Date: 22-11-2021

Experiment 9

Aim: To work with input/output functions in MATLAB.

Apparatus: MATLAB Software

Objective: To learn about MATLAB's input/output capabilities.

Problems:

Q-1 The acceleration due to the Earth's gravity at any height h above the surface of the Earth is given by the equation

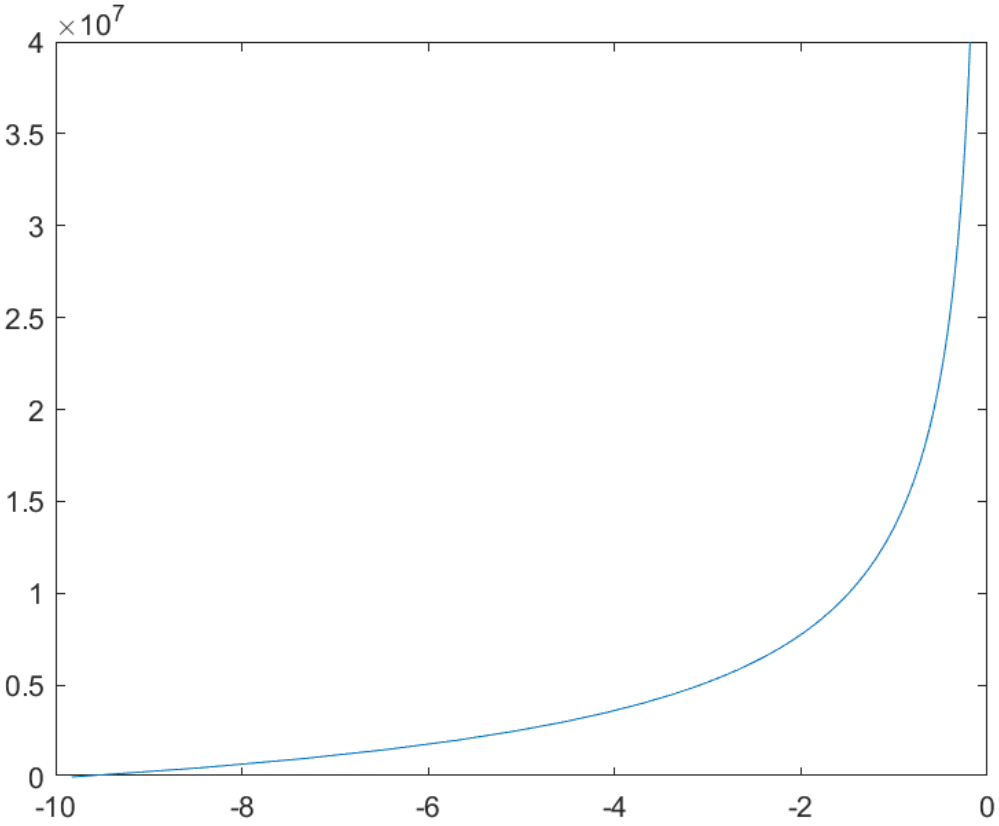
$$g = -G\frac{M}{(R+h)^2}$$

where G is the gravitational constant (6.672×10^{-11} N m^2 / kg^2), M is the mass of the earth (5.98×10^{24} kg), R is the mean radius of the Earth (6371 km), and h is the height above the Earth's surface. If M is measured in kg and R and h in meters, then the resulting acceleration will be in units of meters per second squared. Write a program to calculate the acceleration due to the Earth's gravity in 500 km increments at heights from 0 km to 40,000 km above the surface of the Earth. Print out the results in a table of height versus acceleration with appropriate labels, including the units of the output values. Plot the data as well.

Code:

```
clc;
clear all;
close all;

G=6.672e-11;
M=5.98e24;
R=6.371e6;
h=0:5e5:4e7;
g=-G.*M./(R+h).^2;

fprintf('Height\tGrav. Acc.\n');

for ii=1:length(g)
    fprintf('%5d\t%5d\n', h(ii), g(ii));
end

plot(g,h)
```

Output:



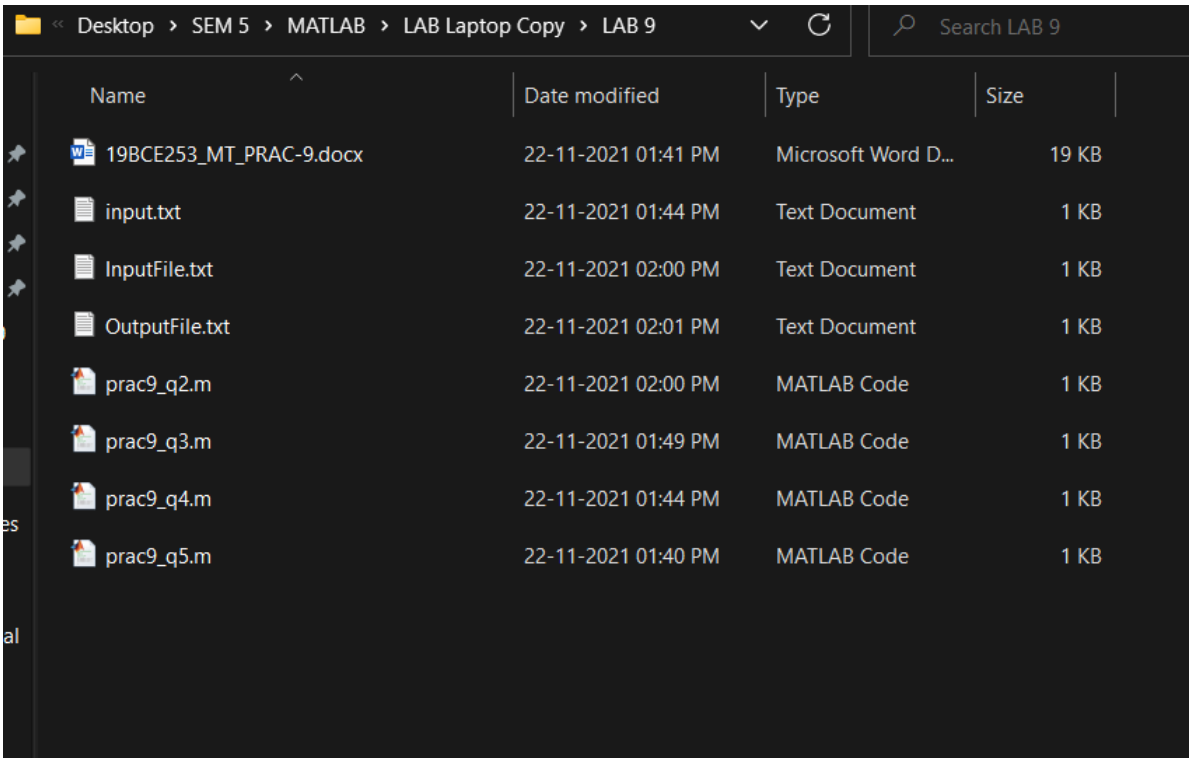
Q-2. Write a program that reads an arbitrary number of real values from a user specified input data file, rounds the values to the nearest integer, and writes the integers out to a user-specified output file. Make sure that the input file exists, and if not, tell the user and ask for another input file. If the output file exists, ask the user whether or not to delete it. If not, prompt for a different output file name.

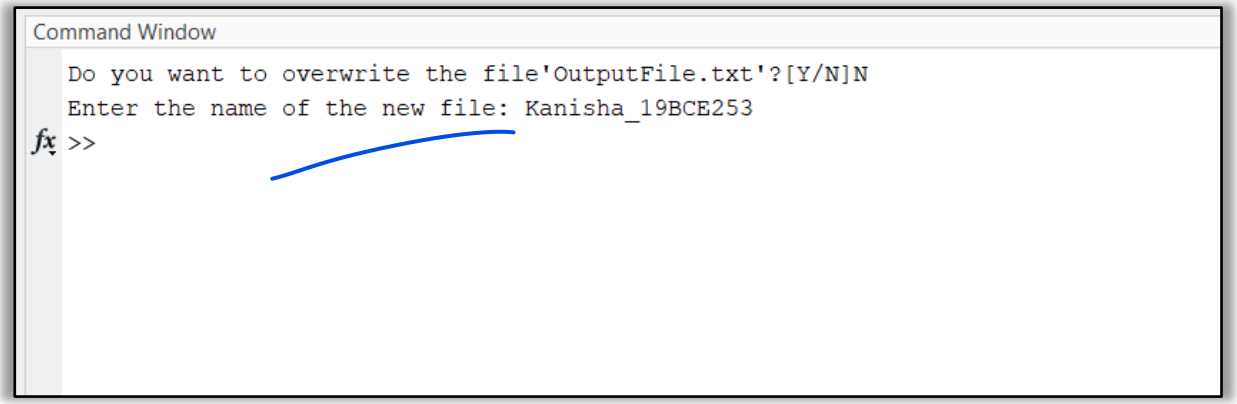
Code:

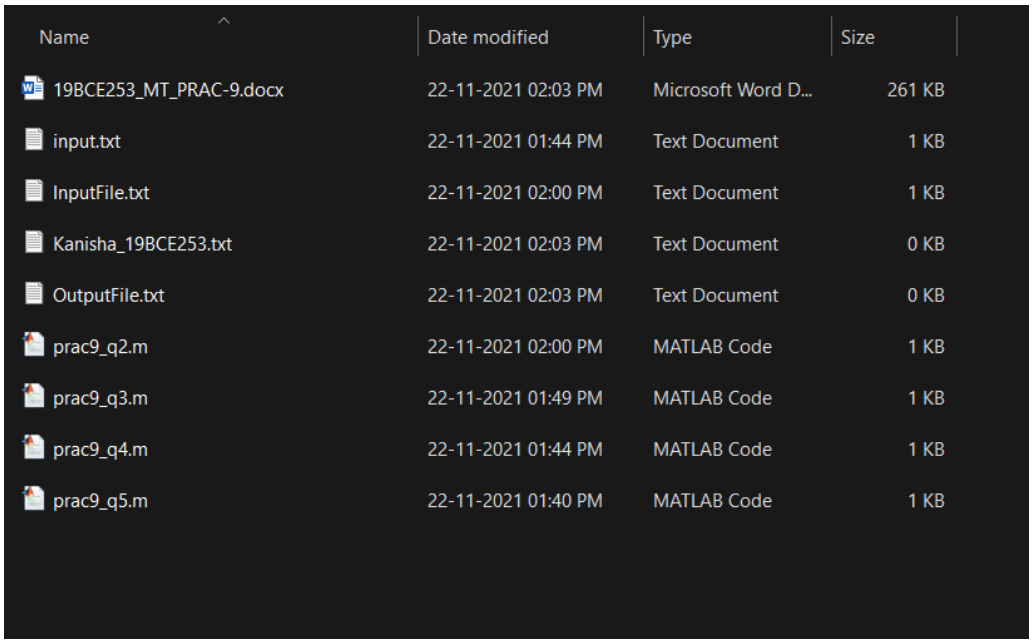
```
clc;
clear all;
close all;

if ~isfile('InputFile.txt')
 fprintf('File do not exist');
 quit
end

fileID=fopen('InputFile.txt', 'r');
A=fscanf(fileID, '%f');
fclose(fileID);
A;
A=round(A);
```

```
if isfile('OutputFile.txt')
 user=input("Do you want to overwrite the
file'OutputFile.txt'?[Y/N]", 's');
     if(user=='Y')
        file=fopen('OutputFile.txt', 'wt');
     else
         name=input("Enter the name of the new file: ",'s');
         file=fopen(strcat(name, '.txt'), 'wt');
     end
else
     file=fopen('OutputFile.txt', 'wt');
end

for ii=1:length(A)
 fprintf(file,'%d\n',A(ii));
end

fclose(file);
```

Output:







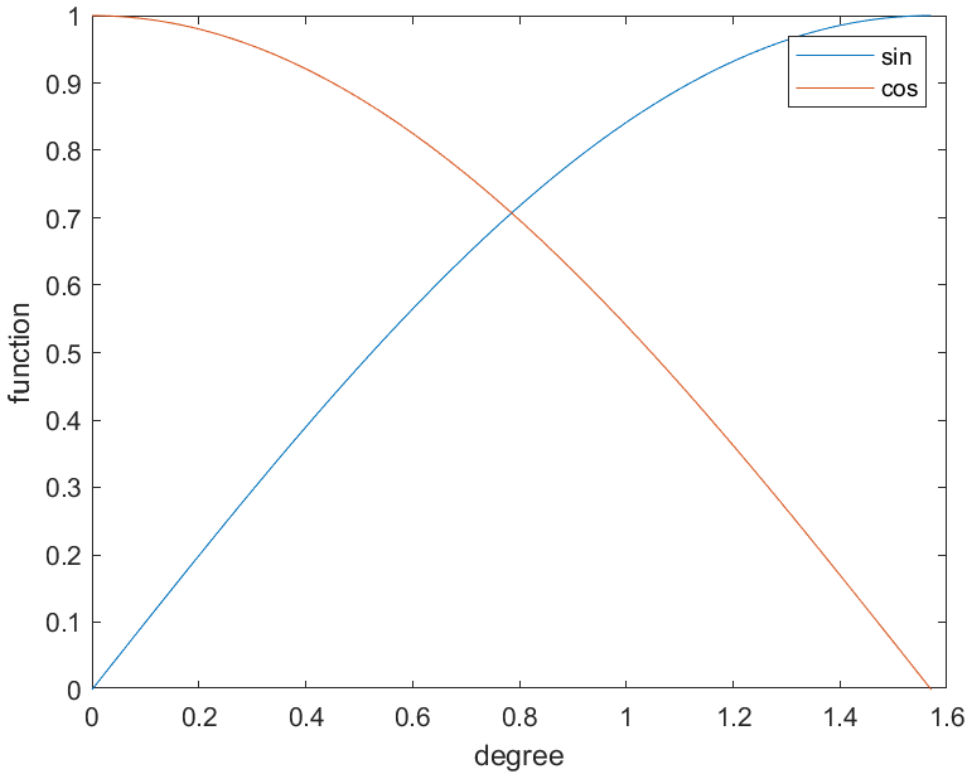
Name	Date modified	Type	Size
19BCE253_MT_PRAC-9.docx	22-11-2021 02:03 PM	Microsoft Word D...	261 KB
input.txt	22-11-2021 01:44 PM	Text Document	1 KB
InputFile.txt	22-11-2021 02:00 PM	Text Document	1 KB
Kanisha_19BCE253.txt	22-11-2021 02:03 PM	Text Document	0 KB
OutputFile.txt	22-11-2021 02:03 PM	Text Document	0 KB
prac9_q2.m	22-11-2021 02:00 PM	MATLAB Code	1 KB
prac9_q3.m	22-11-2021 01:49 PM	MATLAB Code	1 KB
prac9_q4.m	22-11-2021 01:44 PM	MATLAB Code	1 KB
prac9_q5.m	22-11-2021 01:40 PM	MATLAB Code	1 KB

Q-3. Write a program to generate a table containing the sine and cosine of for between 0° and 90°, in 1° increments. The program should properly label each of the column in the table.

Code:

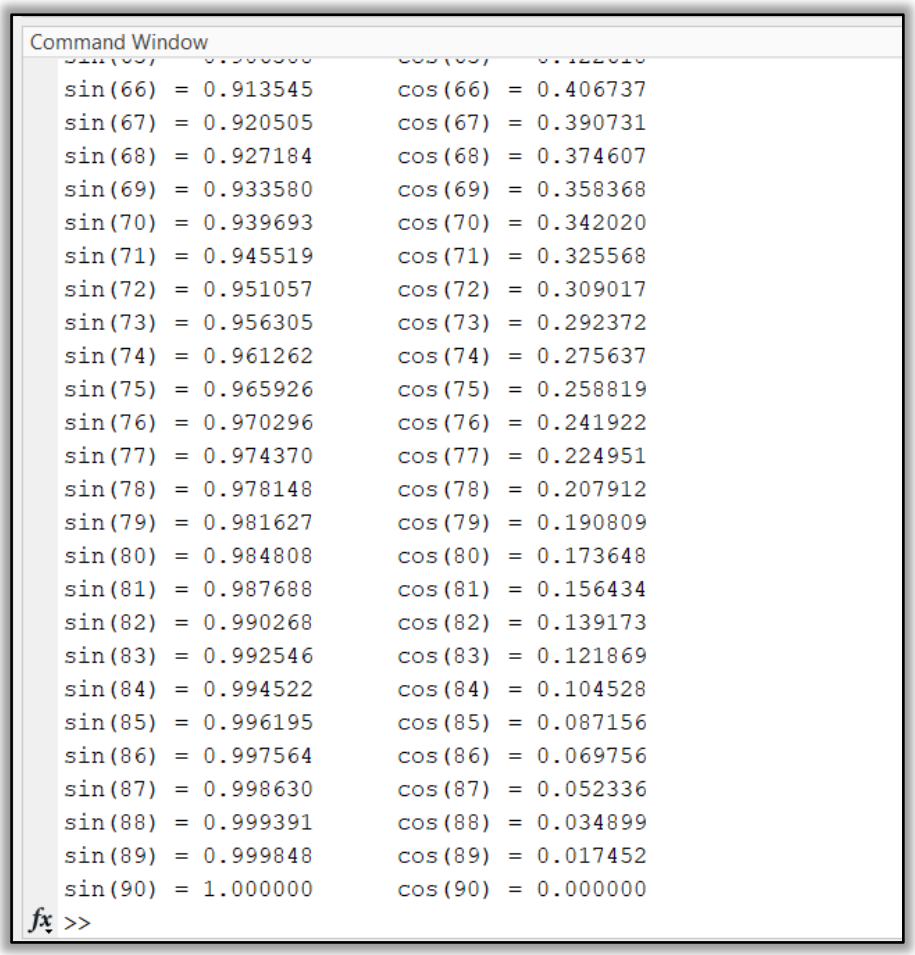
```
clc;
clear all;
close all;

degree=0:1:90;
degree=degree.*pi./180;

for ii=1:length(degree)
    fprintf('sin(%d) = %f\t\tcos(%d) = %f\n', ii-1,sin(degree(ii)),
ii-1, cos(degree(ii)));
end

figure(1)
plot(degree, sin(degree))
hold on

plot(degree, cos(degree))
legend('sin','cos')
xlabel('degree')
ylabel('function')
```

Output:



Command Window

```
sin(0) = 0.000000       cos(0) = 1.000000
sin(1) = 0.017452       cos(1) = 0.999848
sin(2) = 0.034899       cos(2) = 0.999391
sin(3) = 0.052336       cos(3) = 0.998630
sin(4) = 0.069756       cos(4) = 0.997564
sin(5) = 0.087156       cos(5) = 0.996195
sin(6) = 0.104528       cos(6) = 0.994522
sin(7) = 0.121869       cos(7) = 0.992546
sin(8) = 0.139173       cos(8) = 0.990268
sin(9) = 0.156434       cos(9) = 0.987688
sin(10) = 0.173648      cos(10) = 0.984808
sin(11) = 0.190809      cos(11) = 0.981627
sin(12) = 0.207912      cos(12) = 0.978148
sin(13) = 0.224951      cos(13) = 0.974370
sin(14) = 0.241922      cos(14) = 0.970296
sin(15) = 0.258819      cos(15) = 0.965926
sin(16) = 0.275637      cos(16) = 0.961262
sin(17) = 0.292372      cos(17) = 0.956305
sin(18) = 0.309017      cos(18) = 0.951057
sin(19) = 0.325568      cos(19) = 0.945519
sin(20) = 0.342020      cos(20) = 0.939693
sin(21) = 0.358368      cos(21) = 0.933580
sin(22) = 0.374607      cos(22) = 0.927184
sin(23) = 0.390731      cos(23) = 0.920505
sin(24) = 0.406737      cos(24) = 0.913545
sin(25) = 0.422618      cos(25) = 0.906308
sin(26) = 0.438371      cos(26) = 0.898794
sin(27) = 0.453990      cos(27) = 0.891007
sin(28) = 0.469472      cos(28) = 0.882948
sin(29) = 0.484810      cos(29) = 0.874620
```



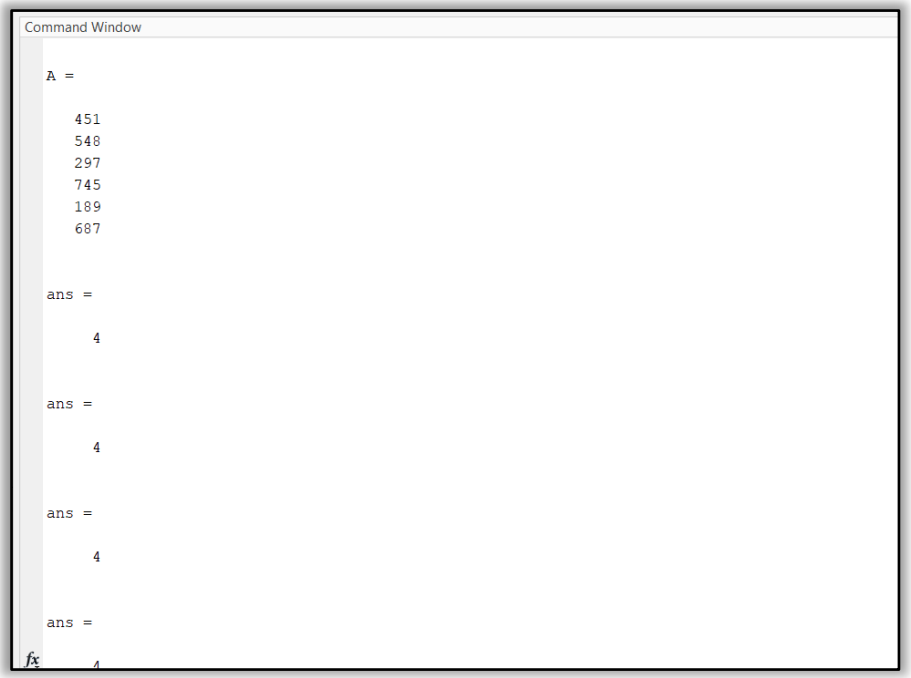
Q-4. Write a program to read a set of integers from an input data file, and locate the largest and smallest values within the data file. Print out the largest and smallest values, together with the lines on which they were found. Assume that you do not know the number of values in the file before the file is read.

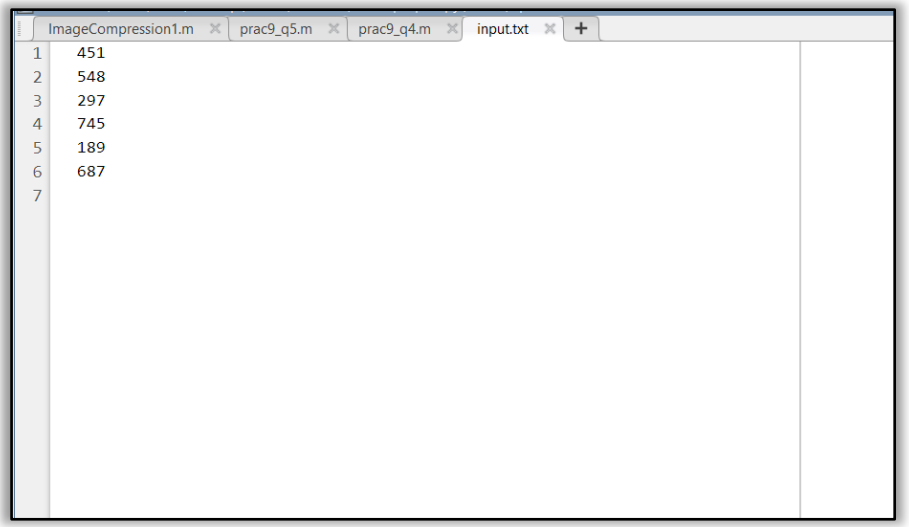
Code:

```
clc;
clear all;
close all;

file=fopen('input.txt', 'wt');

A=randi(1000, round(rand()*10), 1)

for ii=1:length(A)
    fprintf(file,'%d\n', A(ii))
end
```

```
fclose(file);

fileID=fopen('input.txt', 'r');

A=fscanf(fileID, '%d');

fclose(fileID);
```

Output:





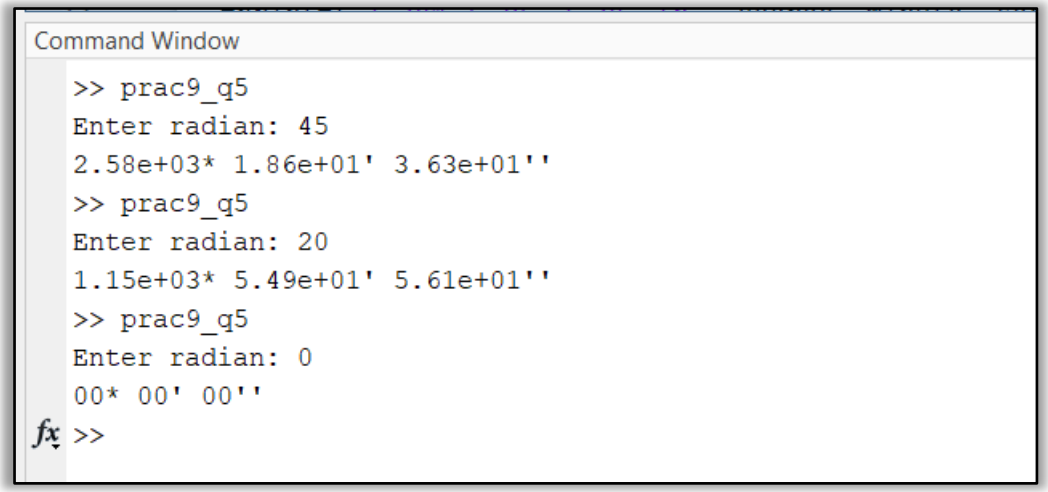
Q-5. Angles are often measured in degrees (°), minutes (′), and seconds (″), with 360 degrees in a circle, 60 minutes in a degree, and 60 seconds in a minute. Write a program that reads angles in

radians from an input disk file and converts them into degrees, minutes, and seconds. Test your program by placing the following four angles expressed in radians into an input file and reading that file into the program: 0.0, 1.0, 3.141593, 6.0.

Code:

```
% clc;
clear all;
close all;

r=input("Enter radian: ");
degree=r*180/pi;

minute=rem(degree,1)*60;
second=rem(minute,1)*60;

fprintf("%.2d* %.2d' %.2d''\n", degree, minute, second);
```

Output:



Conclusion:

From this experiment we learnt a lot about how to handle files and write and read input and outputs from files. We got to know the machinery that is libraries needed to work with files.