

# A Brief Introduction to R

```
> 1+1
[1] 2
> 2^3 # Two to the power 3
[1] 8

> 1:30
[1] 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
[26] 26 27 28 29 30

> gamma(.5)^2      # Gamma(1/2) = Sqrt(Pi)
[1] 3.141593

> x <- 1           # Assigns the value 1 to x
> y <- 2
> x+y
[1] 3
> z <- x+y
> z
[1] 3
> x <- c(1,2,3,4,5,6) # Collect these numbers; x is now a vector

> z # No dynamic updating; it's not a spreadsheet
[1] 3
> x+y
[1] 3 4 5 6 7 8

> y = 1 + 2*x # Another way to do assignment
> cbind(x,y)
      x y
[1,] 1 3
[2,] 2 5
[3,] 3 7
[4,] 4 9
[5,] 5 11
[6,] 6 13

> z <- y[x>4]      # z gets y such that x > 4
> z
[1] 11 13

> # If you put an array of integers inside the brackets, you get those
> # elements, in the order indicated.

> y[c(6,5,4,3,2,1)] # y in opposite order
[1] 13 11 9 7 5 3
> y[c(2,2,2,3,4)] # Repeats are okay
[1] 5 5 5 7 9
> y[7] # There is no seventh element. NA is the missing value code
[1] NA
```

---

```
> # Random number generation
> # Maybe transforming a uniform by inverse CDF
> help(Exponential) # Could also use help(rexp)
```

Exponential {stats}

R Documentation

## The Exponential Distribution

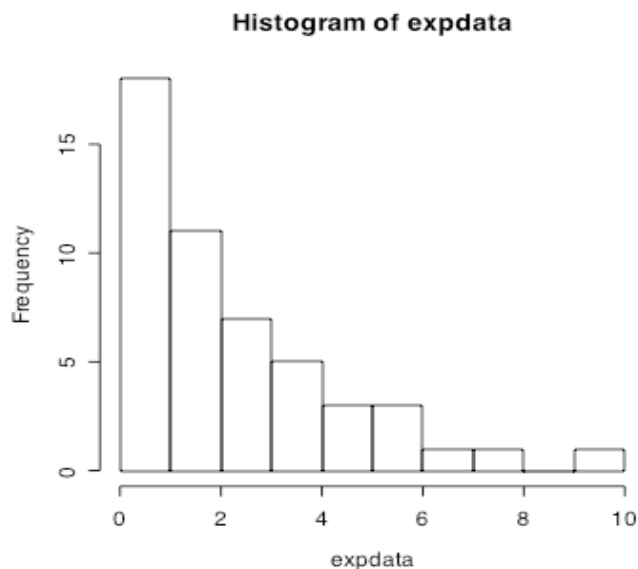
### Description

Density, distribution function, quantile function and random generation for the exponential distribution with rate `rate` (i.e., mean  $1/\text{rate}$ ).

### Usage

```
dexp(x, rate = 1, log = FALSE)
pexp(q, rate = 1, lower.tail = TRUE, log.p = FALSE)
qexp(p, rate = 1, lower.tail = TRUE, log.p = FALSE)
rexp(n, rate = 1)
```

```
> expdata = rexp(50,rate=1/2) # Random sample from exponential distribution, mean=theta=2
> expdata
 [1] 0.4330015 5.7893762 0.9803759 0.7172530 2.2696433 4.0045302 3.3989651 0.3104736
 [9] 1.2026790 0.8543951 1.0438012 5.5095891 0.7587579 1.9263300 6.0660176 9.3017992
[17] 1.0910204 0.6551285 1.5747176 5.9417700 0.8464761 7.6684436 0.1107589 1.6787699
[25] 2.4744338 3.3470232 0.3209082 4.4307811 4.5510434 1.4316870 0.3457547 0.1302476
[33] 0.5777305 1.0898631 1.4467458 3.2472808 1.8113195 0.5090032 2.4633656 0.8972205
[41] 0.7562905 2.4623634 0.3413955 2.3122374 0.4166320 2.6279765 1.5072294 3.5732947
[49] 3.5449348 2.6472542
> mean(expdata) # The MLE
[1] 2.267962
> hist(expdata)
```



```

> # Linear Regression
> kars = read.table("http://www.utstat.toronto.edu/~brunner/appliedf13/code_n_data/lecture/mcars2.data")
> kars[1:10,] # Rows 1:10, all columns
  Cntry  kpl weight length
1    US  5.04 2178.0 591.82
2  Japan 10.08 1026.0 431.80
3    US  9.24 1188.0 426.72
4    US  7.98 1444.5 510.54
5    US  7.98 1485.0 502.92
6    US  7.98 1485.0 502.92
7  Europ  9.66  972.0 436.88
8    US  7.56 1665.0 543.56
9  Europ  5.88 1539.0 487.68
10   US 10.92 1003.5 431.80

> modelkar = lm(kpl~weight+length,data=kars)
> summary(modelkar)

```

```

Call:
lm(formula = kpl ~ weight + length, data = kars)

```

```

Residuals:
    Min       1Q   Median       3Q      Max
-2.97979 -0.84152 -0.08533  0.84027  5.04694

```

```

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 24.785719   2.693092   9.203 7.04e-15 ***
weight      -0.001616   0.001410  -1.146  0.25455
length      -0.028268   0.009270  -3.049  0.00296 **
---

```

```

Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

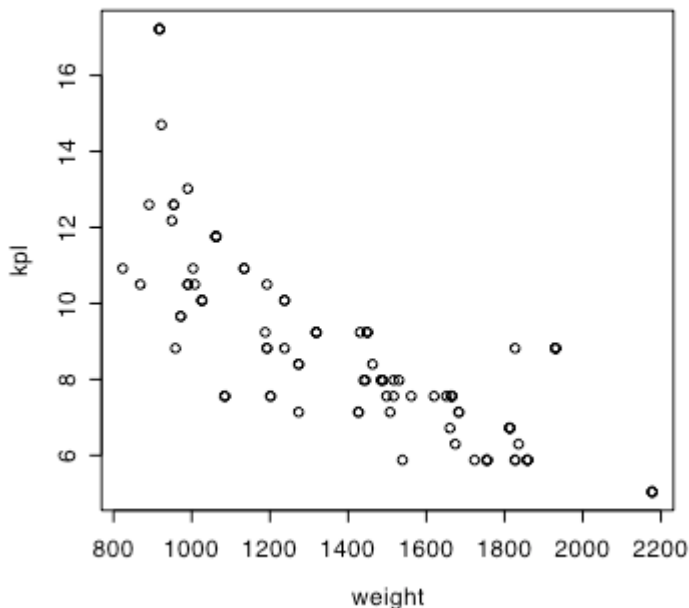
Residual standard error: 1.643 on 97 degrees of freedom
Multiple R-Squared: 0.6291, Adjusted R-squared: 0.6215
F-statistic: 82.26 on 2 and 97 DF, p-value: < 2.2e-16

```

```

> weight = kars$weight; kpl = kars$kpl
> plot(weight,kpl)

```



# Going further on your own

Look at the free mini-book *An introduction to R* by Venables et al. A copy is available at <http://www.utstat.toronto.edu/~brunner/help/R-intro.pdf>. Or, try

```
> library(help="stats")
```

AIC	Akaike's An Information Criterion
ARMAacf	Compute Theoretical ACF for an ARMA Process
ARMAtoMA	Convert ARMA Process to Infinite MA Process
Beta	The Beta Distribution
Binomial	The Binomial Distribution
Box.test	Box-Pierce and Ljung-Box Tests
C	Sets Contrasts for a Factor
Cauchy	The Cauchy Distribution
Chisquare	The (non-central) Chi-Squared Distribution
Exponential	The Exponential Distribution
FDist	The F Distribution
GammaDist	The Gamma Distribution
Geometric	The Geometric Distribution
HoltWinters	Holt-Winters Filtering

. . . list continues!

To see details on one of these packages, type something like

```
> help(t.test)
```

Generally, R's help assumes knowledge of the topic, but they often give references. For a quicker introduction to many statistical topics, try the Wikipedia:

<http://en.wikipedia.org>

Or you could ask me, but I might have to look in the Wikipedia.

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<http://www.utstat.utoronto.ca/~brunner/oldclass/appliedf13>