

105-1: EE4052  
 計算機程式設計  
 Computer Programming

Unit 09: 繪圖功能設定與文字

連 豐 力

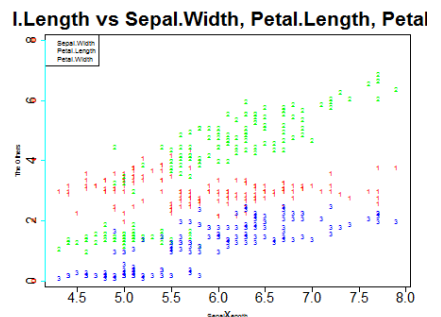
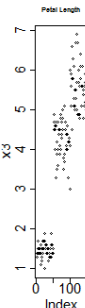
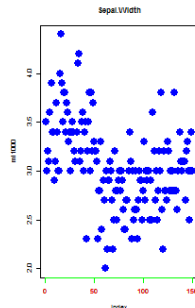
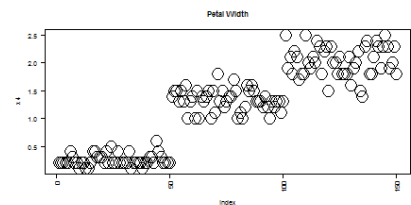
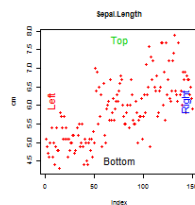
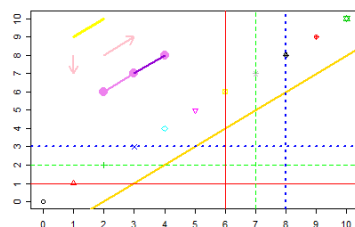
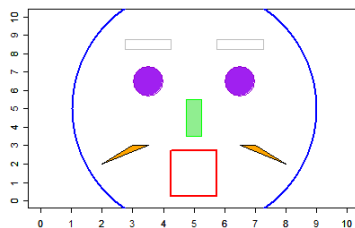
臺大電機系

Sep 2016 - Jan 2017

Unit 09: 繪圖功能設定與文字

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 Chap 09: 繪圖功能文字  
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- 一頁之中，至少放了多張的圖
- 每張圖的長寬或大小，不一樣
- 主標題，軸標題，字體要有變化
- 數據點的顏色要有變化
- 數據點的形式要有變化
- 不同數據加上不同註解



- 繪圖視窗之設定
- 常用的圖形參數
- 座標軸及邊界
- 加入文字
- 多張圖形
- 多張圖形之位置安排
- 加入圖形元件
- 顏色
- 數學函數繪圖

## 繪圖視窗之設定

- `plot( )`
- `windows( )`
- `curve( )`

`windows( width, height, pointsize, record, rescale, xpinch, ypinch, bg, canvas, gamma, xpos, ypos, buffered, title, restoreConsole, clickToConfirm, fillOddEven, family, antialias )`

`plot( x, y, ... )`

`curve( expr, from = NULL, to = NULL, n = 101, add = FALSE, type = "l", xname = "x", xlab = xname, ylab = NULL, log = NULL, xlim = NULL, ... )`

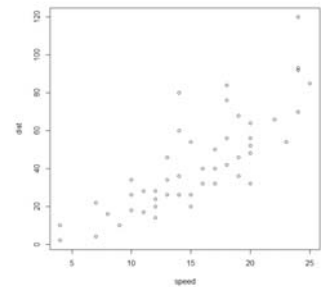
- `# in Mac OS`
- `quartz( )`

`quartz( title, width, height, pointsize, family, antialias, type, file = NULL, bg, canvas, dpi )`

- `# in UNIX`
- `X11( )`

`X11( width, height, pointsize, bg, gamma, xpos, ypos, title )`

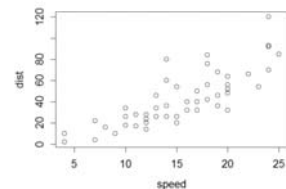
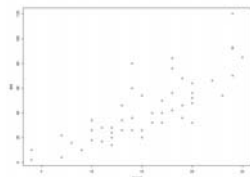
- `data( cars )`
- `summary( cars )`
- `cars`
- `head( cars )`
- `tail( cars )`
- `str( cars )`
- `plot ( cars )`



- 7

## 繪圖視窗之設定

- `windows( width = 4.5, height = 3.3, fontsize = 8 )`  
# `fontsize`: 文字或符號字體大小
- `windows( width = 8, height = 6, fontsize = 20 )`
- `old.par <- par( mex = 0.8, mar = c(5, 5, 4, 2) + 0.1 )`  
# `mex`: 邊界文字的縮放比  
# `mar`: 下 左 上 右 四個邊界之預留距離  
# 下: `side=1`, 左: `side=2`, 上: `side=3`, 右: `side=4`
- `plot ( cars )`
- `par( old.par )` # reset to previous settings



- 8

- `windows( width = 4.5, height = 3.3, pointsize = 8 )`
- `old.par <- par( mex = 0.8, mar = c(5, 5, 4, 2) + 0.1 )`
- `plot ( cars )`
- `par( old.par )` # reset to previous settings
  
- `win.graph( width = 4.5, height = 3.3, pointsize = 8 )`
- `old.par <- par( mex = 0.8, mar = c(5, 5, 4, 2) + 0.1 )`
- `plot( cars )`
- `par( old.par )` # reset to previous settings

- `windows( width, height, pointsize, record, rescale, xpinch, ypinch, bg, canvas, gamma, xpos, ypos, buffered, title, restoreConsole, clickToConfirm, fillOddEven, family, antialias )`
- `win.graph( width, height, pointsize )`
- `x11( width, height, pointsize, bg, gamma, xpos, ypos, title )`
- `X11( width, height, pointsize, bg, gamma, xpos, ypos, title )`
- `win.metafile( filename = "", width = 7, height = 7, pointsize = 12, family, restoreConsole = TRUE )`
- `win.print( width = 7, height = 7, pointsize = 12, printer = "", family, antialias, restoreConsole = TRUE )`

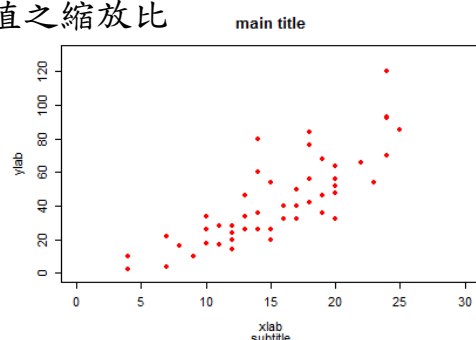
# 常用的圖形參數

11

## 圖形參數

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Chap 09: 繪圖功能文字  
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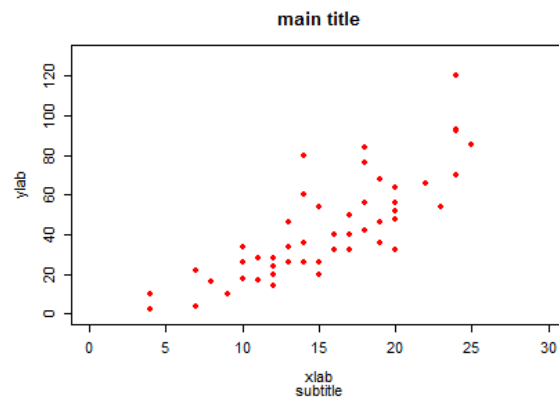
- **xlim:** # X 軸 (橫) 之範圍; **xlim[1]**: 左邊界, **xlim[2]**: 右邊界
- **ylim:** # y 軸 (縱) 之範圍; **ylim[1]**: 下邊界, **ylim[2]**: 上邊界
- **xlab:** # X 軸 (橫) 之名稱, 出現在橫軸下方
- **ylab:** # y 軸 (縱) 之名稱, 出現在橫軸左方
- **main:** # 整個圖形的之主標題, 出現在圖形的上方
- **sub:** # 副標題, 出現在橫軸下方
- **cex:** # 文字及符號相對於內定值之縮放比
- **pch:** # 點的型式
- **col:** # 繪圖的顏色



- 12

- `windows( width = 4.5, height = 3.3, pointsize = 8 )`
- `old.par <- par( mex = 0.8, mar = c(7, 5, 4, 2) + 0.1 )`
- `plot( cars, xlim = c(0, 30), ylim = c(0, 130), xlab = "xlab", ylab = "ylab", main = "main title", sub = "subtitle", cex = 0.8, pch = 16, col = "red")`

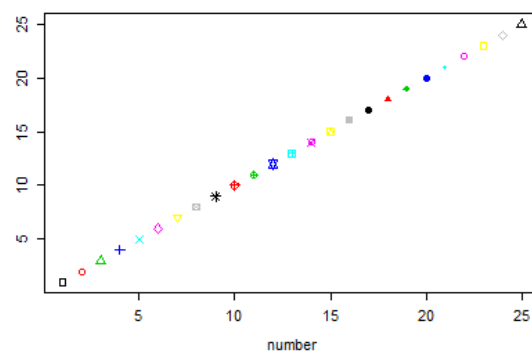
- `par( old.par )`  
# reset to previous settings



- 13

- `windows( width = 4.5, height = 3.3, pointsize = 8 )`
- `old.par <- par( mex = 0.8, mar = c(5, 5, 4, 2) + 0.1 )`
- `plot( 1:25, pch = 0:25, col = 1:8, xlab = "number", ylab = "" )`

- `par( old.par )`  
# reset to previous settings



- 14

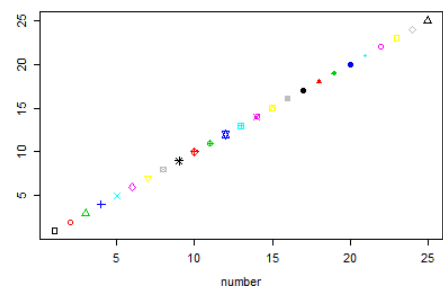
# 座標軸及邊界

15

## 座標軸及邊界參數

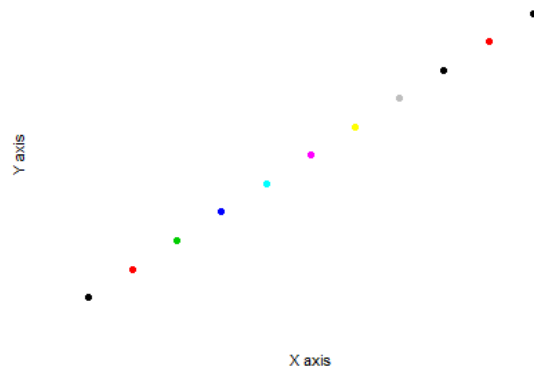
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Chap 09: 繪圖功能文字  
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- **axis:** # 設定座標軸之函數
- **axes:** # `axes = TRUE` : 要畫座標軸; `axes = FALSE` : 不要畫座標軸
- **xaxt:** # `xaxt = "n"` : 不要畫 x 軸
- **yaxt:** # `yaxt = "n"` : 不要畫 y 軸
- **col.axis:** # 座標軸之文字顏色
- **side:** # 繪圖區域邊界的編號
- **mex:** # 邊界文字之縮放比
- **mar:** # 下左上下右四個邊界之預留距離



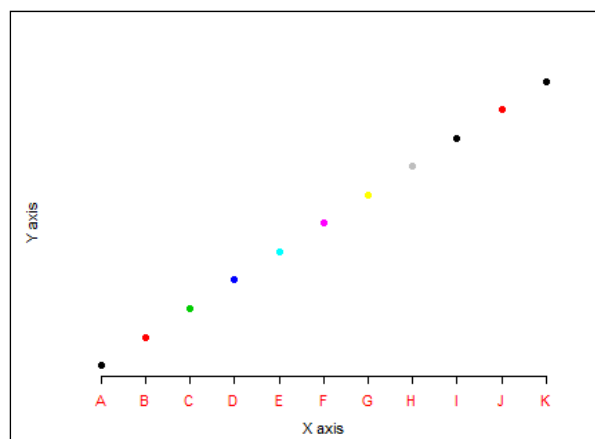


- `windows( width = 4.5, height = 3.3, pointsize = 8 )`
- `old.par <- par( mex = 0.8, mar = c(5, 5, 4, 3) + 0.1 )`
- `plot( 0:10, 0:10, col = 1:10, pch = 16, xlab = "X axis", ylab = "Y axis", axes = FALSE )`



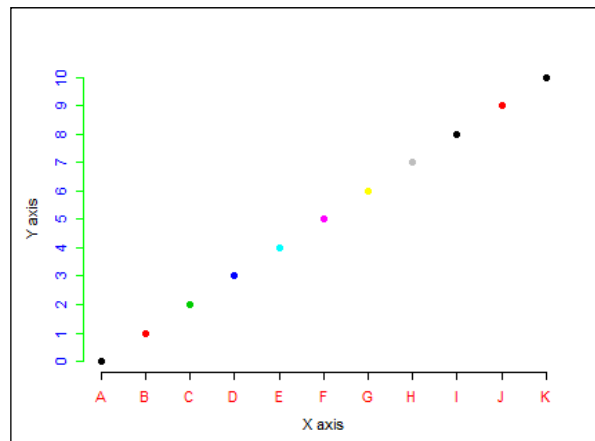
- 17

- `plot( 0:10, 0:10, col = 1:10, pch = 16, xlab = "X axis", ylab = "Y axis", axes = FALSE )`
- `axis( side = 1, col = "black", col.axis = "red", at = 0:10, label = LETTERS[1:11] )`



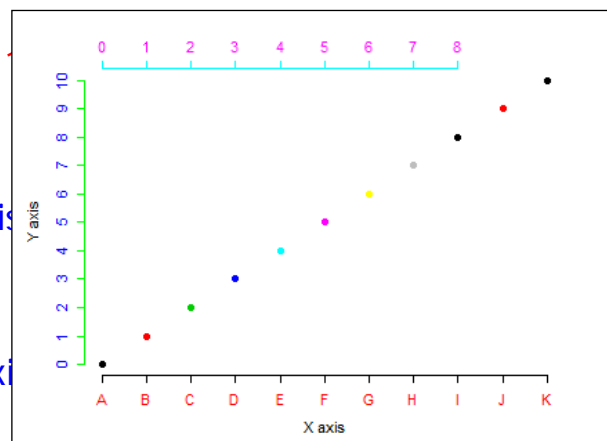
- 18

- `plot( 0:10, 0:10, col = 1:10, pch = 16, xlab = "X axis", ylab = "Y axis", axes = FALSE )`
- `axis( side = 1, col = "black", col.axis = "red", at = 0:10, label = LETTERS[1:11] )`
- `axis( side = 2, col = "green", col.axis = "blue", at = seq(from = 0, to = 10, by = 1) )`



- 19

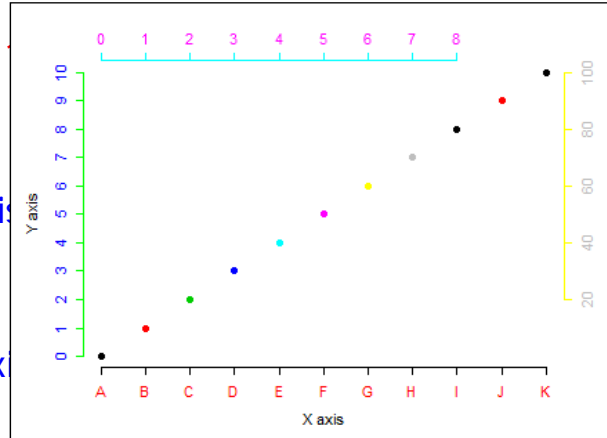
- `plot( 0:10, 0:10, col = 1:10, pch = 16, axes = FALSE )`
- `axis( side = 1, col = "black", col.axis = "red", at = LETTERS[1:11] )`
- `axis( side = 2, col = "green", col.axis = "blue", at = seq(from = 0, to = 10, by = 1) )`
- `axis( side = 3, col = "cyan", col.axis = "magenta", at = seq(from = 0, to = 8, by = 1) )`



- 20

## 座標軸及邊界參數

- `plot( 0:10, 0:10, col = 1:10, pch = 1, axes = FALSE )`
- `axis( side = 1, col = "black", col.axis = "black", at = 1:10, label = LETTERS[1:11] )`
- `axis( side = 2, col = "green", col.axis = "green", at = 0:10, by = 1 )`
- `axis( side = 3, col = "cyan", col.axis = "magenta", at = seq(from = 0, to = 8, by = 1) )`
- `axis( side = 4, col = "yellow", col.axis = "gray", at = seq(from = 2, to = 10, by = 2), label = c(20, 40, 60, 80, 100) )`
- `par( old.par )`



- 21

## 大綱

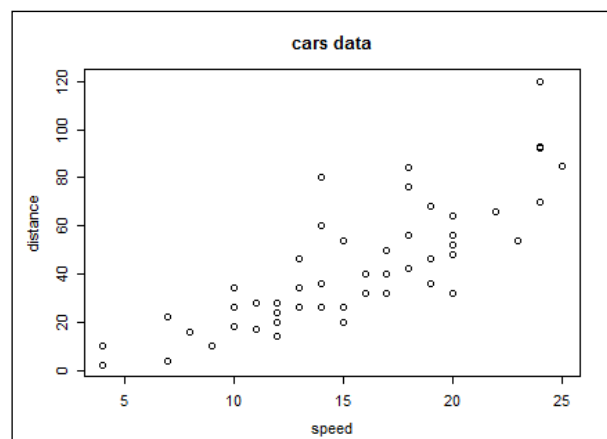
# 加入文字

# 加入文字

- `text:` # 加入文字
- `title:` # 加入註解
- `legend:` # 加入圖標, 圖例, 備註
- `mtext:` # 在邊界加入文字

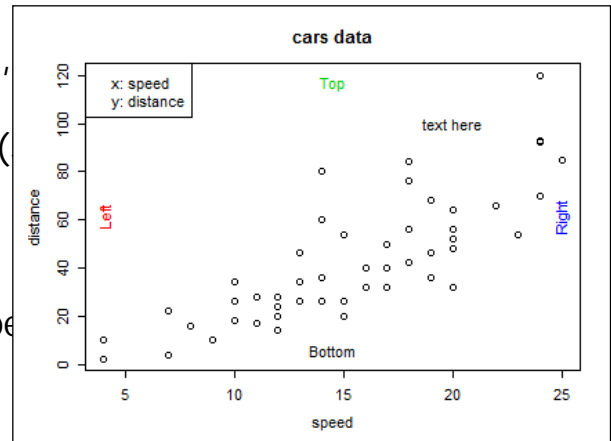
# 加入文字

- `windows( width = 4.5, height = 3.3, pointsize = 8 )`
- `old.par <- par( mex = 0.8, mar = c(5, 5, 4, 2) + 0.1 )`
- `plot( cars, xlab = "", ylab = "" )`
- `title( main = "cars data", xlab = "speed", ylab = "distance" )`



## 加入文字

- `windows( width = 4.5, height = 3.3,`
- `old.par <- par( mex = 0.8, mar = c(`
- `plot( cars, xlab = "", ylab = "" )`
- `title( main = "cars data", xlab = "spe`
- `text( 20, 100, label = "text here" )`
- `legend( "topleft", legend = c("x: speed", "y: distance" ) )`
- `mtext( text = c("Bottom", "Left", "Top", "Right"), side = 1:4, col = 1:4,`  
`line = -2 )`



# line = -2: 往內移動兩個線寬度

- `par(old.par)`

- 25

## 加入文字

- legend 位置：

topleft,	top,	topright
left,	center,	right
bottomleft,	bottom,	bottomright

- 26

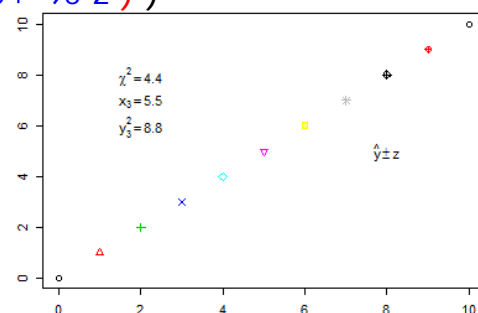
## 加入文字 - 用滑鼠

- `windows( width = 4.5, height = 3.3, pointsize = 8 )`
- `old.par <- par( mex = 0.8, mar = c(5, 5, 4, 2) + 0.1 )`
- `plot( cars, xlab = "", ylab = "" )`
- `title( main = "cars data", xlab = "speed", ylab = "distance" )`
- `text( 20, 100, label = "text here" )`
- `legend( locator(1), legend = c("x: speed", "y: distance") )`
- `mtext( text = c("Bottom", "Left", "Top", "Right"), side = 1:4, col = 1:4, line = -2 )`
- `par(old.par)`

- 27

## 加入數學符號

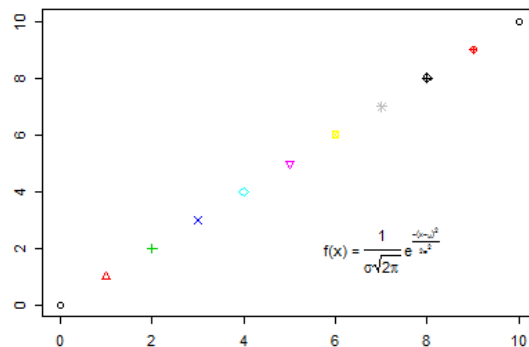
- `windows( width = 4.5, height = 3.3, pointsize = 8 )`
- `old.par <- par( mex = 0.8, mar = c(5, 5, 4, 2) + 0.1 )`
- `plot(0:10, 0:10, xlab = "", ylab = "", pch = 1:10, col = 1:10)`
- `text( 2, 8, label = expression( chi^2 == "4.4" ) )`
- `text( 2, 7, label = expression( x[3] == "5.5" ) )`
- `text( 2, 6, label = expression( y[3]^2 == "8.8" ) )`
- `text( 8, 5, label = expression( hat(y) %+-% z ) )`



- 28

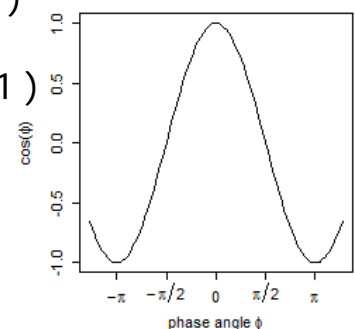
- `label.eq <- expression( paste( "f(x) = ", frac(1, sigma*sqrt(2 * pi)), " ", e^{frac(-(x - mu)^2, 2*sigma^2)} ) )`
- `text( 7, 2, label = label.eq )`

- `par( old.par )`



- 29

- `x <- seq( from = -4, to = 4, length = 101 )`
- `win.graph( width = 2.8, height = 2.8, pointsize = 8 )`
- `old.par <- par( mex = 0.8, mar = c(5, 5, 3, 2) + 0.1 )`
- `xlab <- expression( paste( "phase angle ", phi ) )`
- `ylab <- expression( paste( "cos(", phi, ")" ) )`
- `plot( x, cos(x), type = "l", xaxt = "n", xlab = xlab, ylab = ylab )`
- `label <- expression( -pi, -pi / 2, 0, pi / 2, pi )`
- `axis( side = 1, at = c(-pi, -pi / 2, 0, pi / 2, pi), label = label )`
- `par(old.par)`



- 30

- `?plotmath`
- `demo( plotmath )`

- `font:` # 文字及符號之字型
- `font.axis:` # 座標軸數字，文字及符號之字型
- `font.lab:` # 座標軸標記之字型
- `font.mian:` # 主標題文字及符號之字型
- `font.sub:` # 副標題文字及符號之字型
  
- `demo( Hershey )`