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Plotting with MATLAB

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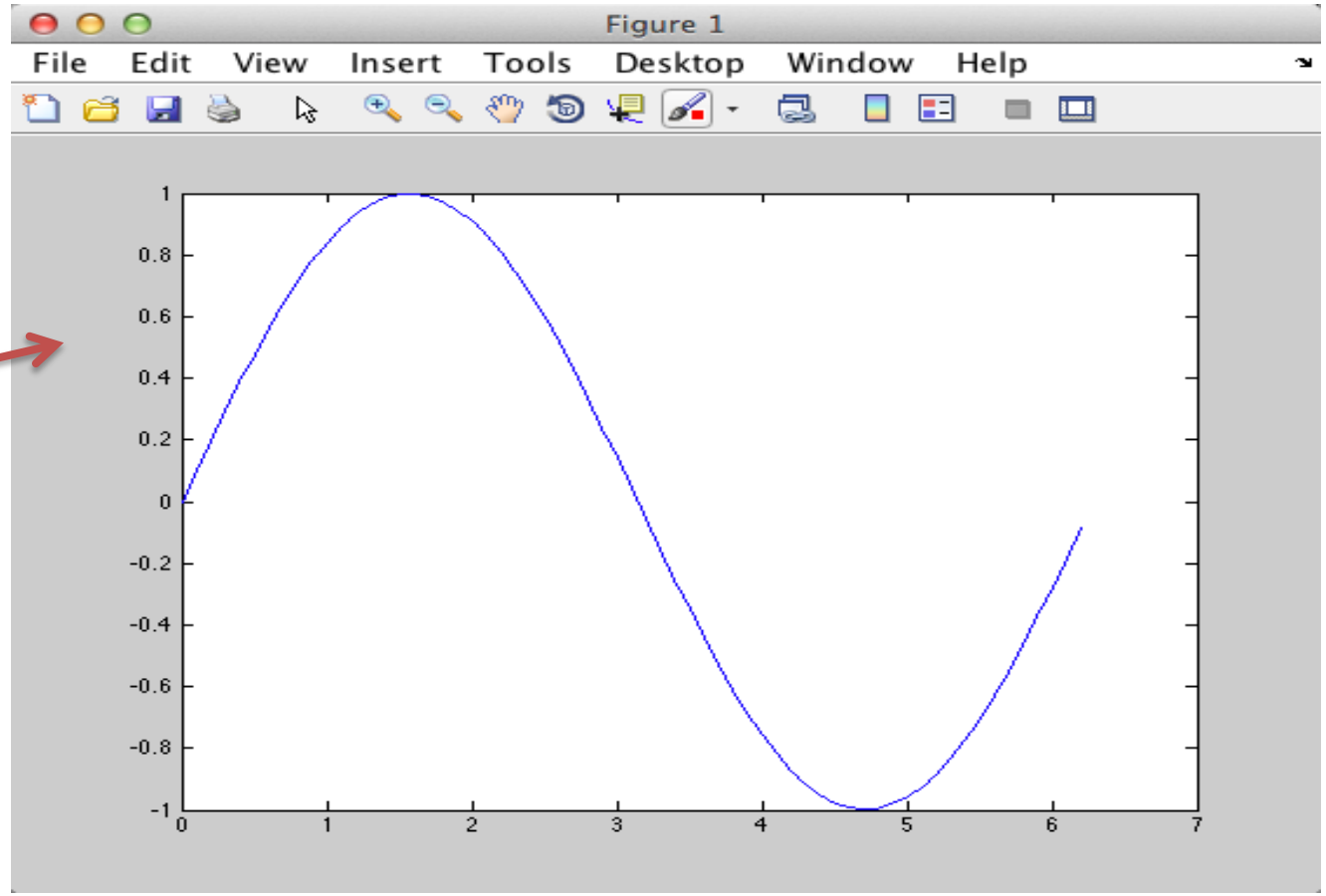
Plotting

MATLAB has powerful Plotting features

```
>> x = 0:0.1:2*pi;
>> y = sin(x);
>> plot(x,y)
```




```
>> x = 0:0.1:2*pi;
>> y = sin(x);
>> y2 = cos(x);
>> plot(x,y, x,y2)
```

```
...
>> plot(x,y,'r*', x,y2,'g+')
```

Plotting

Plotting functions:

Name	Description
plot	Create a Plot
figure	Define a new Figure/Plot window
grid on/off	Create Grid lines in a plot
title	Add Title to current plot
xlabel	Add a Label on the x-axis
ylabel	Add a Label on the x-axis
axis	Set xmin,xmax,ymin,ymax
hold on/off	Add several plots in the same Figure
legend	Create a legend in the corner (or at a specified position) of the plot
subplot	Divide a Figure into several Subplots

```
>> x=0:0.1:2*pi;
>> y=sin(x);
>> plot(x,y)
>> title('Plot Example')
>> xlabel('x')
>> ylabel('y=sin(x)')
>> grid on
>> axis([0,2*pi,-1,1])
>> legend('Temperature')
```

Plotting

Given the following Rain Data for a given Week (Monday to Sunday):

Day	Rain Amount
Monday	2,1 mm
Tuesday	10 mm
Wednesday	9,7 mm
Thursday	6,2 mm
Friday	2,5 mm
Saturday	0 mm
Sunday	8,3 mm

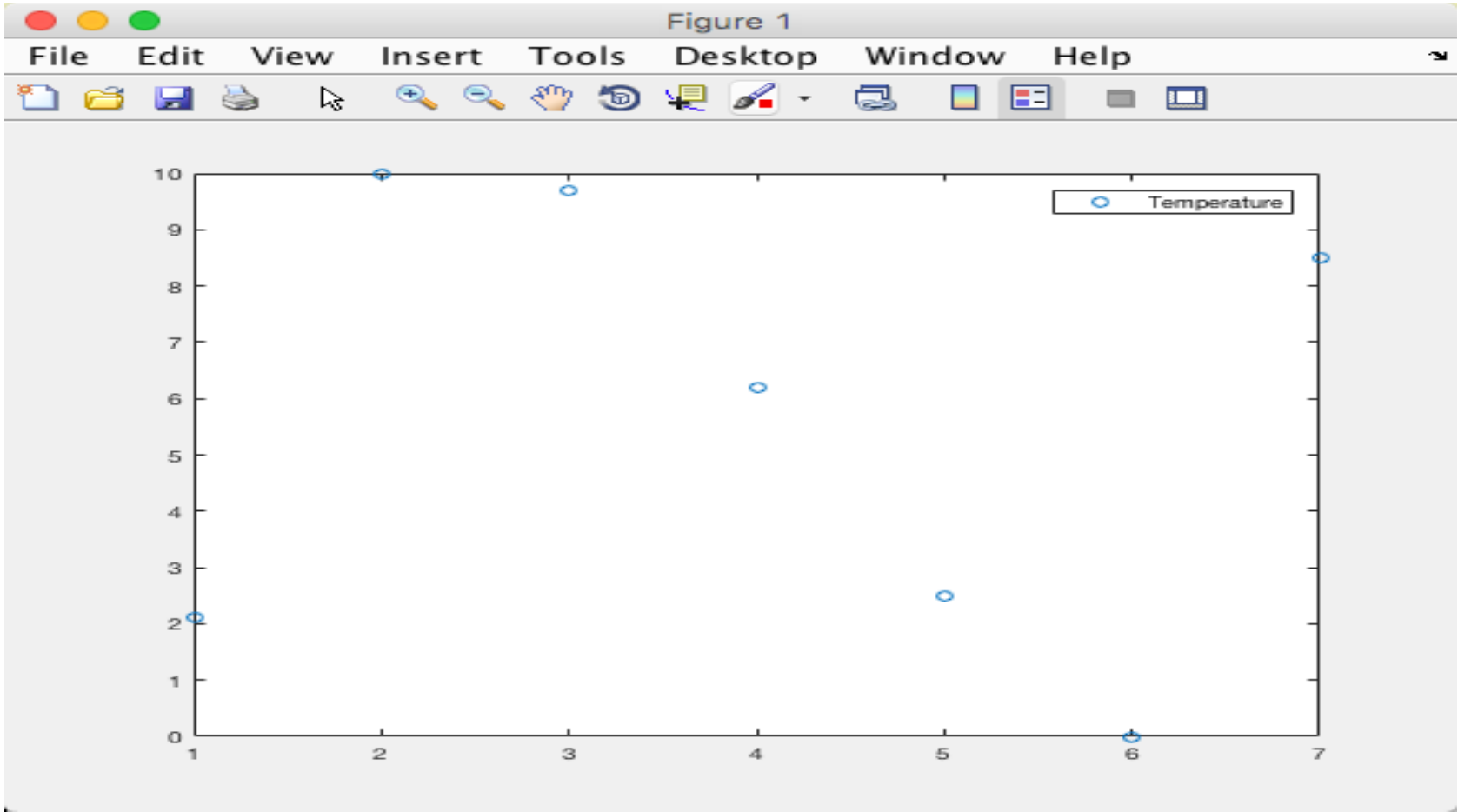
We want to plot these values

Solution

Plotting

Day	Rain Amount
Monday	2,1 mm
Tuesday	10 mm
Wednesday	9,7 mm
Thursday	6,2 mm
Friday	2,5 mm
Saturday	0 mm
Sunday	8,3 mm

```
x = [2.1, 10, 9.7, 6.2, 2.5, 0, 8.5]
>> plot(x, 'o')
```



Plotting

Given the following function ($-10 \leq x \leq 10$):

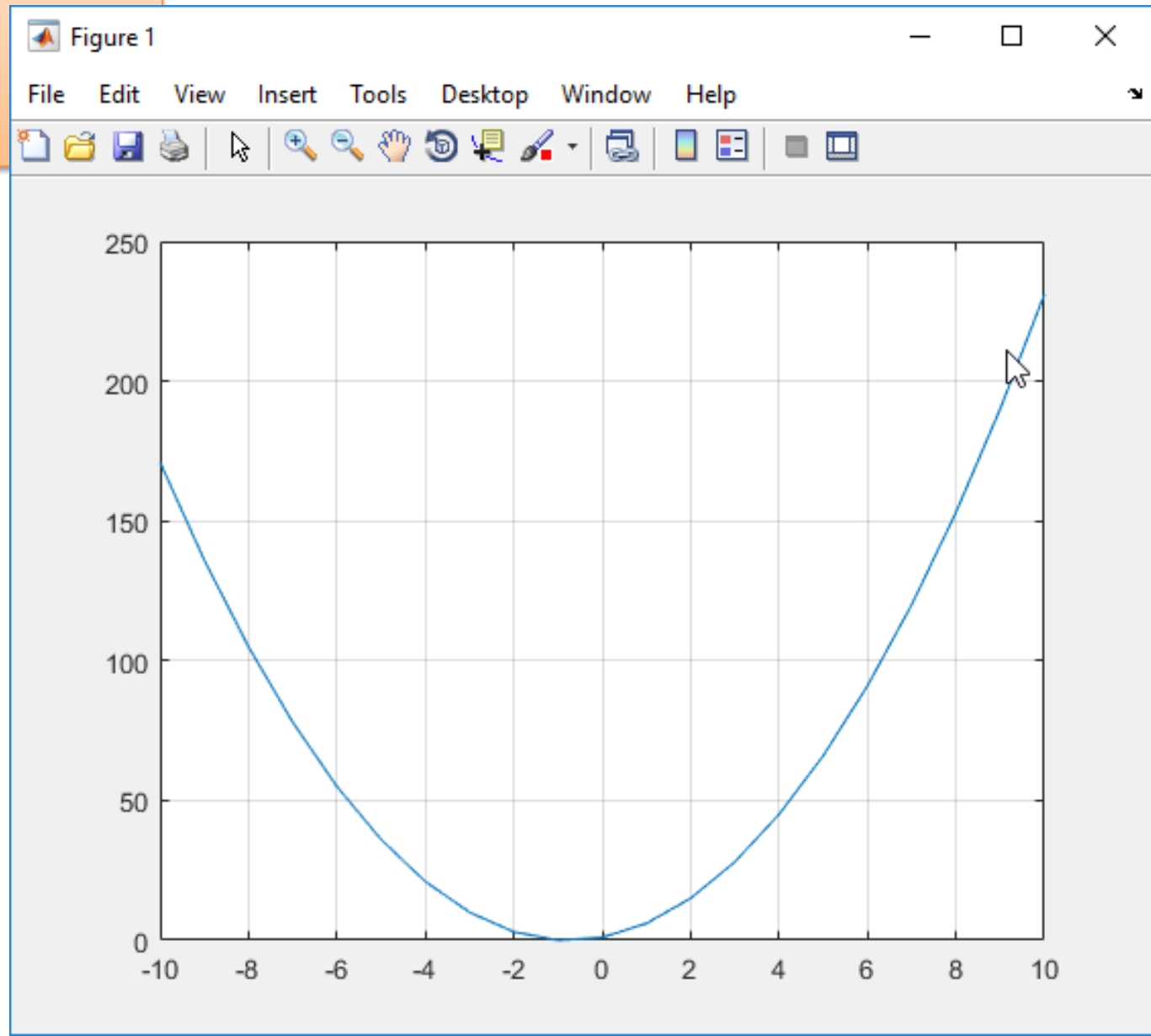
$$f(x) = 2x^2 + 3x + 1$$

We will:

- Plot this function

- Use the Plot to find out:
  - For which value of x is $f(x) = 0$?
  - What is $f(5) =$?

```
>> x = -10:10;
>> f = 2*x.^2 + 3*x + 1;
>> plot(x,f)
>> grid on
```



Variables - x

x

1x21 double

	8	9	10	11	12	13	14	15	16	17	18	19
1	-3	-2	-1	0	1	2	3	4	5	6	7	
2												
3												
4												
5												
6												
7												

Command Window

```
>> f(16)

ans =

    66
```

$f(5) = ?$

$f(5) = ?$

```
x = 5;

>> f=2*x.^2 + 3*x + 1

f =

    66
```

Plot of Dynamic System

Given the autonomous system (differential equation):

$$\dot{x} = ax$$

where $a = -\frac{1}{T}$,where T is the time constant

The solution for the differential equation is:

$$x(t) = e^{at}x_0$$

Set $T = 5$ and the initial condition $x(0) = 1$

→ Create a Script in MATLAB (.m file) where you plot the solution $x(t)$ in the time interval $0 \leq t \leq 25$

→ Add Grid, and proper Title and Axis Labels to the plot.

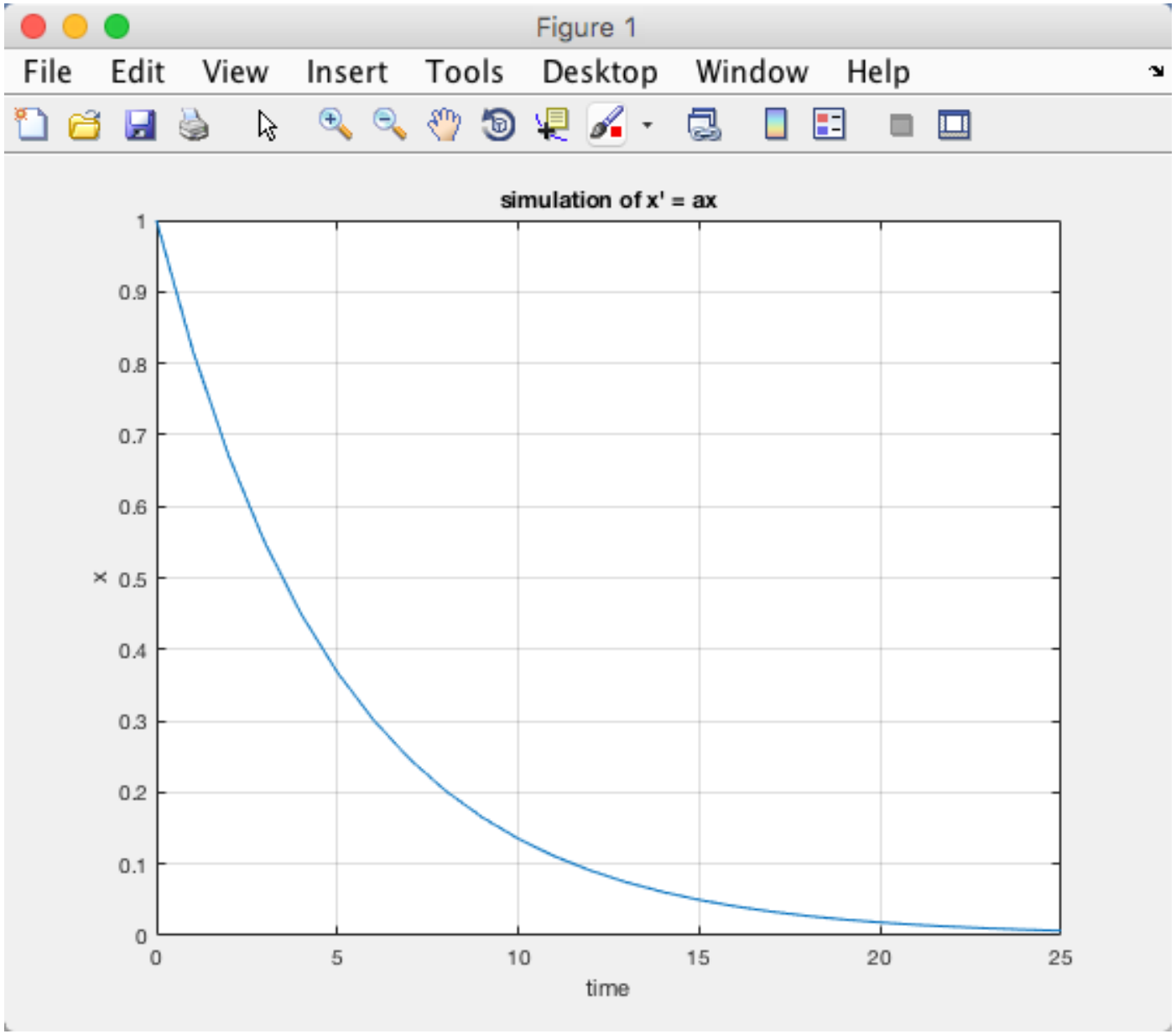
```
clear, clc

%Define Variabes
T=5;
a=-1/T;

%Start Condition, etc
x0=1;
t=[0:1:25]

%Define the function
x=exp(a*t)*x0;

%Plotting
plot(t,x);
grid
title('simulation of x'' = ax')
xlabel('time')
ylabel('x')
```



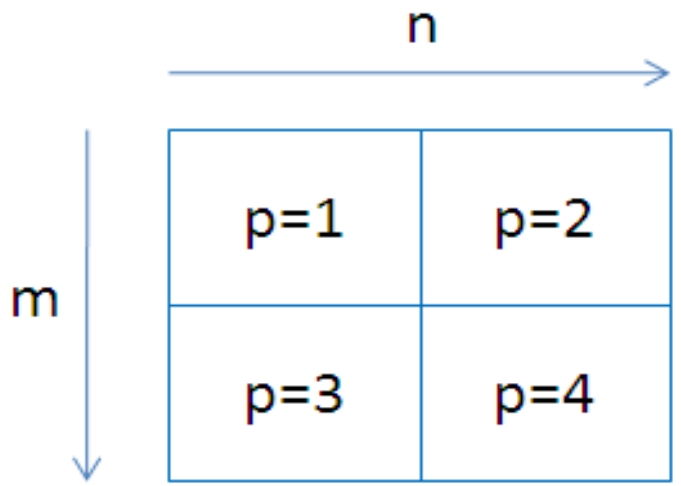
Sub-plots

Displaying Multiple Plots in one Figure – Sub-Plots

We will in this example:

- Plot Sin(x) and Cos(x) in 2 different subplots.
- Add Titles and Labels.

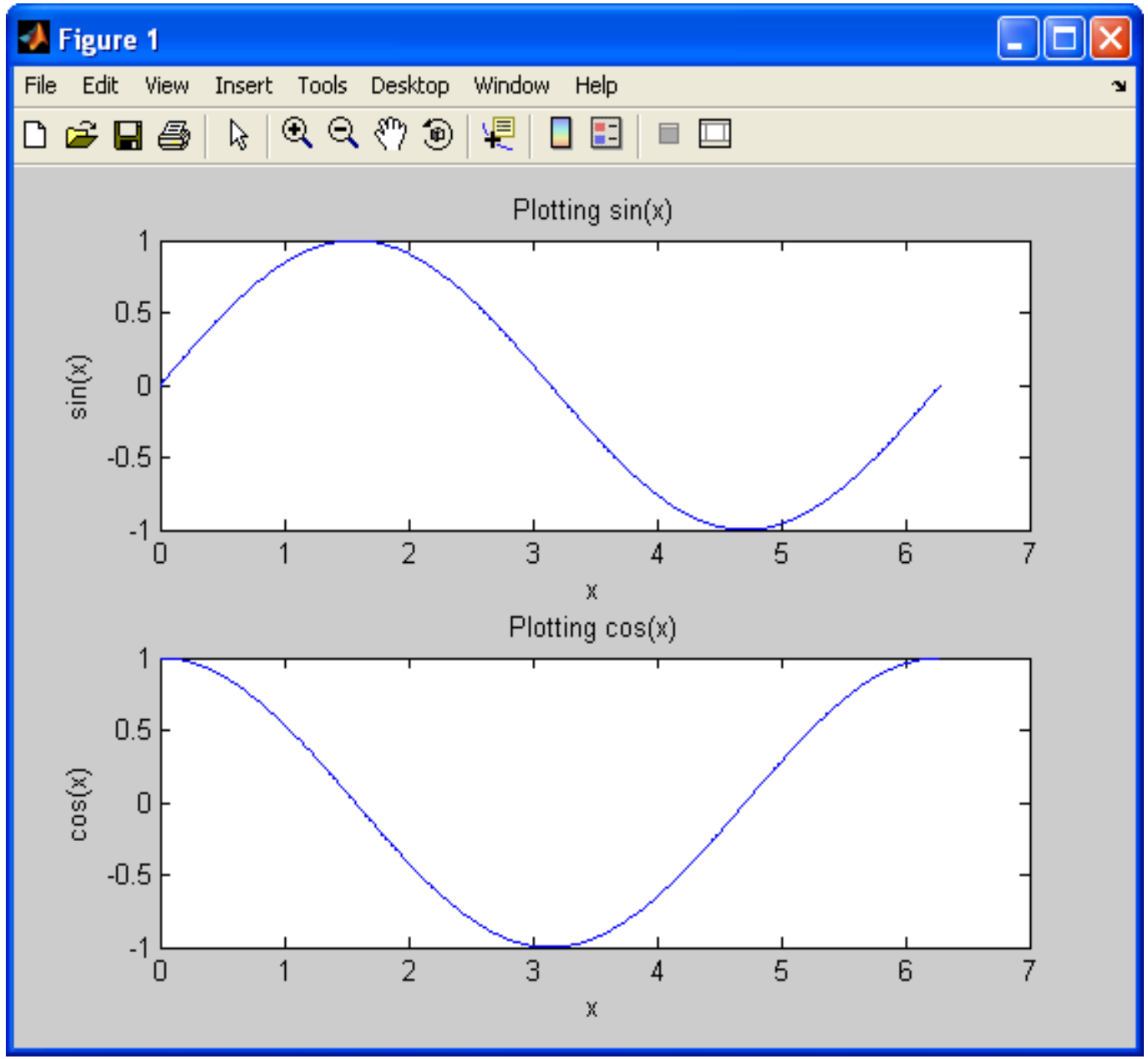
```
subplot(m,n,p)
```



```
% Define x-values
x=0:0.01:2*pi;

% subplot 1
subplot(2,1,1)
plot(x, sin(x))
title('Plotting sin(x)')
xlabel('x')
ylabel('sin(x)')

% Subplot 2
subplot(2,1,2)
plot(x, cos(x))
title('Plotting cos(x)')
xlabel('x')
ylabel('cos(x)')
```

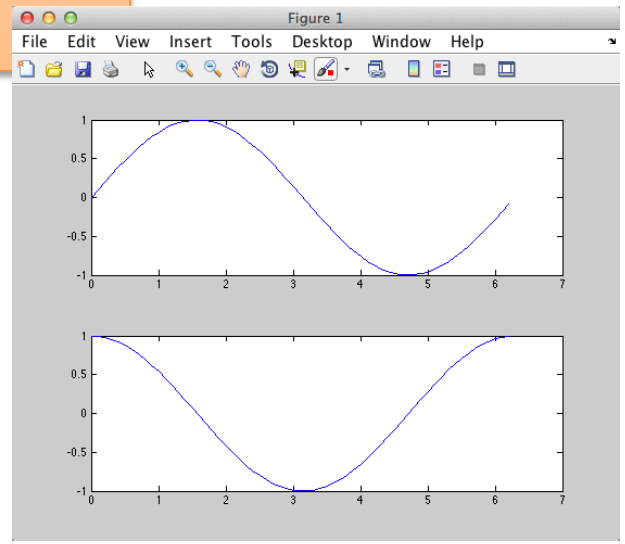


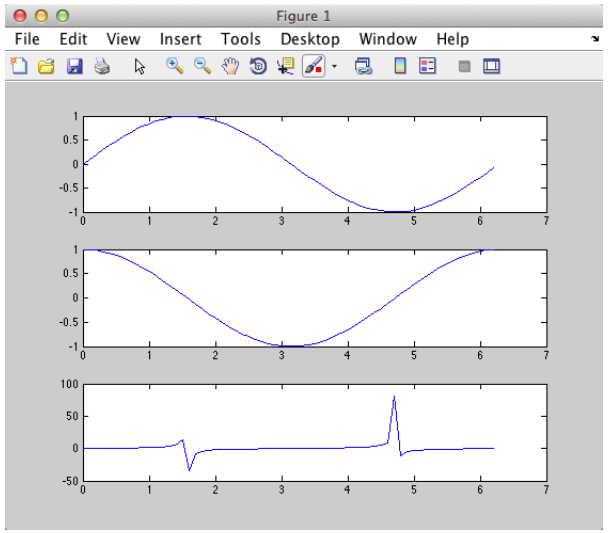
Plotting - Subplot

```
>> x=0:0.1:2*pi;
>> y=sin(x);
>> y2=cos(x);

>> subplot(2,1,1)
>> plot(x,y)

>> subplot(2,1,2)
>> plot(x,y2)
```



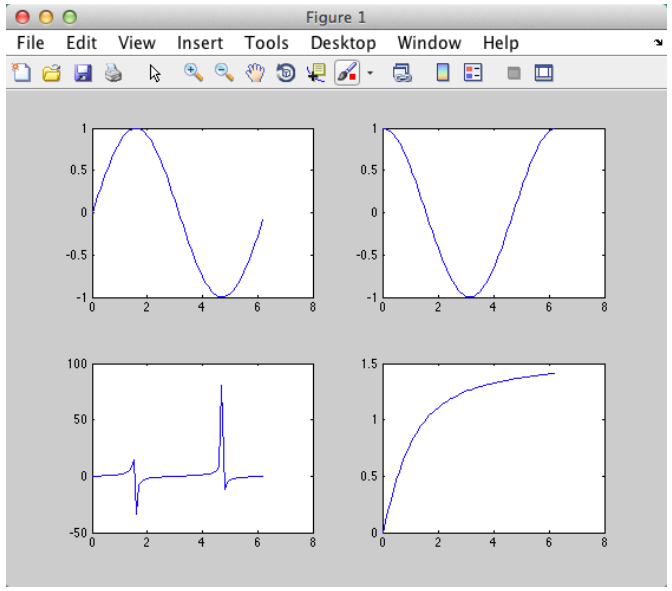



```
>> x=0:0.1:2*pi;
>> y=sin(x);
>> y2=cos(x);
>> y3=tan(x);

>> subplot(3,1,1)
>> plot(x,y)

>> subplot(3,1,2)
>> plot(x,y2)

>> subplot(3,1,3)
>> plot(x,y3)
```




```
>> x=0:0.1:2*pi;
>> y=sin(x);
>> y2=cos(x);
>> y3=tan(x);
>> y4=atan(x);

>> subplot(2,2,1)
>> plot(x,y)

>> subplot(2,2,2)
>> plot(x,y2)

>> subplot(2,2,3)
>> plot(x,y3)

>> subplot(2,2,4)
>> plot(x,y4)
```

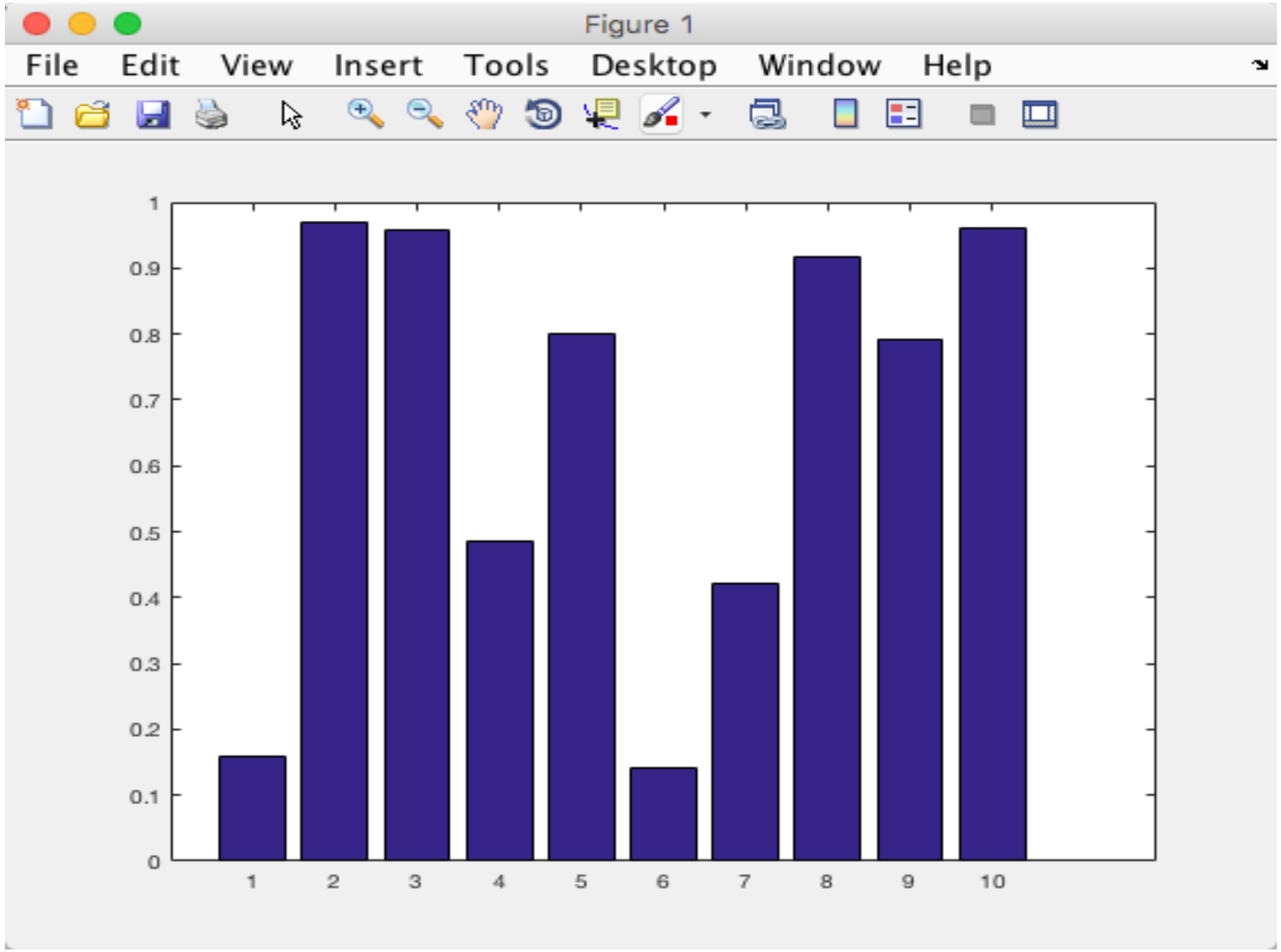
Other Plots

- MATLAB offers many different types of plots: loglog, semilogx, semilogy, plotyy, polar, fplot, fill, area, bar, barh, hist, pie, errorbar, scatter.
- We will try some of them, e.g., bar, hist and pie.

Check out the help for the different plot functions in MATLAB

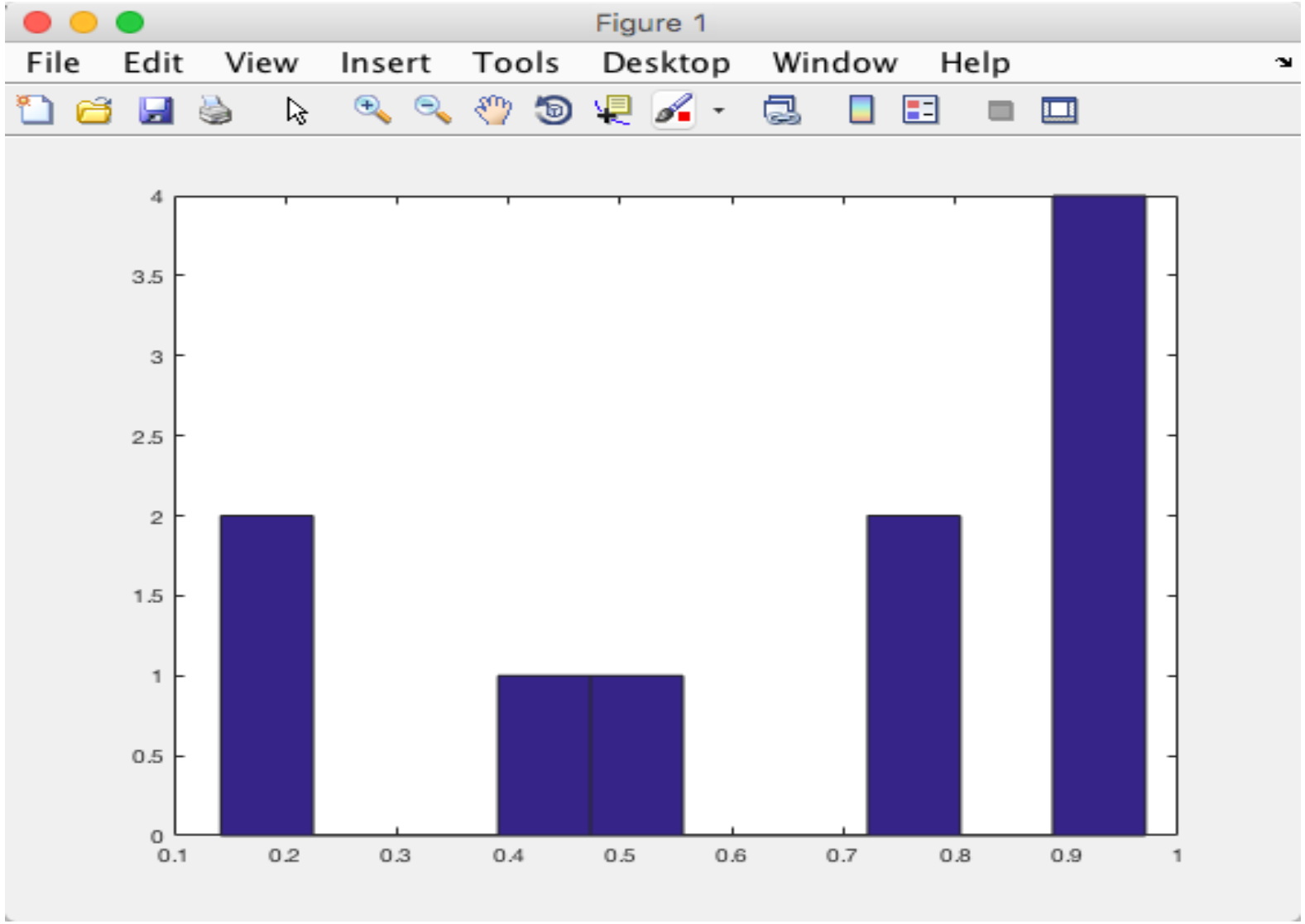
We create a bar plot using the **bar** function:

```
>> x=rand(10,1)
x =
    0.6557
    0.0357
    0.8491
    0.9340
    0.6787
    0.7577
    0.7431
    0.3922
    0.6555
    0.1712
>> bar(x)
```



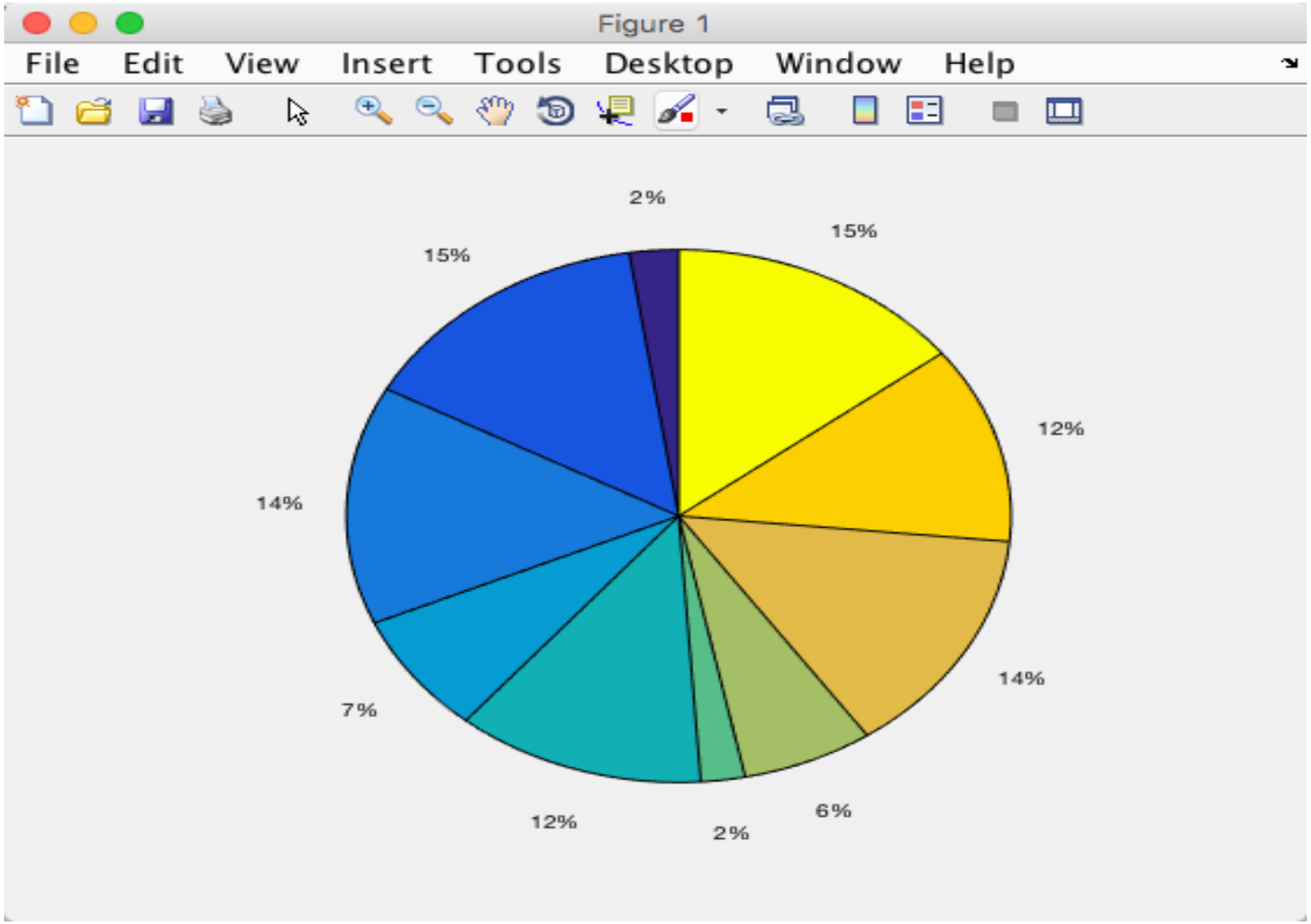
Using the **hist** function gives:

```
>> x=rand(10,1)
x =
    0.6557
    0.0357
    0.8491
    0.9340
    0.6787
    0.7577
    0.7431
    0.3922
    0.6555
    0.1712
>> hist(x)
```



Using the **pie** function gives:

```
>> x=rand(10,1)
x =
    0.6557
    0.0357
    0.8491
    0.9340
    0.6787
    0.7577
    0.7431
    0.3922
    0.6555
    0.1712
>> pie(x)
```



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