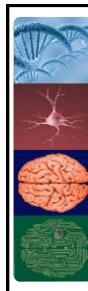

Introduction to Programming 2017/2018

Tirgul 6: Graphics

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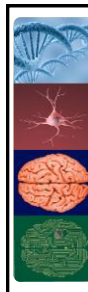
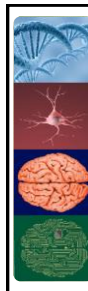
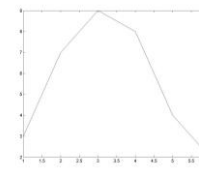


Basic graphics



Plot

- Drawing a curve – Y values versus X values
  - X and Y are variables.
  - Plots pairs of points: (X1, Y1) (X2, Y2) (X3, Y3)...
- Example:
  a = [1 2 3 4 5 6]
  b = [3 7 9 8 4 2]
  plot(a, b)
- ***scriptGraphics.m***

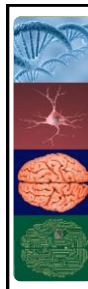


The figure window

- Matlab displays plots on the current figure window.
- We can add a new figure window, and display the new plot on it.
- 'figure' – opens a new figure window to display plot on.
- 'clf' – clear figure.
- 'close' and 'close all' – close figures.
- *scriptGraphics.m*

Subplot

- You can divide your figure into several separate graphs (axes objects).
- Syntax: subplot(m,n,p)
  m = number of rows
  n = number of columns
  p = current axes to work on (axes are numbered row-wise).
- Example: subplot(2,3,5)
  Creates a figure with 6 areas for graphs (arranged in 2 rows, 3 columns in each row)
- *scriptGraphics.m*

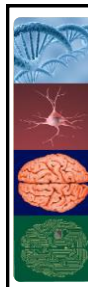


Accessories

- title
- xlabel
- ylabel
- ylim, xlim – change or get the axes limits.
- legend
  - Syntax: legend('text1', 'text2')
  - legend off → Remove legend.

Text

- Syntax: text(x, y, 'text')
- Text properties:
  - text(x, y, 'text', 'P-Name', P-Val)
  - Example:
    text(10, 15, 'peak', 'FontSize', 10)
- The text properties can be applied also to title, xlabel, ylabel.
- For a list of text properties: search for *text properties* in the Matlab helpdesk.



Text - Specials

- Subscript letters/digits – use underscore (_) before the letter.
  Example: title('mat_1') → the title will be 'mat$_1$'
- Superscript letters/digits – use ^ before the letter/digits.
  Example: title('mat^1') → the title will be 'mat^1'
- An underscore is required before <u>each</u> letter/digit.
- Greek letters – use backslash and the name of the letter.
  Example: title('\alpha') → the title will be 'α'

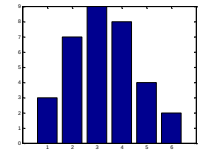
Line

- Syntax: line(x, y)
- Draws a line between the points specified by the x and y vectors.
- line properties:
  - line(x, y, 'P-Name', P-Val)
  - Example:
    line([0 10],[3 3], 'color', 'r', 'lineWidth', 3)
- For a list of line properties: search for *line properties* in the Matlab helpdesk.

Bar

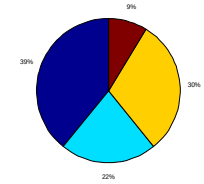
- Displays a bar graph for the given values.
- Syntax: bar(Y)
  bar(x,Y)

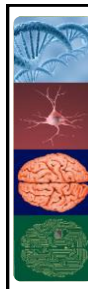
Y is the height of each bar, x is the location of the center of each bar.



Pie plot

- Syntax: pie(x)
- The values in X are normalized via x/sum(x) to determine the area of each slice of pie.
- Example:
  x = [45 25 35 10];
  pie(x)
- pie3 – 3D pie plot.



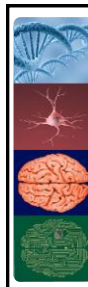


Printing and Saving Plots - from the figure window

- Print
  - 'print' icon
  - File → Print
- Save
  - 'save' icon
  - File → Save (or 'Save As')
- When saving, default extension is '.fig' – can be opened only from Matlab.
  - A different extension can be chosen: jpg, bmp, pdf.

Interactive editing

- The figure can be interactively edited through the figure window.
- Zoom in, zoom out, reset zoom.
- Menu options: xlabel, ylabel, title, figure properties, ...



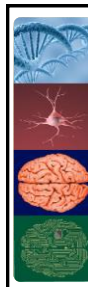
Graphic handles

Objects

- Figures and graphs are MATLAB **objects**.
- Objects have **properties** which determine their appearance and behavior.
- Some object properties are objects themselves, which have properties of their own – thus creating a **hierarchy** of objects.
- Whenever MATLAB creates a graphics object, it assigns a unique identifier (called a **handle**) to the object.
- Handles can be used to access and change the object's properties.

Changing properties

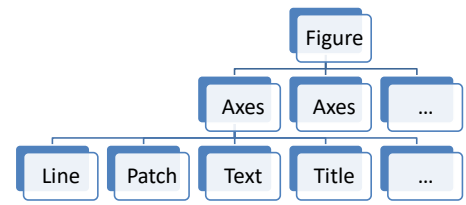
- Properties have **names** and **values**.
- Retrieval of a property value:
  - propVal = get(objectHandle, 'propertyName')
  - Or (≥2014b): propVal = objectHandle.propertyName
- Changing a property value:
  - Set(objectHandle, 'propertyName',*newValue*)
  - Or (≥2014b): objectHandle.propertyName = *newValues*
  - Multiple properties of a single object can be changed within a single 'set' command: set(objectHandle, 'propertyName',*newValue*, 'propertyName',*newValue …)*



Handles hierarchy

- Useful properties for navigating the handles hierarchy are the '**parent**' and '**children**' properties.
  - For example:
    h = hAxes.Parent ***or*** h = get(hAxes,'parent')
    If *hAxes* is the handle of an axes object, *h* will be the handle of the figure object.

Commonly used objects hierarchy



Functions/Commands List

- figure, clf, close, hold on/off
- plot
- subplot
- bar, pie,pie3
- Line properties and specifies
- title, xlabel, ylabel, xlim, ylim, legend
- text
- Line

- get
- set