Descriptive Statistics With R Software

Association of Variables

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Quantile - Quantile and Three Dimensional Plots

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Quantile – Quantile (QQ) Plots

When the quantiles of two variables are plotted against each other, we get the quantile-quantile plot.

This provides a summary of whether the distributions of two variables are the similar or not with respect to the location.

Plot the quantiles of the variables against each other.

Quantile – Quantile (QQ) Plots

`qqplot(x,y)` produces a QQ plot of two datasets.

`qqnorm(x)` produces a normal QQ plot of the values in data vector `x`.

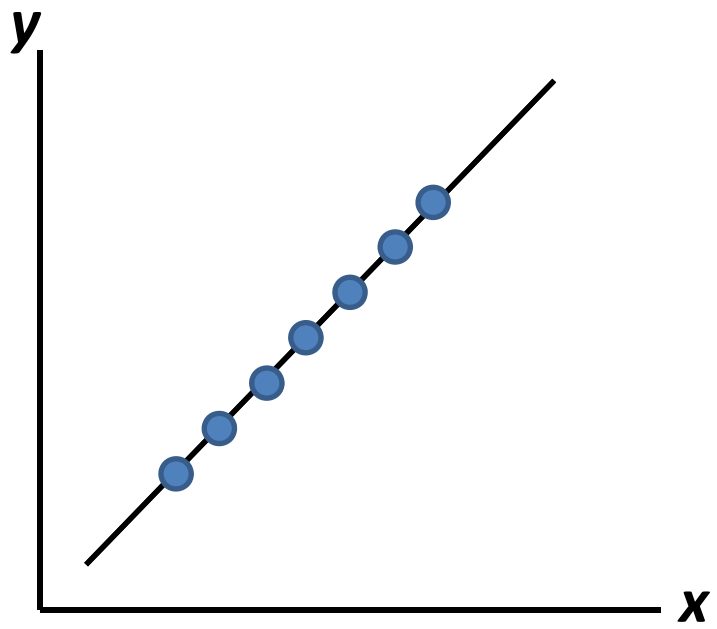
`qqline(x)` adds a line to a "theoretical", by default normal, QQ plot which passes through the `probs` quantiles, by default the first and third quartiles.

Quantile – Quantile (QQ) Plots

Interpretatons

(i) All point of quantiles lie on or close to straight line at an angle of 45% from *x* – axis.

It indicates the two samples have similar distributions.

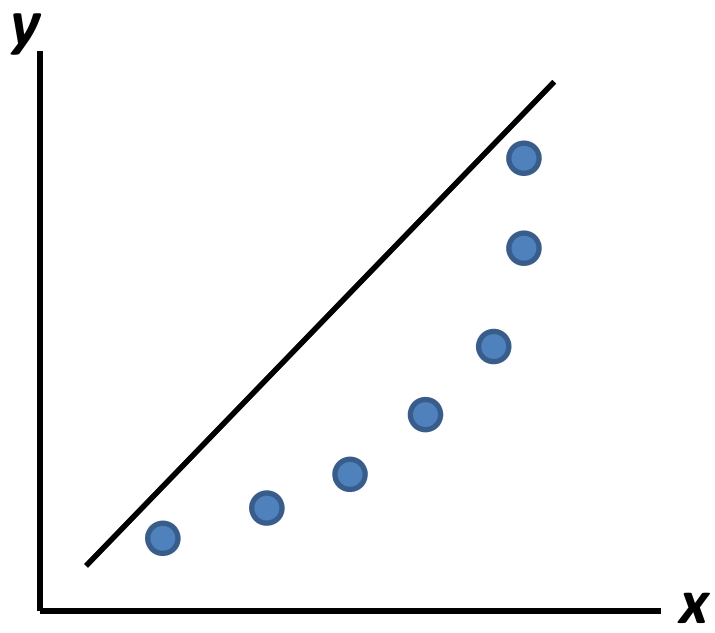


Quantile – Quantile (QQ) Plots

Interpretatons

(ii) The *y* – quantiles are lower than the *x* – quantiles.

It indicates *y* values have a tendency to be lower than the *x* values.

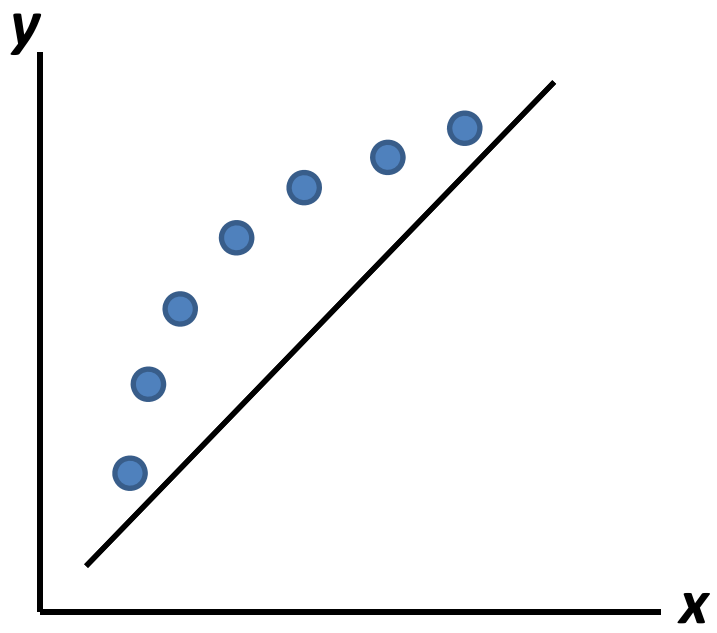


Quantile – Quantile (QQ) Plots

Interpretatons

(iii) The *x* – quantiles are lower than the *y* – quantiles.

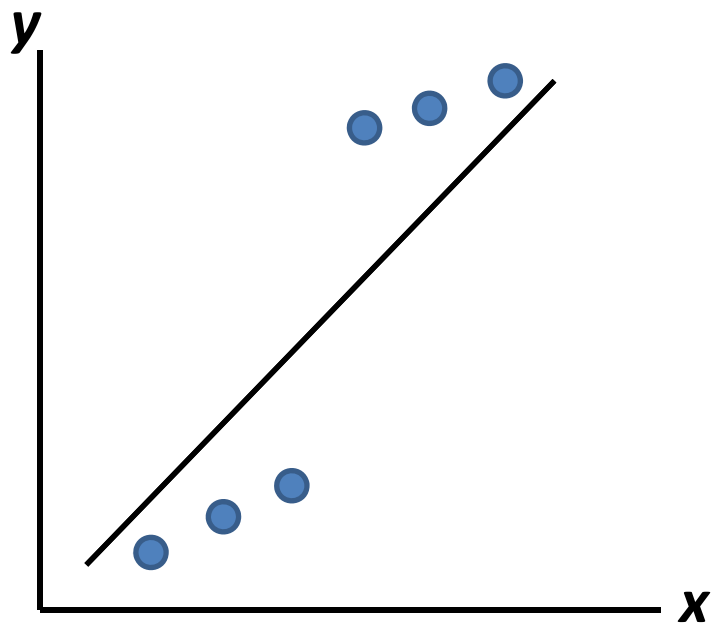
It indicates *x* values have a tendency to be lower than the *y* values.



Quantile – Quantile (QQ) Plots

Interpretatons

(iv) Indicates that there is a break point up to which the *y* quantiles are lower than the *x* quantiles and after that point, the *y* quantiles are higher than the *x* quantiles.



Quantile – Quantile (QQ) Plots

Example

Height of 50 persons are recorded as follow:

166,125,130,142,147,159,159,147,165,156,149,164,137,166,135,142,

133,136,127,143,165,121,142,148,158,146,154,157,124,125,158,159,

164,143,154,152,141,164,131,152,152,161,143,143,139,131,125,145,

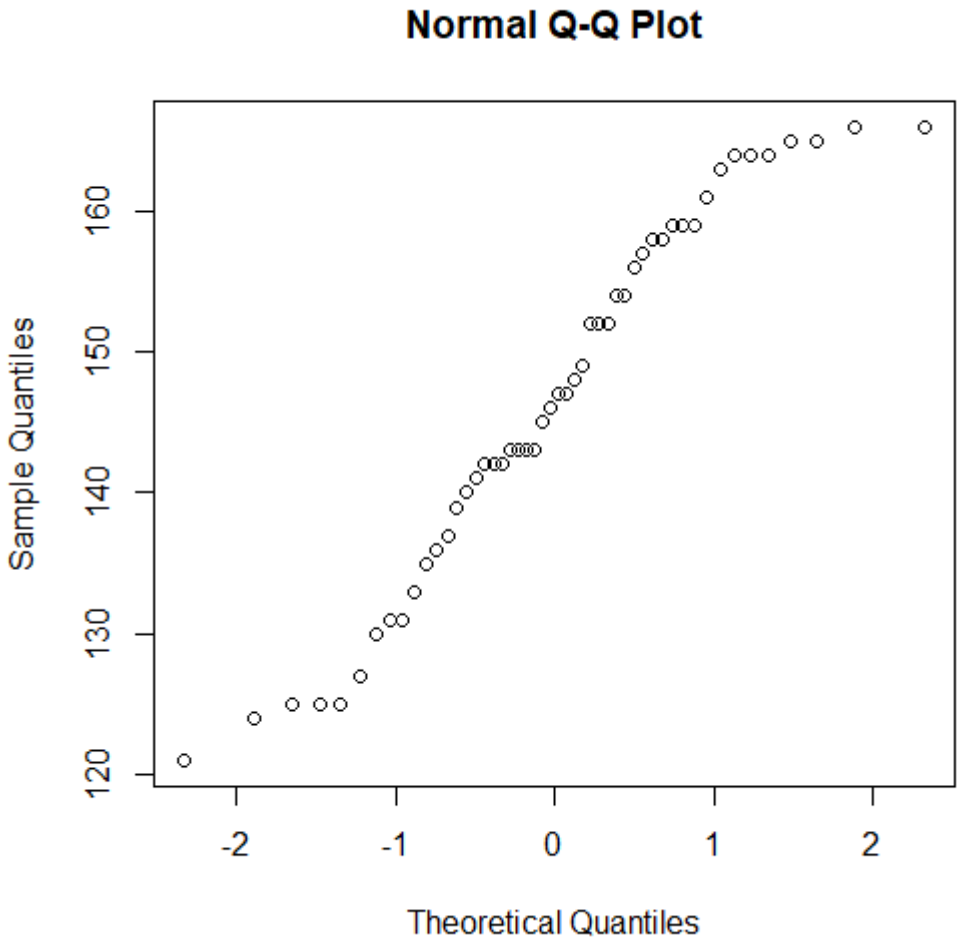
140,163

```
> height = c(166,125,130,142,147,159,159,147,
165,156,149,164,137,166,135,142,133,136,127,143,
165,121,142,148,158,146,154,157,124,125,158,159,
164,143,154,152,141,164,131,152,152,161,143,143,
139,131,125,145,140,163)
```

Quantile – Quantile (QQ) Plots

Example

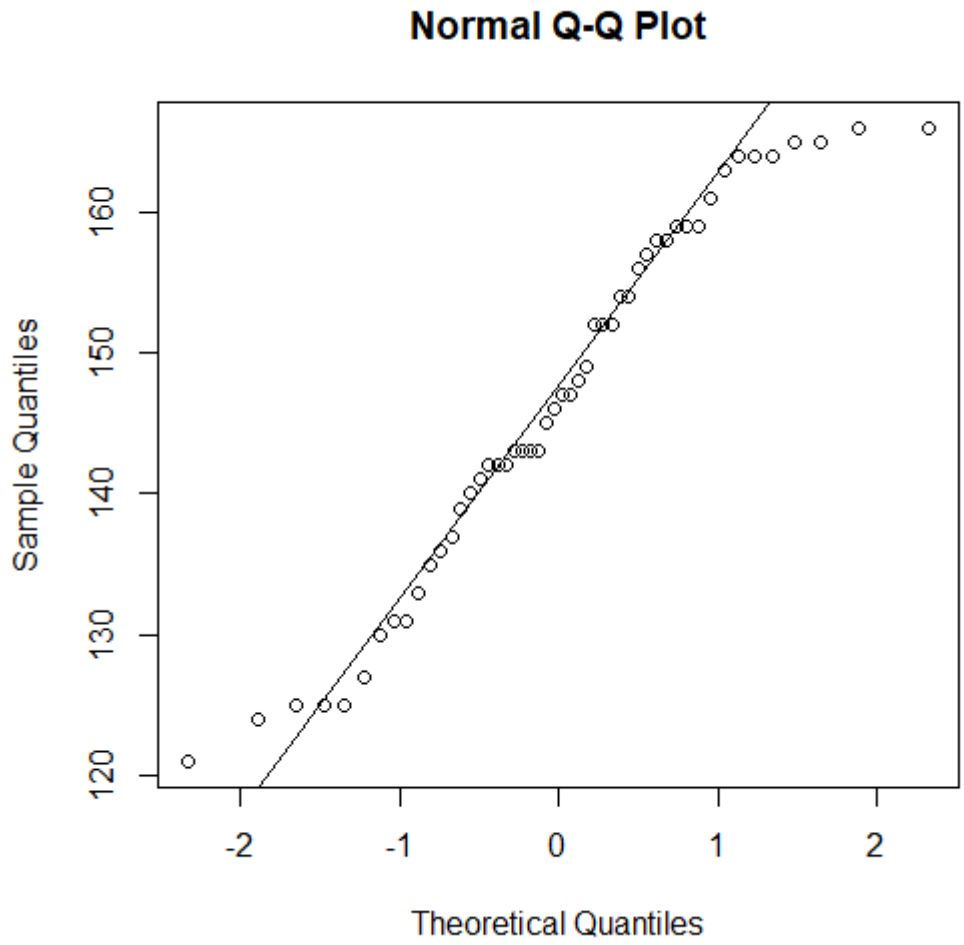
```
> qqnorm(height)
```



Quantile – Quantile (QQ) Plots

Example

```
> qqline(height)
```



Quantile – Quantile (QQ) Plots

Example

Data on marks obtained by 20 students out of 500 marks and the number of hours they studied per week are recorded as follows:

We know from experience that marks obtained by students increase as the number of hours increase.

Marks	337	316	327	340	374	330	352	353	370	380
Number of hours per week	23	25	26	27	30	26	29	32	33	34

Marks	384	398	413	428	430	438	439	479	460	450
Number of hours per week	35	38	39	42	43	44	45	46	44	41

Quantile – Quantile (QQ) Plots

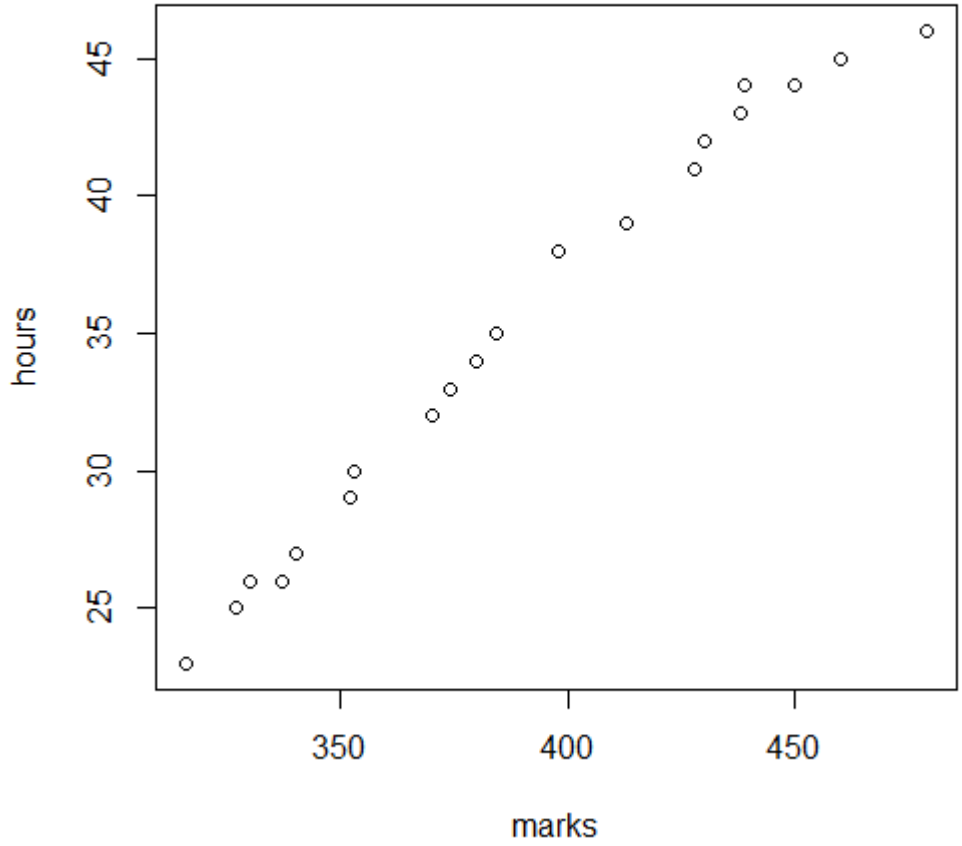
Example

```
marks =
c(337,316,327,340,374,330,352,353,370,380,384,39
8,413,428,430,438,439,479,460,450)

hours =
c(23,25,26,27,30,26,29,32,33,34,35,38,39,42,43,4
4,45,46,44,41)
```

Quantile – Quantile (QQ) Plots

Example

```
> qqplot(marks,hours)
```



3 Dimensional Scatter Plot

```
scatterplot3d(x,y,z)
```

Plots a three dimensional (3D) point cloud of the data in `x,y` and `z`

Need a package `scatterplot3d`

```
install.packages("scatterplot3d")
```

```
library(scatterplot3d)
```

3 Dimensional Scatter Plot

Example

The data on height (in cms.), weight (in kg.) and age (in years) of 5 persons are recorded as follows. We would like to create a 3 dimensional plot for this data.

Person No.	Height (Cms.)	Weight (Kg.)	Age (Years)
1	100	30	10
2	125	35	15
3	145	50	20
4	160	65	30
5	170	70	35

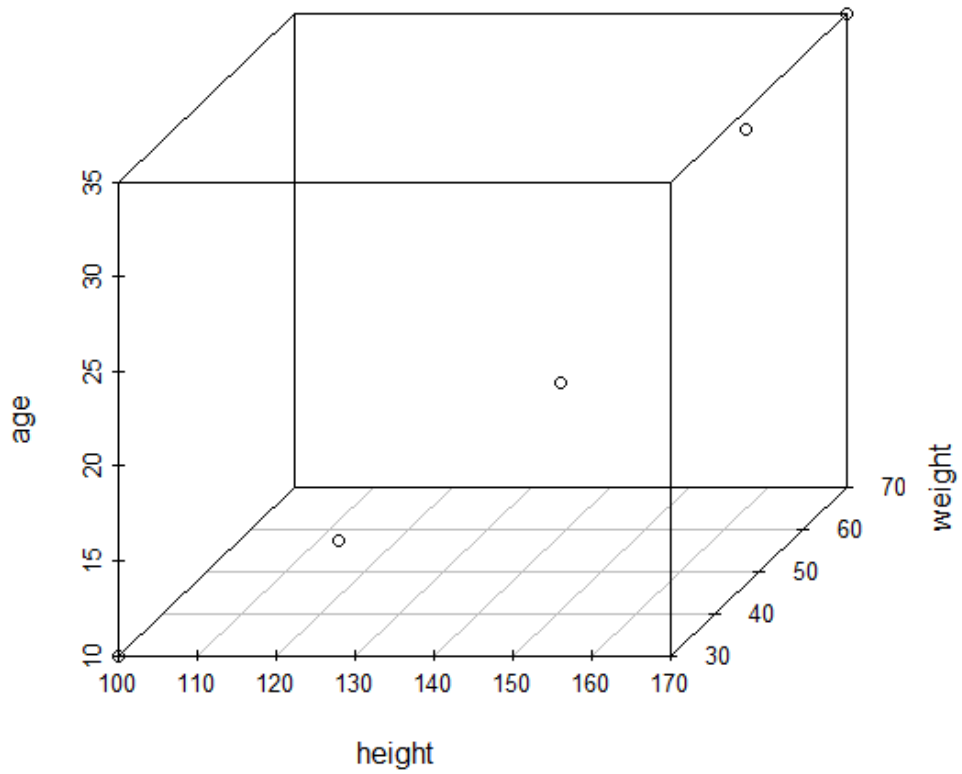
3 Dimensional Scatter Plot

`scatterplot3d()` **Plots a three dimensional (3D) point cloud**

```
> install.packages("scatterplot3d")

> library(scatterplot3d)

> height  = c(100, 125, 145, 160, 170)

> weight = c(30, 35, 50, 65, 70)

> age = c(10, 15, 20, 30, 35)
```

3 Dimensional Scatter Plot:

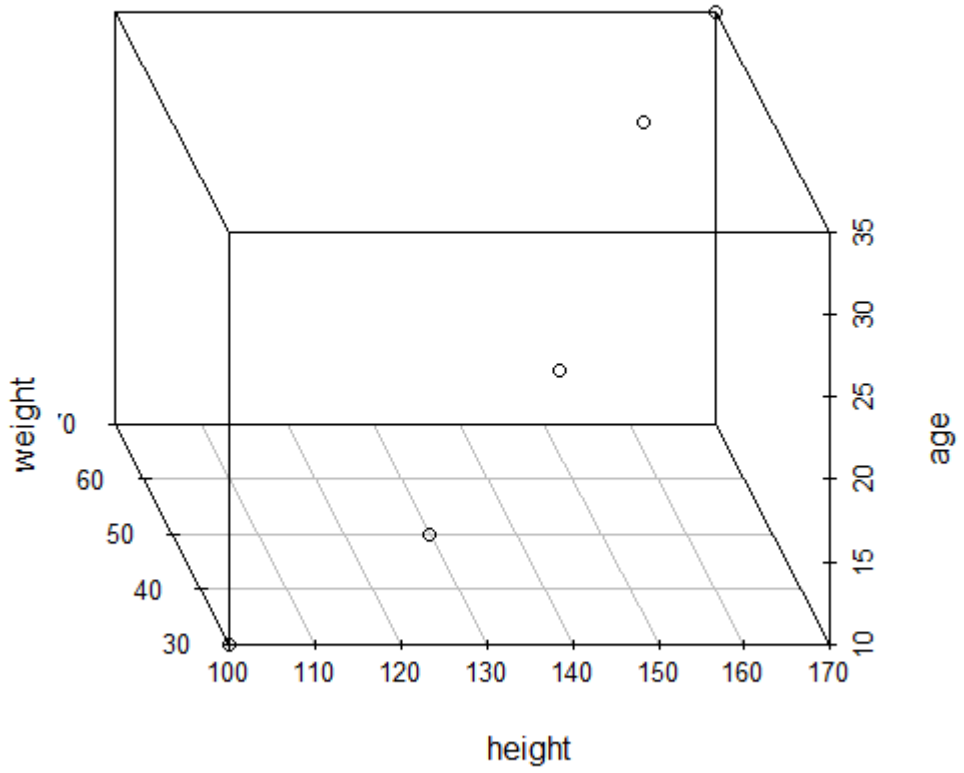
```
> scatterplot3d(height, weight, age)
```



3 Dimensional Scatter Plot:

Direction of the figure can be changed.

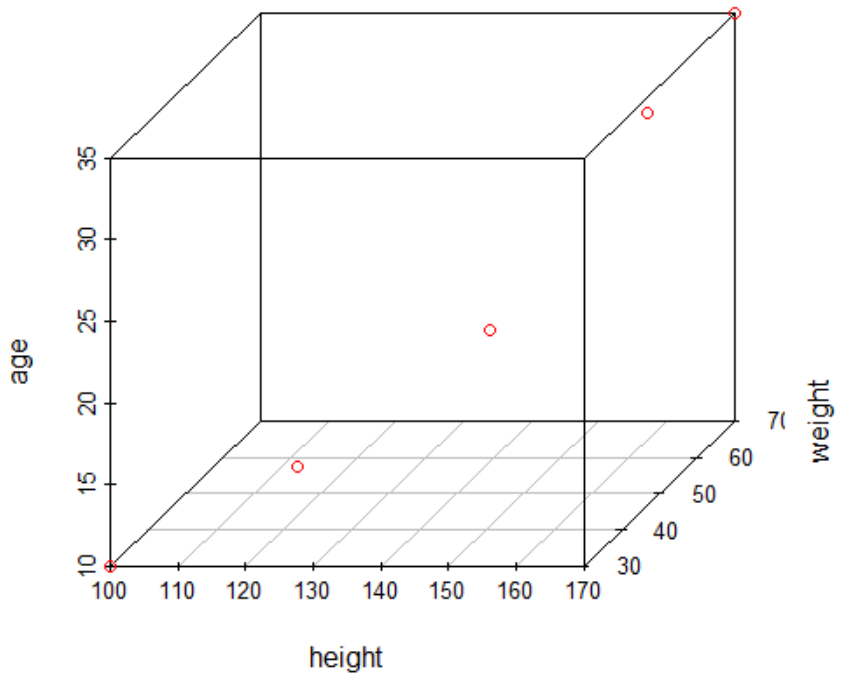
```
> scatterplot3d(height, weight, age, angle = 120)
```



3 Dimensional Scatter Plot:

Colours of points can be changed.

```
> scatterplot3d(height, weight, age, color="red")
```



More functions

- `contour()` for contour lines
- `dotchart()` for dot charts (replacement for bar charts)
- `image()` pictures with colors as third dimension
- `mosaicplot()` mosaic plot for (multidimensional) diagrams of categorical variables (contingency tables)
- `persp()` perspective surfaces over the x–y plane

More functions

Example of perspective plot

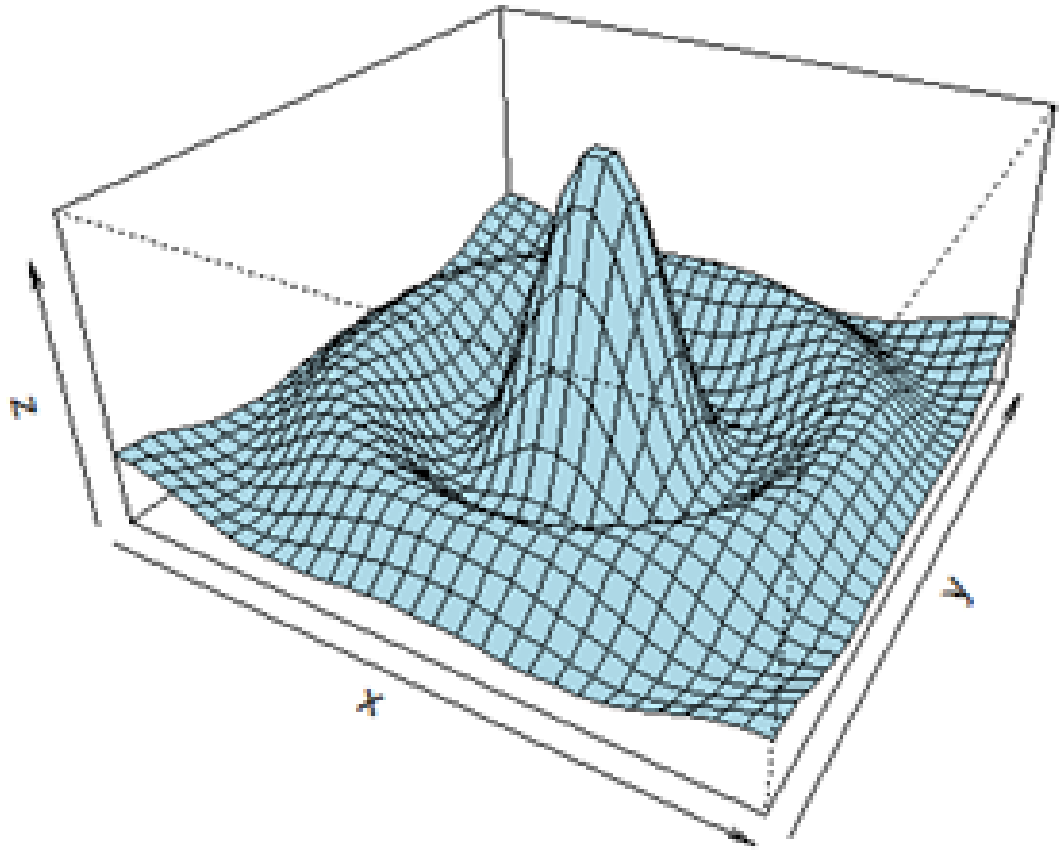
`persp()` perspective surfaces over the x–y plane

```
x = seq(-10, 10, length= 30)
y = x
f =function(x,y){r = sqrt(x^2+y^2);10*sin(r)/r}
z = outer(x, y, f)
z[is.na(z)] = 1
op = par(bg = "white")
```

More functions

Example of perspective plot

```
persp(x,y,z, theta=30, phi=30, expand=0.5, col=
"lightblue")
```



More functions

Example of perspective plot

```
persp(x, y, z, theta = 30, phi = 30, expand =
0.5, col = "lightblue", ltheta = 120, shade =
0.75, ticktype = "detailed", xlab = "X", ylab =
"Y", zlab = "Sinc( r )")
```