Tutorial : 5 Plotting *x-y* (2D) and *x*, *y*, *z* (3D) graphs
Date : 9/08/2016

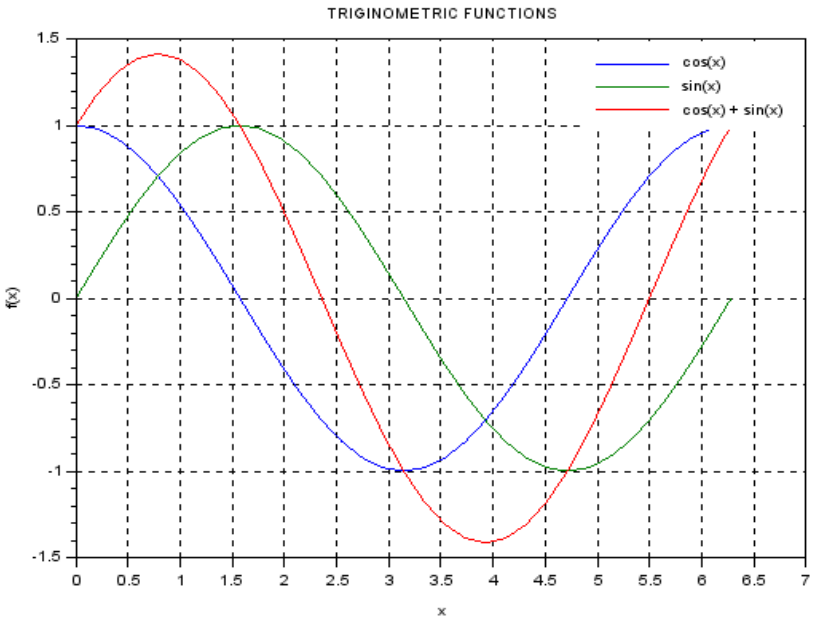
Aim

To learn to produce simple 2-Dimensional x-*y* and 3-Dimensional (*x*, *y*, *z*) graphs using SCILAB.

Exercises:

1. Generate a 2D plot using the SCILAB with built-in function plot for the following data:
   a. For *x* data create the vector with a start value is 0, increment value of $\pi/16$ and end value of 2π using built-in function linspace
   b. For *y* data use the function as $y = \cos(x)$; $y = \sin(x)$; and $y = \cos(x) + \sin(x)$
   c. Give the title of the plot as "TRIGNOMETRIC FUNCTIONS" using the built-in function `xtitle` and label *x*-axis as '*x*' and *y* - axis as '*f*(*x*)'. Use the function `xgrid` and show the grid lines in the plot.
   d. Also use the built-in function legend and show the legends for the functions cos (*x*), sin (*x*) and $y = \cos(x) + \sin(x)$

```
-->x=[0:%pi/16:2*%pi]';

-->y=[cos(x) sin(x) cos(x)+sin(x)];

-->plot(x,y)

-->xtitle('TRIGINOMETRIC FUNCTIONS', 'x', 'f(x)');

-->xgrid(1);

-->legend ('cos(x)', 'sin(x)', 'cos(x) + sin(x)', 1,
%F);
```



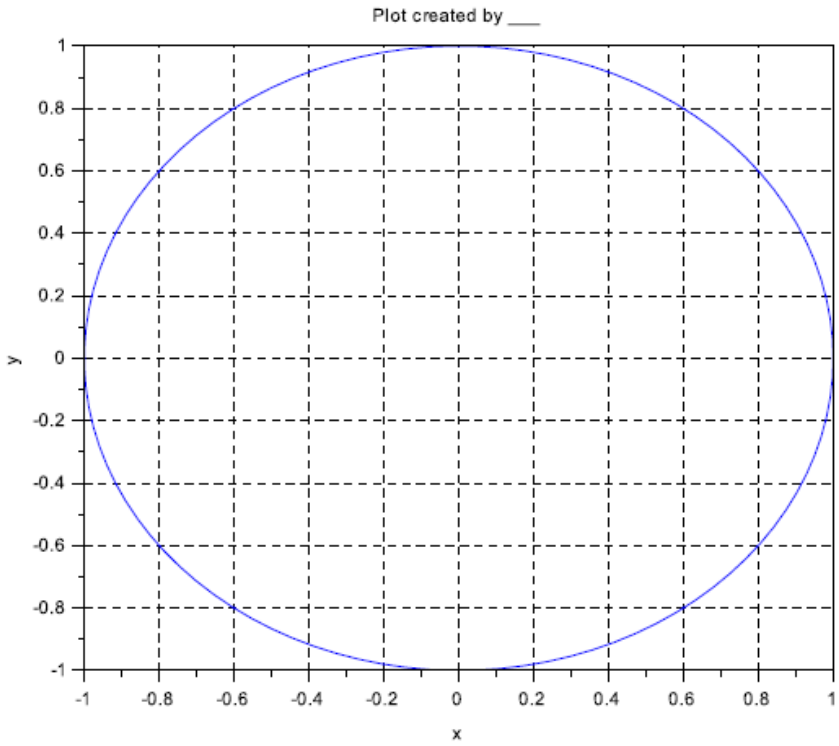
2. a. Create a vector theta (θ) with a linearly spaced 100 elements long vector. (Hint: Use the start value 0, increment value 2π and end value 100 with built-in function `linespace`).

   b. Calculate x and y – coordinates (use, x = cos (theta) and y = sin (theta)).

   c. Plot x vs y

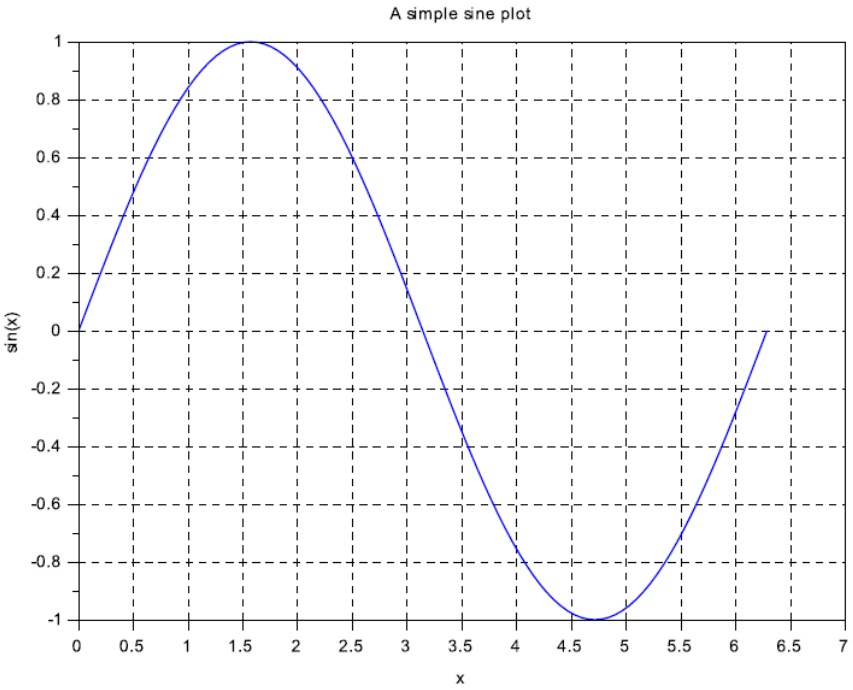
   d. Give the title of the plot as "PLOT CREATED BY YOUR NAME _____" using the built-in function `xtitle` and label x-axis as 'x' and y - axis as '$f(x)$'. Use the function `xgrid` and show the grid lines in the plot.

```
-->theta=linspace(0,2*%pi,100);
-->x=cos(theta);
-->y=sin(theta);
-->plot(x,y)
-->xlabel('x')
-->ylabel('y')
-->xtitle('Plot created by ___')
-->xgrid(1)
```



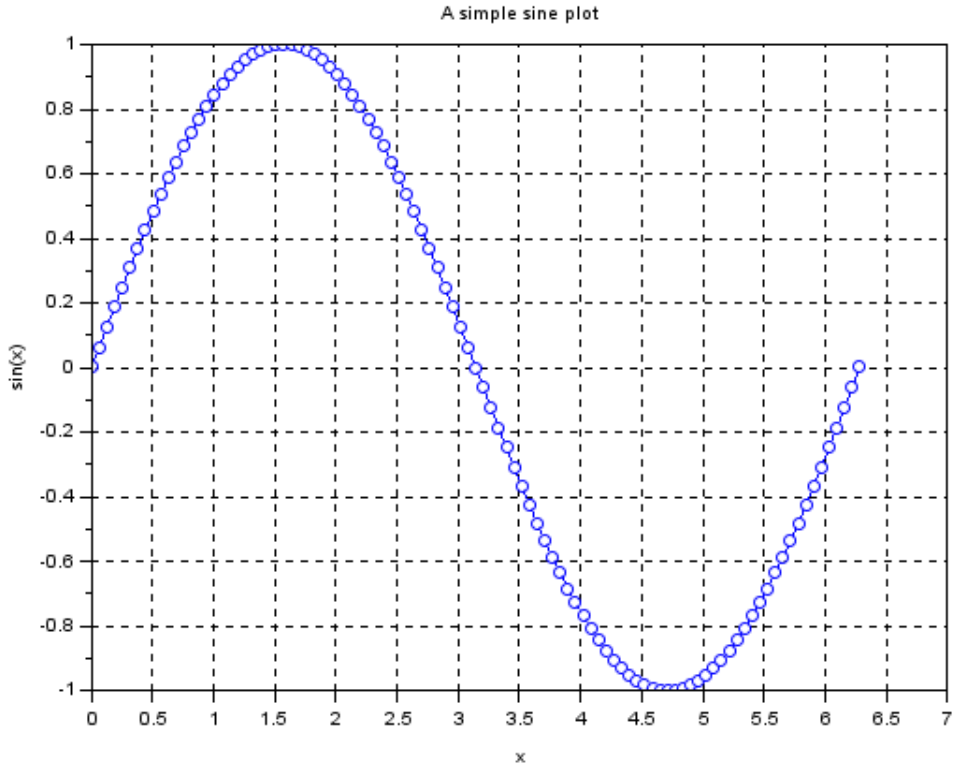
3. Plot $y = \sin x$, $0 \leq x \leq 2\pi$, taking 100 linearly spaced points in the given interval. Label the axes and put plot title as "A simple sine plot". Use the function `xgrid` and show the grid lines in the plot.

```
-->x=[0:%pi/50:2*%pi];

-->y=sin(x);

-->plot(x,y);

-->xgrid(1);

-->xtitle('A simple sine plot', 'x', 'sin(x)');
```



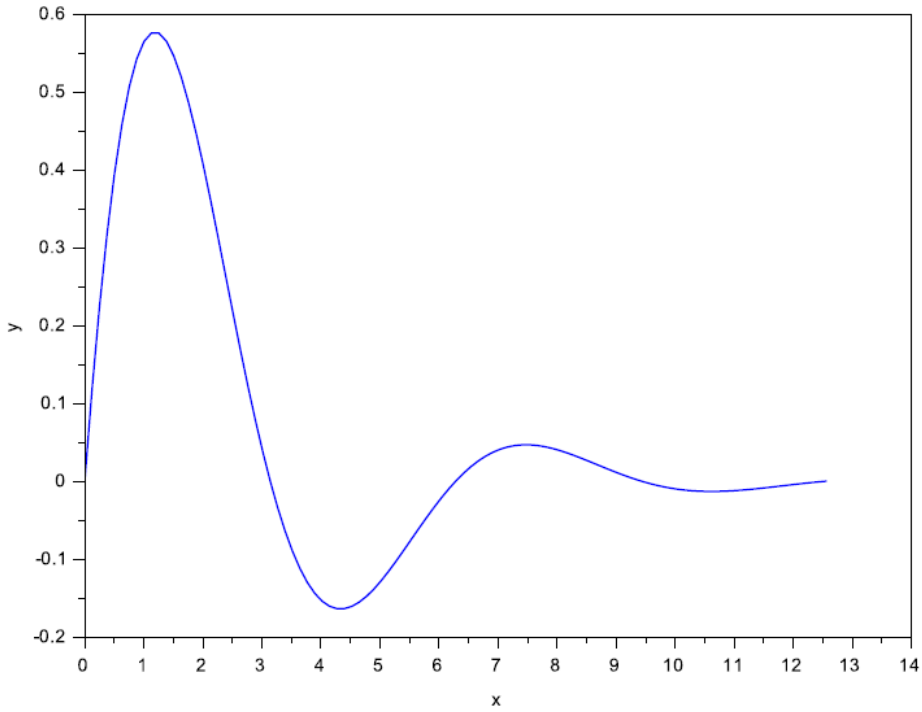
4. Make the same plot as given in the problem 3. But rather than displaying the graph as a curve, show unconnected data point. To display the points with small circles, use the built-in function plot(*x*, *y*, 'o')

```
-->x=[0:%pi/50:2*%pi];

-->y=sin(x);

-->plot(x,y);

-->xgrid(1);

-->xtitle('A simple sine plot', 'x', 'sin(x)');

-->plot(x,y,'o')
```



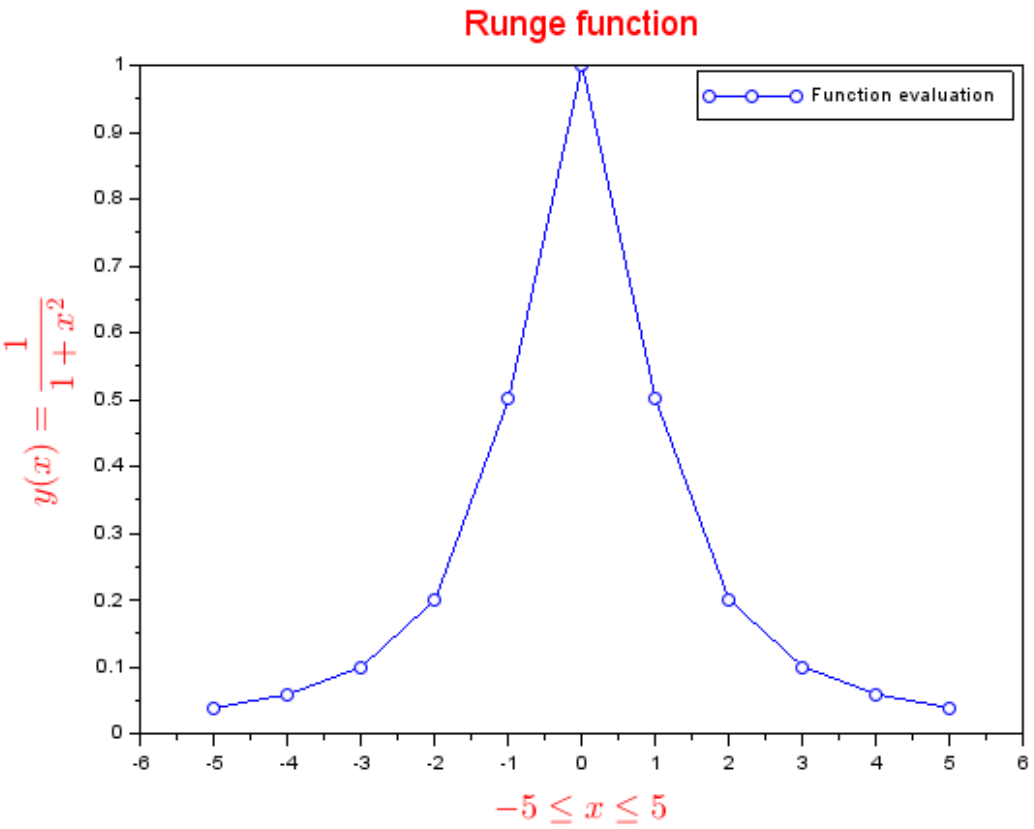
5. Plot an exponentially decaying sine plot: $y = e^{-0.4x} \sin x$, $0 \le x \le 4\pi$, taking 100 points interval. [Be careful about computing y. you need array multiplication between $e^{(-0.4*x)}$ and sin(x) [i.e. term-by-term or element-by-element operations].

```
-->x=[0:%pi/25:4*%pi];

-->y=exp(-0.40*x).*sin(x);

-->plot(x,y)

-->xlabel('x')

-->ylabel('y')
```



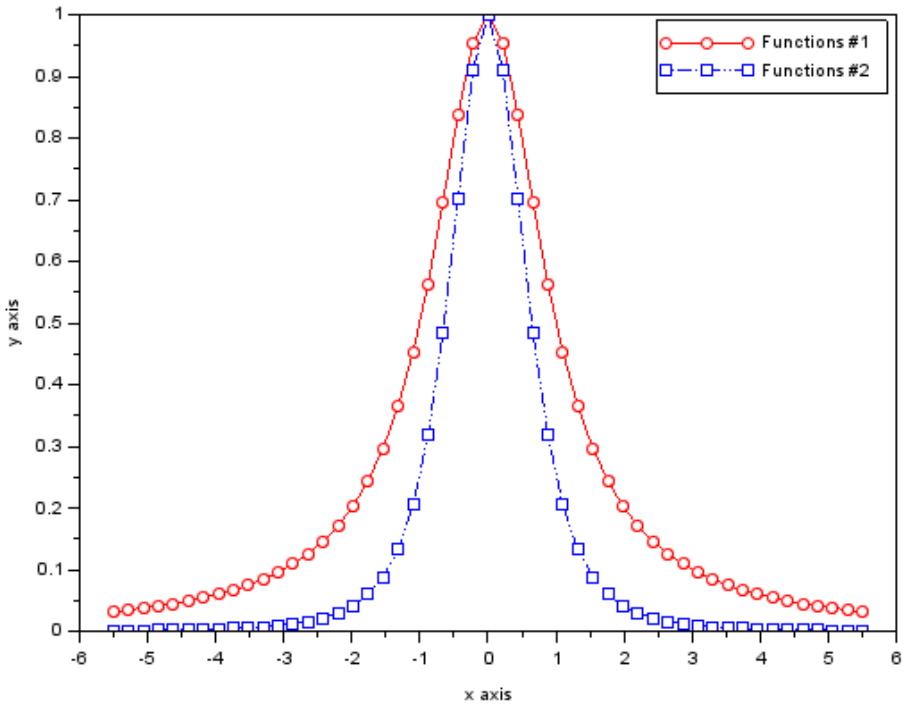
6. Try the following: Basic 2D graph with LaTex annotations to produce the plot for the function with $y = \frac{1}{1+x^2}$ on the interval $-5 \le x \le 5$

```
-->x=[-5:1:5];

-->y=1 ./(1+x.^2);

-->plot(x,y,'o-b');

-->xlabel("$-5\le x\le 5$","fontsize",4,"color","red");

-->ylabel("$y(x)=\frac{1}{1+x^2}$","fontsize",4,

   "color","red");

-->title("Runge function","color","red","fontsize",4);

-->legend("Function evaluation");
```



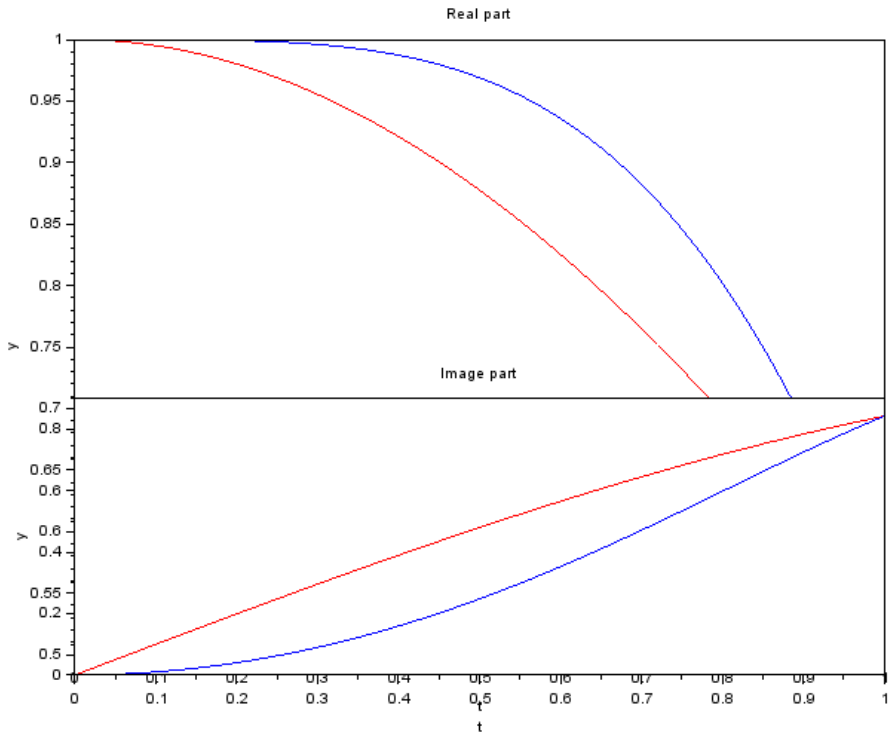
7. Multiple plot for the above problem no. 6. i.e.adding another *y*-coordinates with same *x*-coordinate values as given in problem 6.

```
-->x = linspace(-5.5,5.5,51);
-->y = 1 ./(1+x.^2);
-->plot(x,y,'ro-');
-->plot(x,y.^2,'bs:');
-->plot(x,y,'ro-');
-->plot(x,y.^2,'bs:');
-->xlabel(["x axis"])
-->ylabel(["y axis"])
-->legend(["Functions #1";"Functions #2"]);
```



8. Creating subplot with real and imaginary part functions

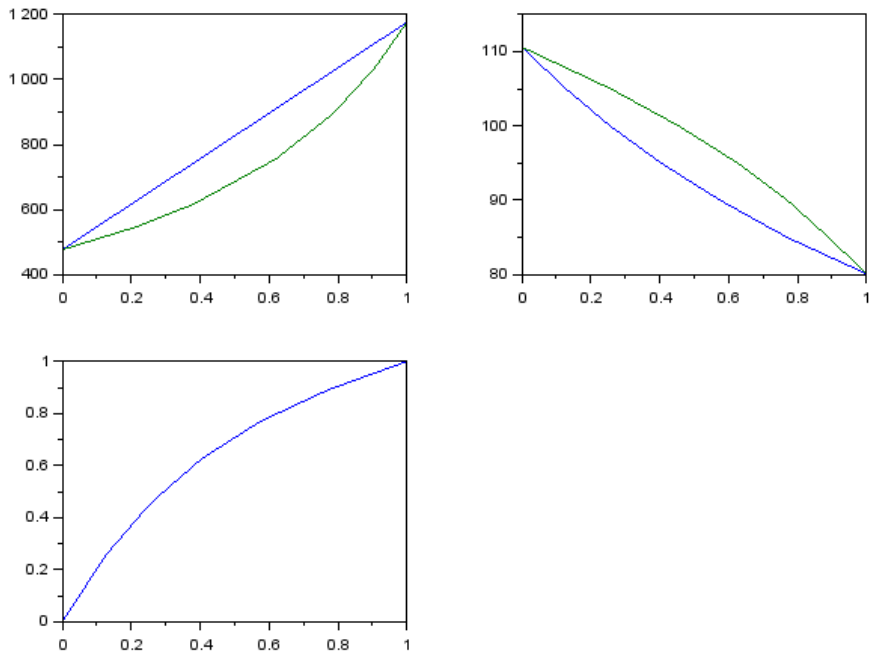
```
-->t = linspace(0,1,101);

-->y1 = exp(%i*t);

-->y2 = exp(%i*t.^2);

-->plot(t,real(y1),'r');

-->plot(t,real(y2),'b');

-->xtitle("Real part");

-->xlabel('t')

-->ylabel('y')

-->subplot(2,1,2);

-->plot(t,imag(y1),'r');

-->plot(t,imag(y2),'b');

-->xtitle("Image part");

-->xlabel('t')

-->ylabel('y')
```



9. Application of subplot in SCILAB in plotting composition (x) vs. pressure (p), composition (y) vs. temperature and composition of components 1(y_1) vs. 2(y_2) in vapor phase

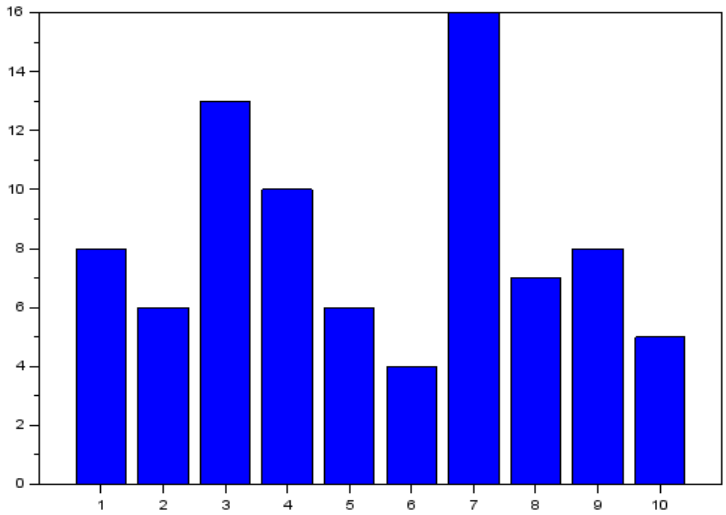
```
-->x(:,1)=[0 0.1 0.2 0.4 0.6 0.8 1]';

-->x(:,2)=[0 0.215 0.381 0.621 0.787 0.907 1]';

-->p=[477 546.9 616.8 756.6 896.5 1036.3 1176.2]';

-->t=[80.1 85 90 95 100 105 110.6]';

-->y(:,1)=[1 0.77 0.575 0.404 0.256 0.127 0]';

-->y(:,2)=[1 0.89 0.77 0.626 0.455 0.257 0]';
-->clf();

-->subplot(221);

-->plot(x,p);

-->subplot(222);

-->plot(y,t);

-->subplot(223);
```

```
-->plot(y(:,1),y(:,2))
```



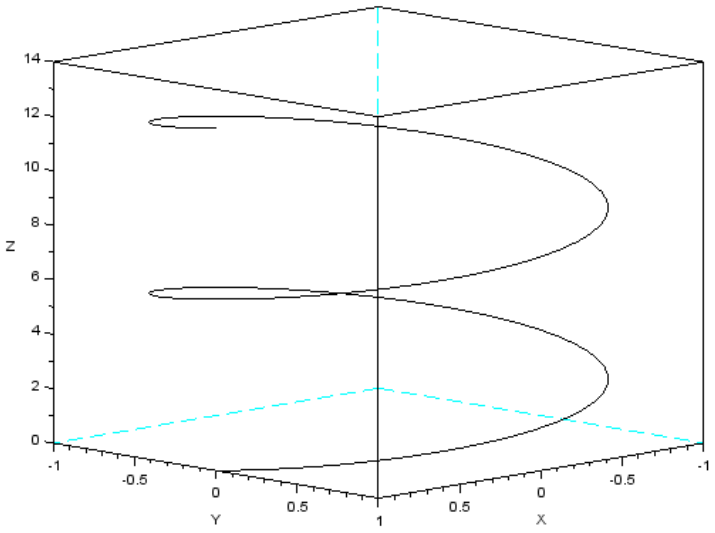
10. Try the bar chart for the following case using the built-in function `bar`

```
-->x=[1:10];

-->n=[8,6,13,10,6,4,16,7,8,5];

-->bar(x,n)
```



11. Try the following helix defined by $x = \cos t$, $y = \sin t$, $z = t$; use `linspace` and `param3d` built-in functions to show the 3D plot.

```
-->t=linspace(0,4*%pi,100);

-->param3d(cos(t),sin(t),t);
```



12. Construct a tabular column for all the built–in functions and their significance used in plotting 2D and 3D plots in SCILAB.

S. No.	Built-in Function	Significance
1.	`plot`	Used to plot 2D graphs
2.	`plot2d`	
3.	`histplot`	Used to plot a histogram
4.	`polarplot`	Used to plot polar coordinates
5.	`Matplot`	Used to create a 2D plot of a matrix using colors
6.	`champ`	Used to create a 2D vector field plot
7.	`comet`	Used to plot a 2D comet animated plot

8.	`paramfplot2d`	Used to create an animated plot of a 2D parameterized curve
9.	`fplot2d`	2D plot of a curve defined by a function
10.	`plot3d`	Used to create a 3D plot of a surface
11.	`hist3d`	Used to plot a 3D representation of a histogram
12.	`comet3d`	Used to plot a 3D comet animated plot
13.	`contour`	Used to plot level curves on a 3D surface
14.	`mesh`	Used to plot a 3D mesh plot
15.	`param3d`	Used to create a 3D plot of a parameterized curve
16.	`surf`	Used to create 3D surface plot
17.	`replot`	Used to redraw with new boundaries the current or a given set of axes
18.	`subplot`	Used to divide a graphics window into a matrix of sub-windows
19.	`xgrid`	Used to add a grid on a 2D or 3D plot
20.	`title`	Used to display the title for graphs
21.	`legend`	Used to draw the legend for graphs
22.	`captions`	Used to draw graph captions
23.	`xlabel`	Used to set the x-axis label
24.	`ylabel`	Used to set the y-axis label
25.	`zlabel`	Used to set the z-axis label

Result

Thus we learned the simple 2-Dimensional x-*y* and 3-Dimensional (*x*, *y*, *z*) graphs using SCILAB.