Introduction to R Programming

Ozan Bakış[1]
[1]Bahcesehir University, Department of Economics and BETAM

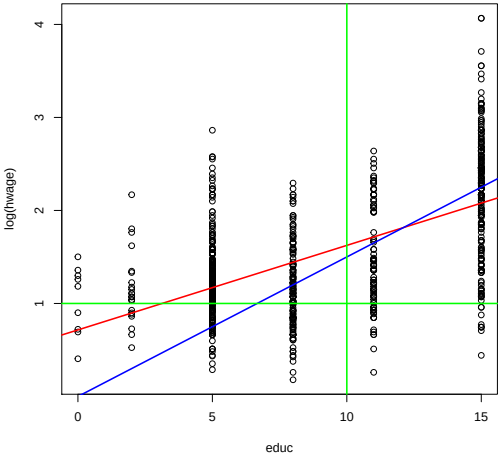
Outline

Load data I

```
f_url = "https://github.com/obakis/econ_data/raw/master/hls2011.rds"
download.file(url = f_url, destfile = "hls2011.rds", mode="wb")
dat1 = readRDS("hls2011.rds")
dat1$educ = factor(dat1$educ,labels=c("Ill","Lit","PS","MS","HS","Col"))
```

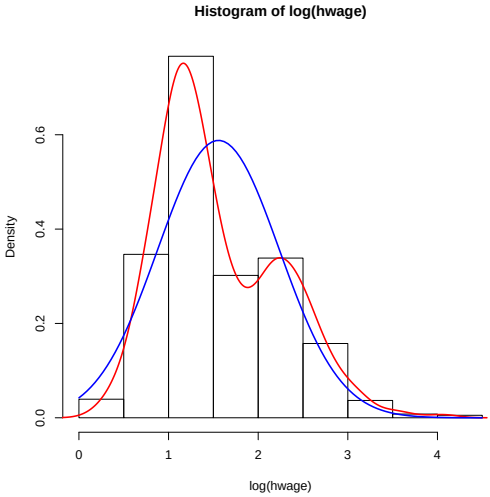
plot() I

```
plot(log(hwage)~educ, dat1)
abline(lm(log(hwage)~educ,
    dat1), lwd=2, col="red")
#a, b :intercept and slope
abline(a=0,b=0.15, lwd=2, col="blue")
# h:horizontal line, v:vertical line
abline(h=1,v=10,lwd=2, col="green")
```



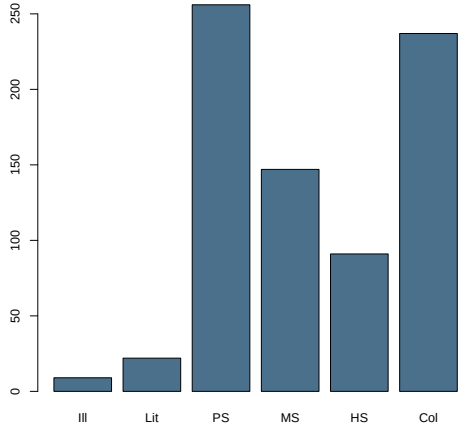
hist()I

```r
with(dat1, hist(log(hwage),
                freq=FALSE))
# See also: freq=TRUE
with(dat1,
     lines(density(log(hwage)),
           col = "red", lwd=2))
m=mean(log(dat1$hwage))
sd = sd(log(dat1$hwage))
curve(dnorm(x,m,sd),add=TRUE,
      col = "blue", lwd=2)
```



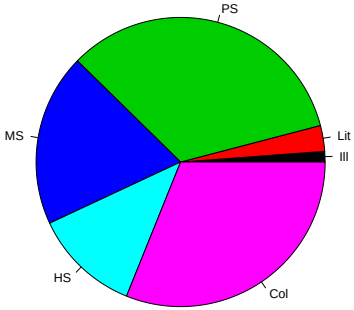
barplot() I

```
tab = table(dat1$educ)
barplot(tab, col="skyblue4")
```



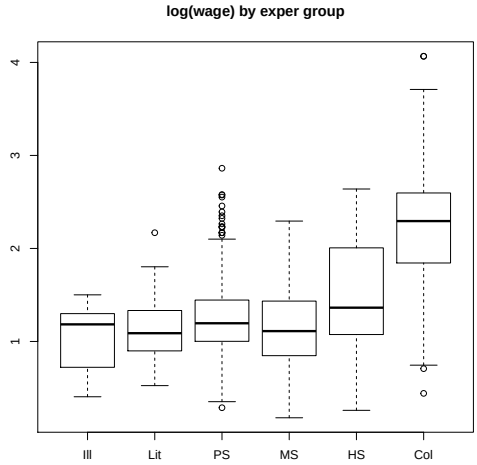
pie() I

```
pie(tab, col=1:6)
```



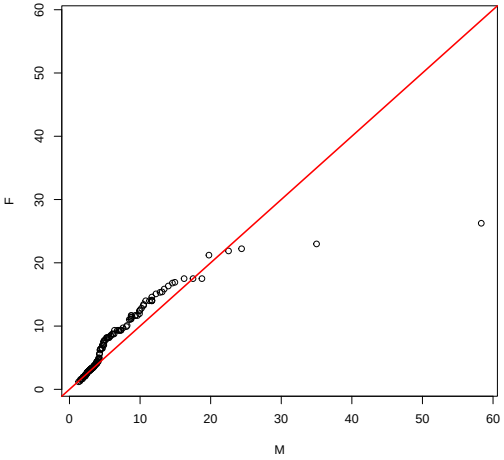
boxplot()

```
boxplot(log(hwage) ~ educ,
        data=dat1,
   main="log(wage) by exper group")
```



qqplot() I

```
mwage = subset(dat1,
               female==0)$hwage
fwage = subset(dat1,
               female==1)$hwage
w_range = range(dat1$hwage)
qqplot(mwage,fwage, xlim=w_range,
     ylim=w_range, xlab="M", ylab="F")
abline(a=0,b=1,lwd=2,col="red")
```



Graphical parameters I

Modifications: `plot()` has many arguments, including

- `type`: modify plot type, e.g., points (`type = "p"`, default), lines (`type = "l"`), both (`type = "b"`), stair steps (`type = "s"`).
- `main`, `xlab`, `ylab`: modify title and axis labels.
- Further graphical parameters (see `?par`) can be passed to `plot()` or set separately via `par()`.
- `col`: set color(s).
- `xlim`, `ylim`: adjust plotting ranges.
- `pch`: modify the plotting character for points.
- `cex`: corresponding character extension.

Graphical parameters II

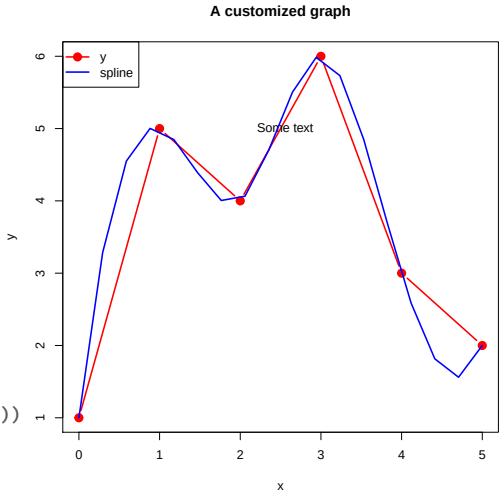
- `lty`, `lwd`: line type and width.
- `cex.lab`, `cex.axis`, `cex.`*foo*: size of labels, axis ticks, etc.

Graphical parameters I

Argument	Description
`axes`	should axes be drawn?
`bg`	background color
`cex`	size of a point or symbol
`col`	color
`las`	orientation of axis labels
`lty, lwd`	line type and line width
`main, sub`	title and subtitle
`mar`	size of margins
`mfcol, mfrow`	array defining layout for several graphs on a plot
`pch`	plotting symbol
`type`	types (see text)
`xlab, ylab`	axis labels
`xlim, ylim`	axis ranges
`xlog, ylog, log`	logarithmic scales

text() and lines() I

```
set.seed(12)
x=0:5; y=sample(6)
plot(y~x, type="b",col="red",
     lwd=2, pch=20,cex=2,
  main = "A customized graph")
text(3.0, 5.0, "Some text",
     pos = 2)
lines(spline(x,y), col="blue",
      lwd=2)
legend("topleft", col=c("red","blue"),
       lty=1,lwd=2,pt.cex=c(2,NA),
     pch=c(20,NA),legend=c("y","spline"))
```



Mathematical annotation of plots I

Overview: `?plotmath` and `demo("plotmath")`.

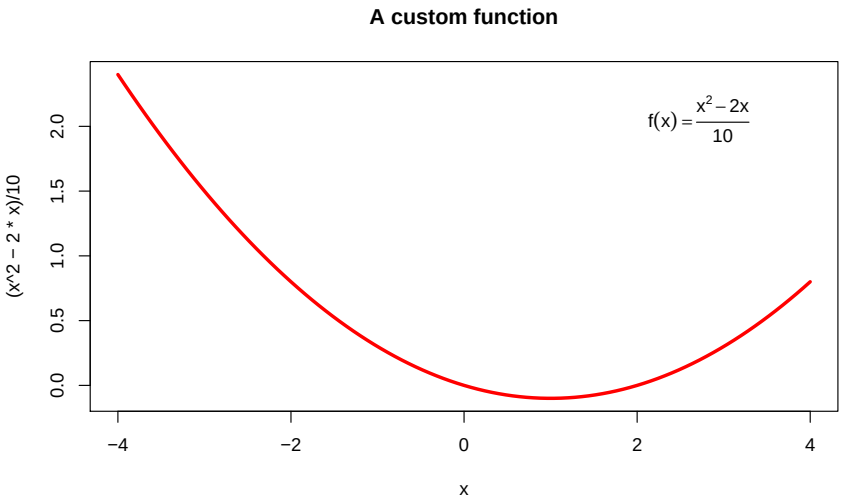
Syntax: Somewhat similar to LaTeX.

Illustration: Let us plot the following function for $-4 \leq x \leq 4$.

$$f(x) = \frac{x^2 - 2x}{10}$$

Mathematical annotation of plots I

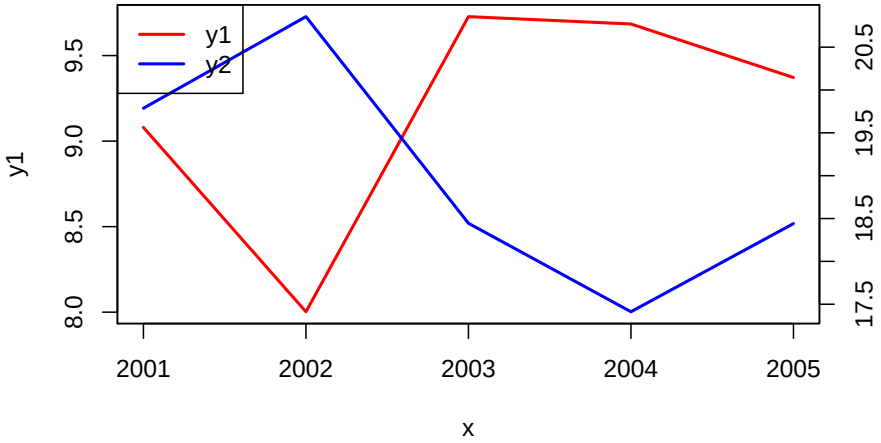
Mathematical annotation of plots II



Double Y axes I

```
## See also,
## stackoverflow.com/questions/6142944/how-can-i-plot-with-2-different-y-axes
x <- 2001:2005
y1 <- rnorm(5,10,1)
y2 <- rnorm(5,20,2)
plot(x,y1,type="l",col="red",lwd=2)
par(new=TRUE)
plot(x, y2,type="l",col="blue",lwd=2,
     xaxt="n",yaxt="n",xlab="",ylab="")
axis(4)
mtext("y2",side=4,line=3)
legend("topleft",col=c("red","blue"),
       lty=1,lwd=2,legend=c("y1","y2"))
```

Double Y axes II



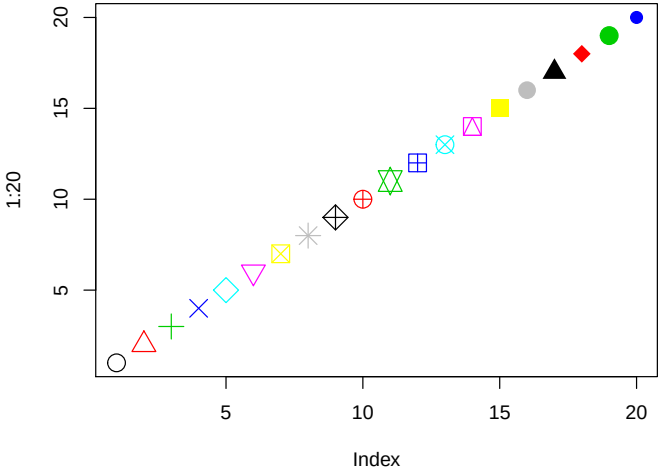
Exporting graphics I

We can save graphics in various formats including `PDF,PS,EPS,PNG,JPG,BMP,WMF,SVG`. In R language it is known as *starting a device driver*. For instance a `PDF` graphic may be created by

```
pdf("myfile.pdf", height = 5, width = 6)
plot(1:20, pch = 1:20, col = 1:20, cex = 2)
dev.off()
```

After graphic is done we should terminate the device driver by issuing the command `dev.off()`.

Exporting graphics II



Outline

ggplot2 I

TO BE COMPLETED