ENSC 180: Introduction to Engineering Analysis

Assignment 1(Solution)

1. Answers ()

```
>> Wildscard = 1

Wildscard =

     1

>> WILDCARD = 1

WILDCARD =

     1

>> *Wildcard
 *Wildcard
 ↑
Error: Unexpected MATLAB operator.

>> 2Wildcard
 2Wildcard
  ↑
Error: Unexpected MATLAB expression.

Did you mean:
>> Wild_card = 1

Wild_card =

     1
```

```
>> Wildscard!! = 1
 Wildscard!! = 1
          ↑
Error: Unexpected MATLAB operator.

>> wild_card = 1

wild_card =

     1
```

2. Consider the arrays, x= <1 2 3 4 5> and y = <7 8 9>. Build matrices C in MATLAB using x and y such that C is 5x5, 5x2, 2x5, 3x3, 3x1, 2x8 and 7x6 (14 marks).

   Ans: 5x5

```
>> x=[1 2 3 4 5]; y=[7 8 9];
>> C=[x;x;x;x;x]

C =

     1     2     3     4     5
     1     2     3     4     5
     1     2     3     4     5
     1     2     3     4     5
     1     2     3     4     5
```

   Ans: 5x2

```
>> C=[x' x']

C =

     1     1
     2     2
     3     3
     4     4
     5     5
```

   Ans: 2x5

```
>> C=[x; x]

C =

     1     2     3     4     5
     1     2     3     4     5
```

   Ans: 3x3

```
>> C=[y; y;y]

C =

     7     8     9
     7     8     9
     7     8     9
```

   Ans: 3x1

```
>> C = y'

C =

     7
     8
     9
```

Ans: 2x8

```
>> C = [x y;x y]

C =

     1     2     3     4     5     7     8     9
     1     2     3     4     5     7     8     9
```

Ans: 7x6

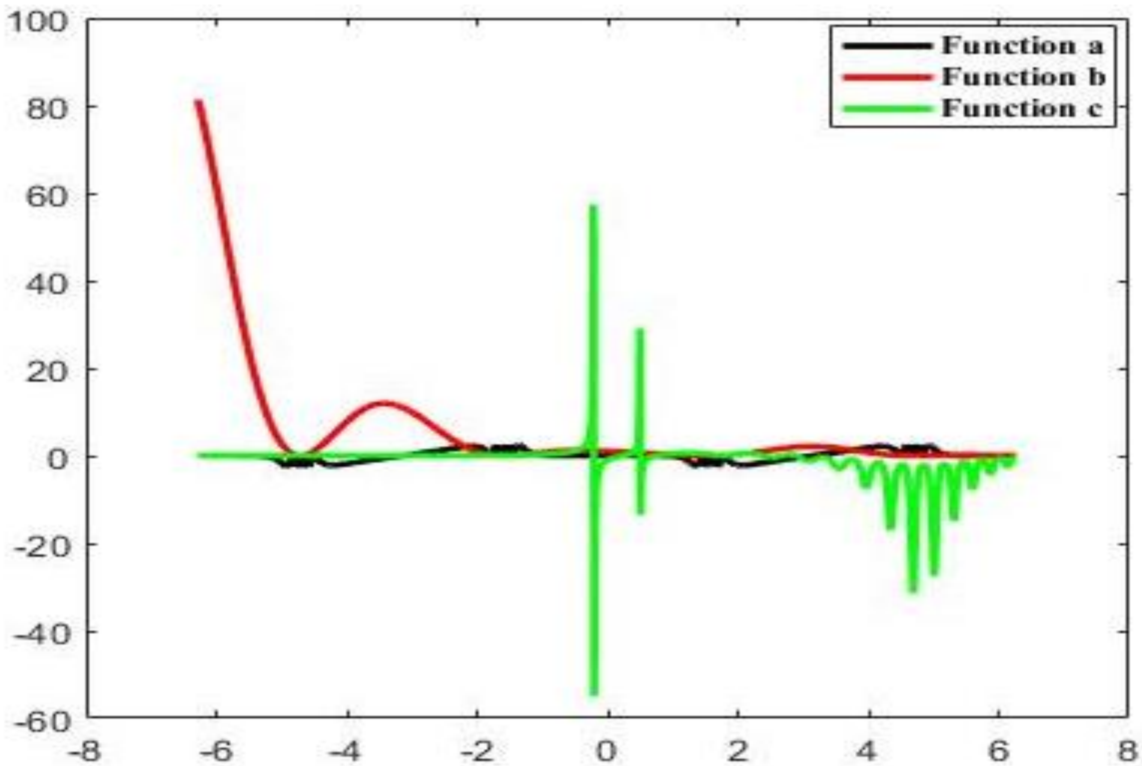
```
>> C = [y y;y y;y y;y y;y y;y y;y y]

C =

     7     8     9     7     8     9
     7     8     9     7     8     9
     7     8     9     7     8     9
     7     8     9     7     8     9
     7     8     9     7     8     9
     7     8     9     7     8     9
     7     8     9     7     8     9
```

3. rite MATALAB statements to evaluate the following functions (16 marks).
    a) $\sin(\tan(x)) - \tan(\sin(x))$
    b) $e^{-0.7x} + (1\text{-}\cos(x))/(1.0+\tan^2(x))$
    c) $(1+x/(x-0.5))/(1+(3.1xe^{-x}+2)/(\sin(x)-\cos^2(x^2)))$
    d) $3.0^{0.25}+\ln(2.1^{3.7}) + \tan^{-1}(0.63)$

```
>> x=pi;
>> sin(tan(x))-tan(sin(x))

ans =

  -2.4493e-16

>> (exp(-0.7*x)+(1-cos(x)))/(1.0+tan(x)^2)

ans =

    2.1109

>> (1+x/(x-0.5))/(1+(3.1*x*exp(-x)+2)/(sin(x)-cos(x^2)^2))

ans =

   -1.1108

>> 3.0^0.25+log(2.1^3.7)+atan(0.63)

ans =

    4.6234
```

4. Plot the functions in 3a, 3b and 3c using MATLAB over the range $-2\pi < x < 2\pi$ (12 marks).

```
>> x=-2*pi:0.01:2*pi;
>> func1=sin(tan(x))-tan(sin(x));
>> func2=(exp(-0.7*x)+(1-cos(x)))./(1.0+tan(x).^2);
>> func3=(1+x./(x-0.5))./(1+(3.1*x.*exp(-x)+2)./(sin(x)-cos(x.^2).^2));
>> plot(x,func1,x,func2,x,func3)
```



5. Consider the array [3.1 5.8 6.2 2.1 7.0 5.0 8.2 4.6]. Using MATLAB, find the size, minimum and maximum values, mean and median values, the standard deviation of this array and sort it starting from the minimum value (14 marks).

Code:

```
arrRealNum = [ 3.1 5.8 6.2 2.1 7.0 5.0 8.2 4.6]
disp('Array Siz :');
disp(size(arrRealNum));
disp('Minimum Value in the Array:');
disp(min(arrRealNum));
disp('Maximum Value in the Array:');
disp(max(arrRealNum));
disp('Mean Value in the Array:');
disp(mean(arrRealNum));
disp('Median Value in the Array:');
disp(median(arrRealNum));
disp('Standard deviation of the Array:');
disp(std(arrRealNum));
disp('Sorting the Array in decesding order:');
disp(sort(arrRealNum));
```

Output:

```
Array Siz :
     1     8

Minimum Value in the Array:
    2.1000

Maximum Value in the Array:
    8.2000

Mean Value in the Array:
    5.2500

Median Value in the Array:
    5.4000

Standard deviation of the Array:
    2.0000

Sorting the Array in decesding order:
    2.1000    3.1000    4.6000    5.0000    5.8000    6.2000    7.0000    8.2000
```

6. Solve Question 2.26 in the textbook (30) marks.

2.26 It has been suggested that the population of the United States may be modeled by the formula

$$P(t) = \frac{19\,72\,73\,000}{1 + e^{-0.03134(t-1913.25)}}$$

where t is the date in years. Write a program to compute and display the population every ten years from 1790 to 2000. Try to plot a graph of the population against time as well (Figure 9.16 shows this graph compared with actual data). Use your program to find out if the population ever reaches a "steady state" (i.e., stops changing).

```
Solution:
t = 1790: 10: 2000; % date T in years
P = (1+exp(-0.03134 *(t-1913.25))).\ 197273000;
plot(t, P), title(' Model of the United states population ');
disp([t' P']) %display a table
```

```
>> t = 1790: 10: 2000; % date T in years
P = (1+exp(-0.03134 *(t-1913.25))).\ 197273000;
plot(t, P), title(' Model of the United states population ');
disp([t' P']) %display a table
   1.0e+08 *

    0.0000    0.0406
    0.0000    0.0551
    0.0000    0.0746
    0.0000    0.1007
    0.0000    0.1352
    0.0000    0.1805
    0.0000    0.2389
    0.0000    0.3128
    0.0000    0.4044
    0.0000    0.5144
    0.0000    0.6421
    0.0000    0.7845
    0.0000    0.9362
    0.0000    1.0903
    0.0000    1.2395
    0.0000    1.3772
    0.0000    1.4989
    0.0000    1.6025
    0.0000    1.6877
    0.0000    1.7560
    0.0000    1.8095
    0.0000    1.8507
```