

Arguments

`num`	number of observations
`y`	data matrix, vector or time series
`A`	time-varying observation matrix, an array with `dim=c(q,p,n)`
`mu0`	initial state mean
`Sigma0`	initial state covariance matrix
`Phi`	state transition matrix
`Ups`	state input matrix; use `Ups = 0` if not needed
`Gam`	observation input matrix; use `Gam = 0` if not needed
`cQ`	Cholesky-type decomposition of state error covariance matrix Q – see details below
`cR`	Cholesky-type decomposition of observation error covariance matrix R – see details below
`input`	matrix or vector of inputs having the same row dimension as y; use `input = 0` if not needed

Details

Practically, the script only requires that Q or R may be reconstructed as `t(cQ)%*%(cQ)` or `t(cR)%*%(cR)`, respectively.

Value

xp	one-step-ahead prediction of the state
Pp	mean square prediction error
xf	filter value of the state
Pf	mean square filter error
like	the negative of the log likelihood
innov	innovation series
sig	innovation covariances
Kn	last value of the gain, needed for smoothing

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/

See also http://www.stat.pitt.edu/stoffer/tsa4/chap6.htm for an explanation of the difference between levels 0, 1, and 2.

Kfilter2 *Kalman Filter - Model may be time varying or have inputs or correlated errors*

Description

Returns the filtered values for the state space model. In addition, the script returns the evaluation of the likelihood at the given parameter values and the innovation sequence.

Usage

```
Kfilter2(num, y, A, mu0, Sigma0, Phi, Ups, Gam, Theta, cQ, cR,
          S, input)
```

Arguments

num	number of observations
y	data matrix, vector or time series
A	time-varying observation matrix, an array with `dim = c(q,p,n)`
mu0	initial state mean
Sigma0	initial state covariance matrix
Phi	state transition matrix

`Ups`	state input matrix; use `Ups = 0` if not needed
`Gam`	observation input matrix; use `Gam = 0` if not needed
`Theta`	state error pre-matrix
`cQ`	Cholesky decomposition of state error covariance matrix Q – see details below
`cR`	Cholesky-type decomposition of observation error covariance matrix R – see details below
`S`	covariance-type matrix of state and observation errors
`input`	matrix or vector of inputs having the same row dimension as y; use `input = 0` if not needed

Details

Practically, the script only requires that Q or R may be reconstructed as `t(cQ)%*%(cQ)` or `t(cR)%*%(cR)`, respectively.

Value

`xp`	one-step-ahead prediction of the state
`Pp`	mean square prediction error
`xf`	filter value of the state
`Pf`	mean square filter error
`like`	the negative of the log likelihood
`innov`	innovation series
`sig`	innovation covariances
`K`	last value of the gain, needed for smoothing

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/

See also http://www.stat.pitt.edu/stoffer/tsa4/chap6.htm for an explanation of the difference between levels 0, 1, and 2.

Ksmooth0 *Kalman Filter and Smoother - Time invariant model without inputs*

Description

Returns both the filtered values and smoothed values for the state-space model.

Usage

```
Ksmooth0(num, y, A, mu0, Sigma0, Phi, cQ, cR)
```

Arguments

num	number of observations
y	data matrix, vector or time series
A	time-invariant observation matrix
mu0	initial state mean vector
Sigma0	initial state covariance matrix
Phi	state transition matrix
cQ	Cholesky-type decomposition of state error covariance matrix Q – see details below
cR	Cholesky-type decomposition of observation error covariance matrix R – see details below

Details

Practically, the script only requires that Q or R may be reconstructed as `t(cQ)%*%(cQ)` or `t(cR)%*%(cR)`, respectively, which allows more flexibility.

Value

xs	state smoothers
Ps	smoother mean square error
x0n	initial mean smoother
P0n	initial smoother covariance
J0	initial value of the J matrix
J	the J matrices
xp	one-step-ahead prediction of the state
Pp	mean square prediction error
xf	filter value of the state
Pf	mean square filter error
like	the negative of the log likelihood
Kn	last value of the gain

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/

See also http://www.stat.pitt.edu/stoffer/tsa4/chap6.htm for an explanation of the difference between levels 0, 1, and 2.

Ksmooth1 *Kalman Filter and Smoother - General model*

Description

Returns both the filtered and the smoothed values for the state-space model.

Usage

```
Ksmooth1(num, y, A, mu0, Sigma0, Phi, Ups, Gam, cQ, cR, input)
```

Arguments

`num`	number of observations
`y`	data matrix, vector or time series
`A`	time-varying observation matrix, an array with `dim=c(q,p,n)`
`mu0`	initial state mean
`Sigma0`	initial state covariance matrix
`Phi`	state transition matrix
`Ups`	state input matrix; use `Ups = 0` if not needed
`Gam`	observation input matrix; use `Gam = 0` if not needed
`cQ`	Cholesky-type decomposition of state error covariance matrix Q – see details below
`cR`	Cholesky-type decomposition of observation error covariance matrix R – see details below
`input`	matrix or vector of inputs having the same row dimension as y; use `input = 0` if not needed

Details

Practically, the script only requires that Q or R may be reconstructed as `t(cQ)%*%(cQ)` or `t(cR)%*%(cR)`, respectively, which allows more flexibility.

Value

`xs`	state smoothers
`Ps`	smoother mean square error
`x0n`	initial mean smoother
`P0n`	initial smoother covariance
`J0`	initial value of the J matrix
`J`	the J matrices
`xp`	one-step-ahead prediction of the state
`Pp`	mean square prediction error
`xf`	filter value of the state
`Pf`	mean square filter error
`like`	the negative of the log likelihood
`Kn`	last value of the gain

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/

See also http://www.stat.pitt.edu/stoffer/tsa4/chap6.htm for an explanation of the difference between levels 0, 1, and 2.

`Ksmooth2` *Kalman Filter and Smoother - General model, may have correlated errors*

Description

Returns the filtered and smoothed values for the state-space model. This is the smoother companion to Kfilter2.

Usage

```
Ksmooth2(num, y, A, mu0, Sigma0, Phi, Ups, Gam, Theta, cQ, cR,
         S, input)
```

Arguments

num	number of observations
y	data matrix, vector or time series
A	time-varying observation matrix, an array with `dim=c(q,p,n)`
mu0	initial state mean
Sigma0	initial state covariance matrix
Phi	state transition matrix
Ups	state input matrix; use `Ups = 0` if not needed
Gam	observation input matrix; use `Gam = 0` if not needed
Theta	state error pre-matrix
cQ	Cholesky-type decomposition of state error covariance matrix Q – see details below
cR	Cholesky-type decomposition of observation error covariance matrix R – see details below
S	covariance matrix of state and observation errors
input	matrix or vector of inputs having the same row dimension as y; use `input = 0` if not needed

Details

Practically, the script only requires that Q or R may be reconstructed as `t(cQ)%*%(cQ)` or `t(cR)%*%(cR)`, respectively, which allows more flexibility.

Value

xs	state smoothers
Ps	smoother mean square error
J	the J matrices
xp	one-step-ahead prediction of the state
Pp	mean square prediction error
xf	filter value of the state
Pf	mean square filter error
like	the negative of the log likelihood
Kn	last value of the gain

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/

See also http://www.stat.pitt.edu/stoffer/tsa4/chap6.htm for an explanation of the difference between levels 0, 1, and 2.

`lag1.plot` *Lag Plot - one time series*

Description

Produces a grid of scatterplots of a series versus lagged values of the series.

Usage

```
lag1.plot(series, max.lag = 1, corr = TRUE, smooth = TRUE, col = gray(.1), ...)
```

Arguments

`series`	the data
`max.lag`	maximum lag
`corr`	if TRUE, shows the autocorrelation value in a legend
`smooth`	if TRUE, adds a lowess fit to each scatterplot
`col`	color of points; default is `gray(.1)`
`...`	additional graphical arguments

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

See Also

`lag2.plot`

Examples

```
lag1.plot(soi, 9, col=4)
lag1.plot(soi, max.lag=4, pch=20, cex=1.5, col=rgb(0,.5,1,.5))
```

lag2.plot	*Lag Plot - two time series*

Description

Produces a grid of scatterplots of one series versus another. The first named series is the one that gets lagged.

Usage

```
lag2.plot(series1, series2, max.lag = 0, corr = TRUE, smooth = TRUE, col = gray(.1), ...)
```

Arguments

`series1`	first series (the one that gets lagged)
`series2`	second series
`max.lag`	maximum number of lags
`corr`	if TRUE, shows the cross-correlation value in a legend
`smooth`	if TRUE, adds a lowess fit to each scatterplot
`col`	color of points; default is `gray(.1)`
`...`	additional graphical arguments

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

See Also

`lag1.plot`

Examples

```
lag2.plot(soi, rec, 3)
lag2.plot(soi, rec, max.lag=8, pch=20, cex=1.5, col=rgb(0,.5,1,.5))
```

LagReg	*Lagged Regression*

Description

Performs lagged regression as discussed in Chapter 4.

Usage

```
LagReg(input, output, L = c(3, 3), M = 40, threshold = 0,
        inverse = FALSE)
```

Arguments

`input`	input series
`output`	output series
`L`	degree of smoothing; see `spans` in the help file for `spec.pgram`.
`M`	must be even; number of terms used in the lagged regression
`threshold`	the cut-off used to set small (in absolute value) regression coeffcients equal to zero
`inverse`	if TRUE, will fit a forward-lagged regression

Details

For a bivariate series, `input` is the input series and `output` is the output series. The degree of smoothing for the spectral estimate is given by L; see `spans` in the help file for `spec.pgram`. The number of terms used in the lagged regression approximation is given by M, which must be even. The threshold value is the cut-off used to set small (in absolute value) regression coeffcients equal to zero (it is easiest to run LagReg twice, once with the default threshold of zero, and then again after inspecting the resulting coeffcients and the corresponding values of the CCF). Setting inverse=TRUE will fit a forward-lagged regression; the default is to run a backward-lagged regression. The script is based on code that was contributed by Professor Doug Wiens, Department of Mathematical and Statistical Sciences, University of Alberta.

Value

Graphs of the estimated impulse response function, the CCF, and the output with the predicted values superimposed.

`beta`	Estimated coefficients
`fit`	The output series, the fitted values, and the residuals

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/

`lap` *LA Pollution-Mortality Study*

Description

LA Pollution-Mortality Study (1970-1979, weekly data).

Format

The format is: mts [1:508, 1:11]

Details

columns are time series	with names
(1) Total Mortality	`tmort`
(2) Respiratory Mortality	`rmort`
(3) Cardiovascular Mortality	`cmort`
(4) Temperature	`tempr`
(5) Relative Humidity	`rh`
(6) Carbon Monoxide	`co`
(7) Sulfur Dioxide	`so2`
(8) Nitrogen Dioxide	`no2`
(9) Hydrocarbons	`hycarb`
(10) Ozone	`o3`
(11) Particulates	`part`

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

`lead` *Leading Indicator*

Description

Leading indicator, 150 months; taken from Box and Jenkins (1970).

Usage

```
data(lead)
```

Format

The format is: Time-Series [1:150] from 1 to 150: 10.01 10.07 10.32 9.75 10.33 ...

Details

This is also the R time series `BJsales.lead`: The sales time series `BJsales` and leading indicator `BJsales.lead` each contain 150 observations. The objects are of class "ts".

See Also

`sales`

Lynx — *Canadian Lynx*

Description

This is one of the classic studies of predator-prey interactions, the 90-year data set is the number, in thousands, of lynx pelts purchased by the Hudson's Bay Company of Canada. While this is an indirect measure of predation, the assumption is that there is a direct relationship between the number of pelts collected and the number of hare and lynx in the wild.

Usage

```
data("Lynx")
```

Format

The format is: Time-Series [1:91] from 1845 to 1935: 30.1 45.1 49.1 39.5 21.2 ...

Note

The data are in units of one thousand. This data set pairs with `Hare` and is NOT the same as `lynx`.

Source

http://people.whitman.edu/~hundledr/courses/M250F03/M250.html

References

and http://www.stat.pitt.edu/stoffer/tsda/

See Also

`Hare`

mvspec *Univariate and Multivariate Spectral Estimation*

Description

This is spec.pgram with a few changes in the defaults and written so you can easily extract the estimate of the multivariate spectral matrix as fxx. The bandwidth calculation has been changed to the more practical definition given in the text. Can be used to replace spec.pgram for univariate series.

Usage

```
mvspec(x, spans = NULL, kernel = NULL, taper = 0, pad = 0,
         fast = TRUE, demean = FALSE, detrend = TRUE,
         plot = TRUE, log='n', type = NULL,
         na.action = na.fail, ...)
```

Arguments

x	univariate or multivariate time series (i.e., the p columns of x are time series)
spans	specify smoothing; same as spec.pgram
kernel	specify kernel; same as spec.pgram
taper	specify taper; same as spec.pgram with different default
pad	specify padding; same as spec.pgram
fast	specify use of FFT; same as spec.pgram
demean	if TRUE, series is demeaned first; same as spec.pgram
detrend	if TRUE, series is detrended first; same as spec.pgram
plot	plot the estimate; same as spec.pgram
log	same as spec.pgram but default is 'no'
type	type of plot to be drawn, defaults to lines
na.action	same as spec.pgram
...	additional arguments; same as spec.pgram

Details

This is spec.pgram with a few changes in the defaults and written so you can easily extract the estimate of the multivariate spectral matrix as fxx. The default for the plot is NOT to plot on a log scale and the graphic will have a grid. The bandwidth calculation has been changed to the more practical definition given in the text, $(L_h/n.used) * frequency(x)$. Although meant to be used to easily obtain multivariate spectral estimates, this script can be used for univariate time series. Note that the script does not taper by default (taper=0); this forces the user to do "conscious tapering".

Value

An object of class "spec", which is a list containing at least the following components:

`fxx`	spectral matrix estimates; an array of dimensions `dim = c(p,p,nfreq)`
`freq`	vector of frequencies at which the spectral density is estimated.
`spec`	vector (for univariate series) or matrix (for multivariate series) of estimates of the spectral density at frequencies corresponding to freq.
`details`	matrix with columns: frequency, period, spectral ordinate(s)
`coh`	NULL for univariate series. For multivariate time series, a matrix containing the squared coherency between different series. Column i + (j - 1) * (j - 2)/2 of coh contains the squared coherency between columns i and j of x, where i < j.
`phase`	NULL for univariate series. For multivariate time series a matrix containing the cross-spectrum phase between different series. The format is the same as coh.
`Lh`	Number of frequencies (approximate) used in the band, as defined in Chapter 4.
`n.used`	Sample length used for the FFT
`series`	The name of the time series.
`snames`	For multivariate input, the names of the component series.
`method`	The method used to calculate the spectrum.

The results are returned invisibly if plot is true.

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

Examples

```
# univariate example
plot(co2)   # co2 is an R data set
mvspec(co2, spans=c(5,5), taper=.5)

# multivariate example
ts.plot(mdeaths, fdeaths, col=1:2)   # an R data set, male/female monthly deaths ...
dog = mvspec(cbind(mdeaths,fdeaths), spans=c(3,3), taper=.1)
dog$fxx        # look a spectral matrix estimates
dog$bandwidth  # bandwidth with time unit = year
dog$bandwidth/frequency(mdeaths)  # ... with time unit = month
plot(dog, plot.type="coherency")  # plot of squared coherency

# analysis with some details printed
mvspec(soi, spans=c(7,7), taper=.5)$details[1:45,]
```

`nyse` *Returns of the New York Stock Exchange*

Description

Returns of the New York Stock Exchange (NYSE) from February 2, 1984 to December 31, 1991.

Usage

```
data(nyse)
```

Format

The format is: Time-Series [1:2000] from 1 to 2000: 0.00335 -0.01418 -0.01673 0.00229 -0.01692 ...

Source

S+GARCH module - Version 1.1 Release 2: 1998

`oil` *Crude oil, WTI spot price FOB*

Description

Crude oil, WTI spot price FOB (in dollars per barrel), weekly data from 2000 to mid-2010.

Format

The format is: Time-Series [1:545] from 2000 to 2010: 26.2 26.1 26.3 24.9 26.3 ...

Details

pairs with the series `gas`

Source

Data were obtained from the URL tonto.eia.doe.gov/dnav/pet/pet_pri_spt_s1_w.htm, but that site no longer exists.

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

See Also

`gas`

part *Particulate levels from the LA pollution study*

Description

Particulate series corresponding to `cmort` from the LA pollution study.

Format

The format is: Time-Series [1:508] from 1970 to 1980: 72.7 49.6 55.7 55.2 66 ...

See Also

`lap`

PLT *Platelet Levels*

Description

PLT: Measurements made for 91 days on the three variables, log(white blood count) [WBC], log(platelet) [PLT] and hematocrit [HCT]. Missing data code is 0 (zero).

Usage

```
data(PLT)
```

Format

The format is: Time-Series [1:91] from 1 to 91: 4.47 4.33 4.09 4.6 4.41 ...

Details

See Examples 6.1 and 6.9 for more details.

Source

Jones, R.H. (1984). Fitting multivariate models to unequally spaced data. In *Time Series Analysis of Irregularly Observed Data*, pp. 158-188. E. Parzen, ed. Lecture Notes in Statistics, 25, New York: Springer-Verlag.

References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

`blood`, `HCT`, `WBC`

`polio` *Poliomyelitis cases in US*

Description

Monthly time series of poliomyelitis cases reported to the U.S. Centers for Disease Control for the years 1970 to 1983, 168 observations.

Format

The format is: Time-Series [1:168] from 1970 to 1984: 0 1 0 0 1 3 9 2 3 5 ...

Details

The data were originally modelled by Zeger (1988).

Source

Data taken from the gamlss.data package; see https://www.gamlss.com/.

References

Zeger, S. L. (1988), “A Regression Model for Time Series of Counts,” *Biometrika*, 75, 822-835.

Examples

```
tsplot(polio, type='s')
```

`prodn` *Monthly Federal Reserve Board Production Index*

Description

Monthly Federal Reserve Board Production Index (1948-1978, n = 372 months).

Usage

```
data(prodn)
```

Format

The format is: Time-Series [1:372] from 1948 to 1979: 40.6 41.1 40.5 40.1 40.4 41.2 39.3 41.6 42.3 43.2 ...

References

http://www.stat.pitt.edu/stoffer/tsa4/

qinfl *Quarterly Inflation*

Description

Quarterly inflation rate in the Consumer Price Index from 1953-Ito 1980-II, n = 110 observations.

Format

The format is: Time-Series [1:110] from 1953 to 1980: 1.673 3.173 0.492 -0.327 -0.333 ...

Details

pairs with qintr (interest rate)

Source

Newbold, P. and T. Bos (1985). *Stochastic Parameter Regression Models*. Beverly Hills: Sage.

References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

qintr

qintr *Quarterly Interest Rate*

Description

Quarterly interest rate recorded for Treasury bills from 1953-Ito 1980-II, n = 110 observations.

Format

The format is: Time-Series [1:110] from 1953 to 1980: 1.98 2.15 1.96 1.47 1.06 ...

Details

pairs with qinfl (inflation)

Source

Newbold, P. and T. Bos (1985). *Stochastic Parameter Regression Models*. Beverly Hills: Sage.

References

See http://www.stat.pitt.edu/stoffer/tsa4/

See Also

qinfl

`rec` *Recruitment (number of new fish index)*

Description

Recruitment (index of the number of new fish) for a period of 453 months ranging over the years 1950-1987. Recruitment is loosely defined as an indicator of new members of a population to the first life stage at which natural mortality stabilizes near adult levels.

Usage

```
data(rec)
```

Format

The format is: Time-Series [1:453] from 1950 to 1988: 68.6 68.6 68.6 68.6 68.6 ...

Details

can pair with `soi` (Southern Oscillation Index)

Source

Data furnished by Dr. Roy Mendelssohn of the Pacific Fisheries Environmental Laboratory, NOAA (personal communication).

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

See Also

soi

sales *Sales*

Description

Sales, 150 months; taken from Box and Jenkins (1970).

Format

The format is: Time-Series [1:150] from 1 to 150: 200 200 199 199 199 ...

Details

This is also the R data set `BJsales`: The sales time series `BJsales` and leading indicator `BJsales.lead` each contain 150 observations. The objects are of class "ts".

See Also

`lead`

salmon *Monthly export price of salmon*

Description

Farm Bred Norwegian Salmon, export price, US Dollars per Kilogram

Usage

```
data("salmon")
```

Format

The format is: Time-Series [1:166] from September 2003 to June 2017: 2.88 3.16 2.96 3.12 3.23 3.32 3.45 3.61 3.48 3.21 ...

Source

http://www.indexmundi.com/commodities/

References

http://www.stat.pitt.edu/stoffer/tsda/

salt *Salt Profiles*

Description

Salt profiles taken over a spatial grid set out on an agricultural field, 64 rows at 17-ft spacing.

Usage

```
data(salt)
```

Format

The format is: Time-Series [1:64] from 1 to 64: 6 6 6 3 3 3 4 4 4 1.5 ...

Details

pairs with `saltemp`, temperature profiles on the same grid

References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

`saltemp`

saltemp *Temperature Profiles*

Description

Temperature profiles over a spatial grid set out on an agricultural field, 64 rows at 17-ft spacing.

Usage

```
data(saltemp)
```

Format

The format is: Time-Series [1:64] from 1 to 64: 5.98 6.54 6.78 6.34 6.96 6.51 6.72 7.44 7.74 6.85 ...

Details

pairs with `salt`, salt profiles on the same grid

References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

salt

---

sarima *Fit ARIMA Models*

Description

Fits ARIMA models (including improved diagnostics) in a short command. It can also be used to perform regression with autocorrelated errors. This is a front end to `arima()` with a different back door.

Usage

```
sarima(xdata, p, d, q, P = 0, D = 0, Q = 0, S = -1,
       details = TRUE, xreg=NULL, Model=TRUE,
       fixed=NULL, tol = sqrt(.Machine$double.eps),
       no.constant = FALSE)
```

Arguments

`xdata`	univariate time series
`p`	AR order (must be specified)
`d`	difference order (must be specified)
`q`	MA order (must be specified)
`P`	SAR order; use only for seasonal models
`D`	seasonal difference; use only for seasonal models
`Q`	SMA order; use only for seasonal models
`S`	seasonal period; use only for seasonal models
`xreg`	Optionally, a vector or matrix of external regressors, which must have the same number of rows as xdata.
`Model`	if TRUE (default), the model orders are printed on the diagnostic plot.
`fixed`	optional numeric vector of the same length as the total number of parameters. If supplied, only parameters corresponding to NA entries will be estimated.
`details`	if FALSE, turns off the diagnostic plot and the output from the nonlinear optimization routine, which is `optim`. The default is TRUE.
`tol`	controls the relative tolerance (reltol in `optim`) used to assess convergence. The default is `sqrt(.Machine$double.eps)`, the R default.

`no.constant` controls whether or not sarima includes a constant in the model. In particular, if there is no differencing (d = 0 and D = 0) you get the mean estimate. If there is differencing of order one (either d = 1 or D = 1, but not both), a constant term is included in the model. These two conditions may be overridden (i.e., no constant will be included in the model) by setting this to TRUE; e.g., `sarima(x,1,1,0,no.constant=TRUE)`. Otherwise, no constant or mean term is included in the model. If regressors are included (via `xreg`), this is ignored.

Details

If your time series is in x and you want to fit an ARIMA(p,d,q) model to the data, the basic call is `sarima(x,p,d,q)`. The values p,d,q, must be specified as there is no default. The results are the parameter estimates, standard errors, AIC, AICc, BIC (as defined in Chapter 2) and diagnostics. To fit a seasonal ARIMA model, the basic call is `sarima(x,p,d,q,P,D,Q,S)`. For example, `sarima(x,2,1,0)` will fit an ARIMA(2,1,0) model to the series in x, and `sarima(x,2,1,0,0,1,1,12)` will fit a seasonal ARIMA$(2,1,0)*(0,1,1)_{12}$ model to the series in x. The difference between the information criteria given by `sarima()` and `arima()` is that they differ by a scaling factor of the effective sample size.

Value

`fit` the `arima` object

`degrees_of_freedom` Error degrees of freedom

`ttable` a little t-table with two-sided p-values

`AIC` value of the AIC - all ICs are the values reported in `fit` divided by the essential number of observations (after differencing)

`AICc` value of the AICc

`BIC` value of the BIC

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

See Also

sarima.for

Examples

```
sarima(log(AirPassengers),0,1,1,0,1,1,12)
(dog <- sarima(log(AirPassengers),0,1,1,0,1,1,12))
summary(dog$fit)  # fit has all the returned arima() values
plot(resid(dog$fit))  # plot the innovations (residuals)
sarima(log(AirPassengers),0,1,1,0,1,1,12,details=FALSE)$BIC  # print model BIC only
# fixed parameters
x = arima.sim(list(order=c(2,0,0), ar=c(0,-.9)), n=200) + 50
sarima(x, 2,0,0, fixed=c(0,NA,NA))
```

sarima.for *ARIMA Forecasting*

Description

ARIMA forecasting - this is a wrapper for R's `predict.Arima`.

Usage

```
sarima.for(xdata, n.ahead, p, d, q, P = 0, D = 0, Q = 0, S = -1,
           tol = sqrt(.Machine$double.eps), no.constant = FALSE,
           plot.all=FALSE, xreg = NULL, newxreg = NULL, fixed=NULL)
```

Arguments

`xdata`	univariate time series
`n.ahead`	forecast horizon (number of periods)
`p`	AR order
`d`	difference order
`q`	MA order
`P`	SAR order; use only for seasonal models
`D`	seasonal difference; use only for seasonal models
`Q`	SMA order; use only for seasonal models
`S`	seasonal period; use only for seasonal models
`tol`	controls the relative tolerance (reltol) used to assess convergence. The default is `sqrt(.Machine$double.eps)`, the R default.
`no.constant`	controls whether or not a constant is included in the model. If `no.constant=TRUE`, no constant is included in the model. See `sarima` for more details.
`plot.all`	if TRUE, all the data are plotted in the graphic; otherwise, only the last 100 observations are plotted in the graphic.
`xreg`	Optionally, a vector or matrix of external regressors, which must have the same number of rows as the series. If this is used, `newxreg` MUST be specified.
`newxreg`	New values of `xreg` to be used for prediction. Must have at least `n.ahead` rows.
`fixed`	optional numeric vector of the same length as the total number of parameters. If supplied, only parameters corresponding to NA entries will be estimated.

Details

For example, `sarima.for(x,5,1,0,1)` will forecast five time points ahead for an ARMA(1,1) fit to x. The output prints the forecasts and the standard errors of the forecasts, and supplies a graphic of the forecast with +/- 1 and 2 prediction error bounds.

Value

pred	the forecasts
se	the prediction (standard) errors

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

See Also

sarima

Examples

```
sarima.for(log(AirPassengers),12,0,1,1,0,1,1,12)
#  with regressors:
nummy   = length(soi)
n.ahead = 24
nureg   = time(soi)[nummy] + seq(1,n.ahead)/12
sarima.for(soi,n.ahead,2,0,0,2,0,0,12, xreg=time(soi), newxreg=nureg)
```

SigExtract — *Signal Extraction And Optimal Filtering*

Description

Performs signal extraction and optimal filtering as discussed in Chapter 4.

Usage

```
SigExtract(series, L = c(3, 3), M = 50, max.freq = 0.05)
```

Arguments

series	univariate time series to be filtered
L	degree of smoothing (may be a vector); see spans in spec.pgram for more details
M	number of terms used in the lagged regression approximation
max.freq	truncation frequency, which must be larger than 1/M.

Details

The basic function of the script, and the default setting, is to remove frequencies above 1/20 (and, in particular, the seasonal frequency of 1 cycle every 12 time points). The sampling frequency of the time series is set to unity prior to the analysis.

Value

Returns plots of (1) the original and filtered series, (2) the estiamted spectra of each series, (3) the filter coefficients and the desired and attained frequency response function. The filtered series is returned invisibly.

Note

The script is based on code that was contributed by Professor Doug Wiens, Department of Mathematical and Statistical Sciences, University of Alberta.

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/

`so2` *SO2 levels from the LA pollution study*

Description

Sulfur dioxide levels from the LA pollution study

Format

The format is: Time-Series [1:508] from 1970 to 1980: 3.37 2.59 3.29 3.04 3.39 2.57 2.35 3.38 1.5 2.56 ...

See Also

`lap`

`soi` *Southern Oscillation Index*

Description

Southern Oscillation Index (SOI) for a period of 453 months ranging over the years 1950-1987.

Format

The format is: Time-Series [1:453] from 1950 to 1988: 0.377 0.246 0.311 0.104 -0.016 0.235 0.137 0.191 -0.016 0.29 ...

Details

pairs with `rec` (Recruitment)

Source

Data furnished by Dr. Roy Mendelssohn of the Pacific Fisheries Environmental Laboratory, NOAA (personal communication).

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

See Also

`rec`

`soiltemp` *Spatial Grid of Surface Soil Temperatures*

Description

A 64 by 36 matrix of surface soil temperatures.

Format

The format is: num [1:64, 1:36] 6.7 8.9 5 6.6 6.1 7 6.5 8.2 6.7 6.6 ...

References

http://www.stat.pitt.edu/stoffer/tsa4/

`sp500w` *Weekly Growth Rate of the Standard and Poor's 500*

Description

Weekly closing returns of the SP 500 from 2003 to September, 2012.

Format

An 'xts' object on 2003-01-03 to 2012-09-28; Indexed by objects of class: [Date] TZ: UTC

References

http://www.stat.pitt.edu/stoffer/tsa4/

speech *Speech Recording*

Description

A small .1 second (1000 points) sample of recorded speech for the phrase "aaa...hhh".

Format

The format is: Time-Series [1:1020] from 1 to 1020: 1814 1556 1442 1416 1352 ...

References

http://www.stat.pitt.edu/stoffer/tsa4/

ssm *State Space Model*

Description

Fits a simple univariate state space model, x[t] = alpha + phi x[t-1] + w[t], and y[t] = A x[t] + v[t]. The parameters alpha, phi, sigma[w] and sigma[v] are estimated; parameter phi may be fixed. State predictions and smoothers and corresponding error variances are evaluated at the estimates. The sample size must be at least 20.

Usage

```
ssm(y, A, phi, alpha, sigw, sigv, fixphi = FALSE)
```

Arguments

`y`	data
`A`	measurement value (fixed constant)
`phi`	initial value of phi, may be fixed
`alpha`	initial value for alpha
`sigw`	initial value for sigma[w]
`sigv`	initial value for sigma[v]
`fixphi`	if TRUE, the phi parameter is fixed

Details

The script works for a specific univariate state space model. The initial state conditions use a default calculation and cannot be specified. The parameter estimates are printed and the script returns the state predictors and smoothers.

Value

At the MLEs, these are returned invisibly:

- `Xp` time series - state prediction, $x_t^t - 1$
- `Pp` corresponding MSPEs, $P_t^t - 1$
- `Xf` time series - state filter, x_t^t
- `Pf` corresponding MSEs, P_t^t
- `Xs` time series - state smoother, x_t^n
- `Ps` corresponding MSEs, P_t^n

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsda/

`star` *Variable Star*

Description

The magnitude of a star taken at midnight for 600 consecutive days. The data are taken from the classic text, The Calculus of Observations, a Treatise on Numerical Mathematics, by E.T. Whittaker and G. Robinson, (1923, Blackie and Son, Ltd.).

Format

The format is: Time-Series [1:600] from 1 to 600: 25 28 31 32 33 33 32 ...

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

stoch.reg *Frequency Domain Stochastic Regression*

Description

Performs frequency domain stochastic regression discussed in Chapter 7.

Usage

```
stoch.reg(data, cols.full, cols.red, alpha, L, M, plot.which)
```

Arguments

`data`	data matrix
`cols.full`	specify columns of data matrix that are in the full model
`cols.red`	specify columns of data matrix that are in the reduced model (use NULL if there are no inputs in the reduced model)
`alpha`	test size
`L`	smoothing - see `spans` in `spec.pgram`
`M`	number of points in the discretization of the integral
`plot.which`	`coh` or `F.stat`, to plot either the squared-coherencies or the F-statistics, respectively

Value

`power.full`	spectrum under the full model
`power.red`	spectrum under the reduced model
`Betahat`	regression parameter estimates
`eF`	pointwise (by frequency) F-tests
`coh`	coherency

Note

The script is based on code that was contributed by Professor Doug Wiens, Department of Mathematical and Statistical Sciences, University of Alberta.

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/

sunspotz — *Biannual Sunspot Numbers*

Description

Biannual smoothed (12-month moving average) number of sunspots from June 1749 to December 1978; n = 459. The "z" on the end is to distinguish this series from the one included with R (called `sunspots`).

Format

The format is: Time Series: Start = c(1749, 1) End = c(1978, 1) Frequency = 2

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

SVfilter — *Switching Filter (for Stochastic Volatility Models)*

Description

Performs a special case switching filter when the observational noise is a certain mixture of normals. Used to fit a stochastic volatility model.

Usage

```
SVfilter(num, y, phi0, phi1, sQ, alpha, sR0, mu1, sR1)
```

Arguments

`num`	number of observations
`y`	time series of returns
`phi0`	state constant
`phi1`	state transition parameter
`sQ`	state standard deviation
`alpha`	observation constant
`sR0`	observation error standard deviation for mixture component zero
`mu1`	observation error mean for mixture component one
`sR1`	observation error standard deviation for mixture component one

Value

xp	one-step-ahead prediction of the volatility
Pp	mean square prediction error of the volatility
like	the negative of the log likelihood at the given parameter values

Author(s)

D.S. Stoffer

References

http://www.stat.pitt.edu/stoffer/tsa4/

---

tempr *Temperatures from the LA pollution study*

Description

Temperature series corresponding to `cmort` from the LA pollution study.

Format

The format is: Time-Series [1:508] from 1970 to 1980: 72.4 67.2 62.9 72.5 74.2 ...

See Also

lap

---

tsplot *Time Series Plot*

Description

Produces a nice plot of univariate or multiple time series in one easy line.

Usage

```
tsplot(x, y=NULL, main=NULL, ylab=NULL, xlab='Time', type=NULL,
        margins=.25, ncolm=1, byrow=TRUE, minor=TRUE, nxm=2, nym=2,
        col=1, gg=FALSE, ...)
```

Arguments

`x, y`	time series to be plotted; if both present, x will be the time index.
`main`	add a plot title - the default is no title.
`ylab`	y-axis label - the default is the name of the ts object.
`xlab`	x-axis label - the default is 'Time'.
`type`	type of plot - the default is line.
`margins`	inches to add (or subtract) to the margins.
`ncolm`	for multiple time series, the number of columns to plot.
`byrow`	for multiple time series - if TRUE (default), plot series row wise; if FALSE, plot series column wise.
`minor, nxm, nym`	if minor=TRUE, the number of minor tick marks on x-axis, y-axis. minor=FALSE removes both or set either to 0 or 1 to remove.
`col`	line color(s), can be a vector for multiple time series.
`gg`	if TRUE, the plots have gray interiors with white grids (like a ggplot); default is FALSE
`...`	other graphical parameteres; see par.

Author(s)

D.S. Stoffer

References

`http://www.stat.pitt.edu/stoffer/tsa4/` and `http://www.stat.pitt.edu/stoffer/tsda/`

Examples

```
tsplot(soi, col=4, main="Southern Oscillation Index")
#
tsplot(1:453, soi, ylab='SOI', xlab='Month')
#
tsplot(climhyd, ncolm=2, gg=TRUE, col=rainbow(6,v=.8), lwd=2)
```

`unemp` *U.S. Unemployment*

Description

Monthly U.S. Unemployment series (1948-1978, n = 372)

Usage

```
data(unemp)
```

Format

The format is: Time-Series [1:372] from 1948 to 1979: 235 281 265 241 201 ...

References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

UnempRate

UnempRate *U.S. Unemployment Rate*

Description

Monthly U.S. unemployment rate in percent unemployed (Jan, 1948 - Nov, 2016, n = 827)

Format

The format is: Time-Series [1:827] from 1948 to 2017: 4 4.7 4.5 4 3.4 3.9 3.9 3.6 3.4 2.9 ...

Source

https://data.bls.gov/timeseries/LNU04000000/

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

See Also

unemp

---

varve *Annual Varve Series*

Description

Sedimentary deposits from one location in Massachusetts for 634 years, beginning nearly 12,000 years ago.

Format

The format is: Time-Series [1:634] from 1 to 634: 26.3 27.4 42.3 58.3 20.6 ...

References

http://www.stat.pitt.edu/stoffer/tsa4/ and http://www.stat.pitt.edu/stoffer/tsda/

WBC *White Blood Cell Levels*

Description

WBC: Measurements made for 91 days on the three variables, log(white blood count) [WBC], log(platelet) [PLT] and hematocrit [HCT]. Missing data code is 0 (zero).

Format

The format is: Time-Series [1:91] from 1 to 91: 2.33 1.89 2.08 1.82 1.82 ...

Details

See Examples 6.1 amd 6.9 for more details.

Source

Jones, R.H. (1984). Fitting multivariate models to unequally spaced data. In *Time Series Analysis of Irregularly Observed Data*, pp. 158-188. E. Parzen, ed. Lecture Notes in Statistics, 25, New York: Springer-Verlag.

References

http://www.stat.pitt.edu/stoffer/tsa4/

See Also

blood, HCT, PLT

Index