Some examples

```
> x = floor(rnorm(30, 100, 15))
> x
[1] 100 107 110 88 90 88 101 92 100 115 104 95 90 96 72 116 99 83 107
[20] 96 101 92 81 102 108 98 85 83 89 93
```

Stem and leaf

> stem(x)

The decimal point is 1 digit(s) to the right of the |

- 7 | 2 7 | 8 | 133 8 | 5889 9 | 00223 9 | 56689 10 | 001124 10 | 778 11 | 0
- 11 | 56

histogram

> hist(x)



histogram with area 1

> hist(x, probablity = TRUE)



Density plot on top of histogram

- > hist(x, probablity = TRUE)
- > lines(density(x), col = "blue")



The density comes from

$$\hat{f}(x) = \frac{1}{n} \sum \frac{1}{h} K(\frac{x_i - x}{h}),$$

here K(x) satisfies  $\int K(x)dx = 1$ . K(X) for a histogram

```
> K = function(x) unlist(sapply(x, function(x) as.numeric(x > -1/2 &&
+ x < 1/2)))
> f = function(x) (1/length(data)) * unlist(sapply(x, function(u) sum(K(u -
+ data)/h) * 1/h))
> data = runif(10, 0, 10)
> h = 1
> x = seq(0, 10, length = 100)
> hist(data, probability = TRUE)
> lines(x, f(x), col = "blue")
```



normal kernel

- > K = function(x) dnorm(x)
  > hist(data, probability = TRUE)
- > lines(x, f(x), col = "blue")



Order statistics

> x = floor(rnorm(10, 100, 15)) > x

[1] 84 103 137 87 80 64 92 132 107 104

> sort(x)

[1] 64 80 84 87 92 103 104 107 132 137

> min(x)

[1] 64

> max(x)

[1] 137

> quantile(x, c(1/4, 1/2))
 25% 50%
84.75 97.50

> median(x)

[1] 97.5

 $\operatorname{boxplot}$ 

> boxplot(x)





> plot(ecdf(x))



Bivariate data

- > library(MASS)
- > attach(faithful)
- > par(mfrow = c(2, 1))
- > hist(eruptions)
- > hist(waiting)



Histogram of waiting



boxplots

> boxplot(faithful)

Scatter plots

> plot(eruptions, waiting)



```
lag plot
```

```
> Head = eruptions[-1]
```

- > Tail = eruptions[-length(eruptions)]
- > plot(Head, Tail)



density plot

- > dd = kde2d(Head, Tail)
- > persp(dd, phi = 30, theta = 20, d = 5)



Countour

> contour(dd)



Transformations

- > attach(Animals)
- > names(Animals)
- [1] "body" "brain"

> plot(body, brain)



> plot(log(body), log(brain))

