Date: 21-08-2021

Experiment 3

Aim: To work with branching statements.

Apparatus: MATLAB Software

Objective: To learn how to control the order in which statements are executed using if-else ~~and switch~~-case.

Problems:

Q-1. The following statements are intended to alert a user to dangerously high oral thermometer readings (values are in degrees Fahrenheit). Are they correct or incorrect? If they are incorrect, explain why and correct them.

```
if temp < 97.5
disp('Temperature below normal');
elseif temp > 97.5
disp('Temperature normal');
elseif temp > 99.5
disp('Temperature slightly high');
elseif temp > 103.0
disp('Temperature dangerously high');
end
```

Reason:

As an when the input exceeds 97.5, it enters into second condition and skips the rest conditions.

Code:

```
clc;
clear all;
close all;

s = 'Enter temp value';
temp = input(s);

if temp <= 97.5
    disp("Below Normal");
elseif temp > 97.5 && temp < 99.5
    disp("Normal");
elseif temp >= 99.5 && temp < 103.0
    disp("Slightly High");
elseif temp >= 103.0
    disp("Dangerously High");
```

```
end
```

Output:

```
Command Window
Enter temp value
98.5
Normal
```

```
Command Window
Enter temp value
100
Slightly High
```

Q-2. Write a MATLAB program to evaluate the function:

$$y(x) = ln\frac{1}{1-x}$$

for any user-specified value of x, where x is a number <1.0 (note that ln is the natural logarithm, the logarithm to the base e). Use an if structure to verify that the value passed to the program is legal. If the value of x is legal, calculate $y(x)$. If not, write a suitable error message and quit.

Code:

```
clc;
clear all;
close all;

while(true)
    s = 'Enter x value';
    x = input(s);
    if x < 1.0
        y = log(1/(1-x));
        fprintf("Y is: %f",y)
        break

    else
        disp("Invalid Input")
    end
end
```

Output:

```
Enter x value
0.5
Y is: 0.693147
```

```
Enter x value
1.5
Invalid Input
Enter x value
1.3
Invalid Input
Enter x value
0.8
Y is: 1.609438
```

Q-3. Examine the following MATLAB statements. Are they correct or incorrect?
If they are correct, what do they output? If they are incorrect, what is wrong with them?

a) if volts > 125
disp('WARNING: High voltage on line.');
if volts < 105
disp('WARNING: Low voltage on line.');
else
disp('Line voltage is within tolerances.');
end

Reason:

Here as we have 2 **if** statements thus, we need 2 **end** statements also.

Code:

```
clc;
clear all;
close all;

s = 'Enter your volts value';
volts = input(s);

if volts < 105
    disp('WARNING: Low voltage on line.');
    if volts > 125
        disp('WARNING: High voltage on line.');
    else
        disp('Line voltage is within tolerances.');
    end
end
```

Output:

```
Enter your volts value
100
WARNING: Low voltage on line.
Line voltage is within tolerances.
```

b) color = 'yellow';
switch (color)
case 'red',
disp('Stop now!');
case 'yellow',
disp('Prepare to stop.');
case 'green',
disp('Proceed through intersection.');
otherwise,
disp('Illegal color encountered.');
end

Code:

```
clc;
clear all;
close all;

s = 'Enter your color value';
color = input(s);

switch ( color )
    case 'red',
    disp('Stop now!');
    case 'yellow',
    disp('Prepare to stop.');
    case 'green',
    disp('Proceed through intersection.');
    otherwise,
    disp('Illegal color encountered.');
end
```

Output:

```
Enter your color value
'yellow'
Prepare to stop.
```

c) if temperature > 37

disp('Human body temperature exceeded.');
elseif temperature > 100
disp('Boiling point of water exceeded.');
end

Reason:

As the input that is temperature won't enter into the **elseif** condition, as and when the value is greater than 37, because in that case it will execute the **if** condition

Code:

```
clc;
clear all;
close all;

s = 'Enter temp value';
temp = input(s);

if temp > 37 && temp <100
    disp('Human body temperature exceeded');
elseif temp >= 100
    disp('Boiling point of water exceeded');
end
```

Output:

```
Command Window
Enter temp value
39
Human body temperature exceeded
```

```
Command Window
Enter temp value
100
Boiling point of water exceeded
```

Q-4 Write a program that allows a user to enter a string containing a day of the week ("Sunday," "Monday," "Tuesday," etc.) and uses a switch construct to convert the day to its corresponding number, where Sunday is considered the first day of the week and Saturday is considered the last day of the week. Print out the resulting day number. Also, be sure to handle the case of an illegal day name! (*Note:* Be sure to use the 's' option on function input so that the input is treated as a string.)

Code:

```
clc;
clear all;
```

```
close all;

s = 'Enter your day';
day = input(s);

switch(day)
    case 'Sunday'
        disp("1");
    case 'Monday'
        disp("2");
    case 'Tuesday'
        disp("3");
    case 'Wednesday'
        disp("4");
    case 'Thursday'
        disp("5");
    case 'Friday'
        disp("6");
    case 'Saturday'
        disp("7");
    otherwise
        disp("Invalid Day");
end
```

Output:

```
Command Window
Enter your day
'Monday'
2
```

```
Command Window
Enter your day
'Kanisha'
Invalid Day
```

Q-5. The gain G of a certain microwave dish antenna can be expressed as a function of angle by the equation

$$G(\theta) = |\mathrm{sinc}\ 4\theta| \quad \text{for} -\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2}$$

where θ is measured in radians from the boresite of the dish, and sinc x=sin x/x. Plot this gain function on a polar plot, with the title "**Antenna Gain vs**" in boldface.

Code:

```
clc;
clear all;
close all;

theta = -pi/2:pi/30:pi/2;
y = abs(sin(4.*theta)./(4.*theta));

polarplot(theta,y,'-b')
title("Antenna Gain Vs \theta")
```

Output:

Q-6. The author of this book now lives in Australia. Australia is a great place to live, but it is also a land of high taxes. In 2002, individual citizens and residents of Australia paid the following income taxes:

Taxable Income (in A$)	Tax on This Income
$0–$6,000	None
$6,001–$20,000	17¢ for each $1 over $6,000
$20,001–$50,000	$2,380 plus 30¢ for each $1 over $20,000
$50,001–$60,000	$11,380 plus 42¢ for each $1 over $50,000
Over $60,000	$15,580 plus 47¢ for each $1 over $60,000

In addition, a flat 1.5% Medicare levy is charged on all income. Write a program to calculate how much income tax a person will owe based on this information. The program should accept a total income figure from the user and calculate the income tax, Medicare levy, and total tax payable by the individual.

Code:

```
clc;
clear all;
close all;

s = 'Enter your Total Income';
inc = input(s);

if inc > 0 && inc <= 6000
    tx = 0;
elseif inc>= 6001 && inc <= 20000
    tx = (inc - 6000) * 17;
elseif inc>= 20001 && inc <= 50000
    tx = 2380 + (inc - 20000)*42;
elseif inc> 50001 && inc < 60000
    tx = (inc - 50000) * 42 + 11380;
elseif inc> 60000
```

```
    tx = (inc - 60000) * 47 + 15580;
end

ml = 0.015 * inc ;
fprintf("Income Tax: %.3f \n",tx)
fprintf("Medicare Levy: %.3f \n",ml)
fprintf("Total Tax: %.3f \n",tx + ml)
```

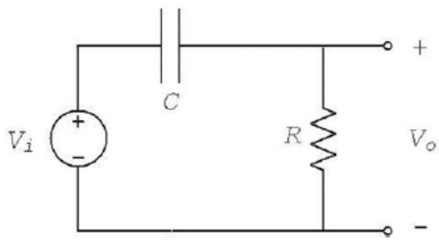
Output:

```
Command Window
Enter your Total Income
6008
Income Tax: 136.000
Medicare Levy: 90.120
Total Tax: 226.120
```

```
Command Window
Enter your Total Income
50010
Income Tax: 11800.000
Medicare Levy: 750.150
Total Tax: 12550.150
```

Q-7. Below figure shows a simple high-pass filter consisting of a resistor and a capacitor. The ratio of the output voltage V_o to the input voltage V_i is given by the equation

$$\boxed{\frac{V_o}{V_i} = \frac{j2\pi fRC}{1 + j2\pi fRC}}$$



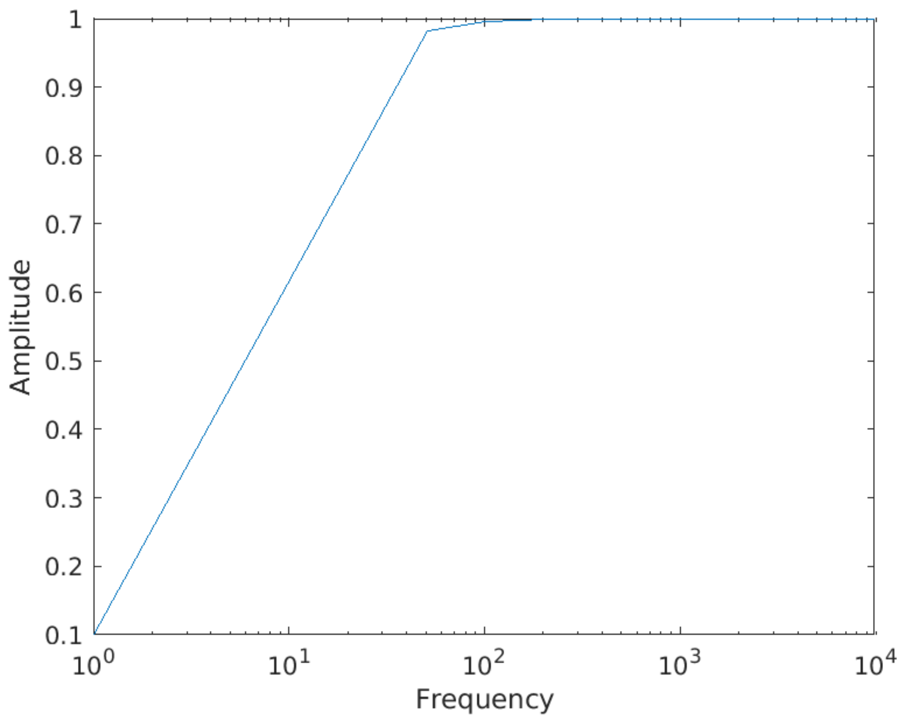
Assume that R =16 kΩ and C =1μF. Calculate and plot the amplitude and phase response of this filter as a function of frequency.

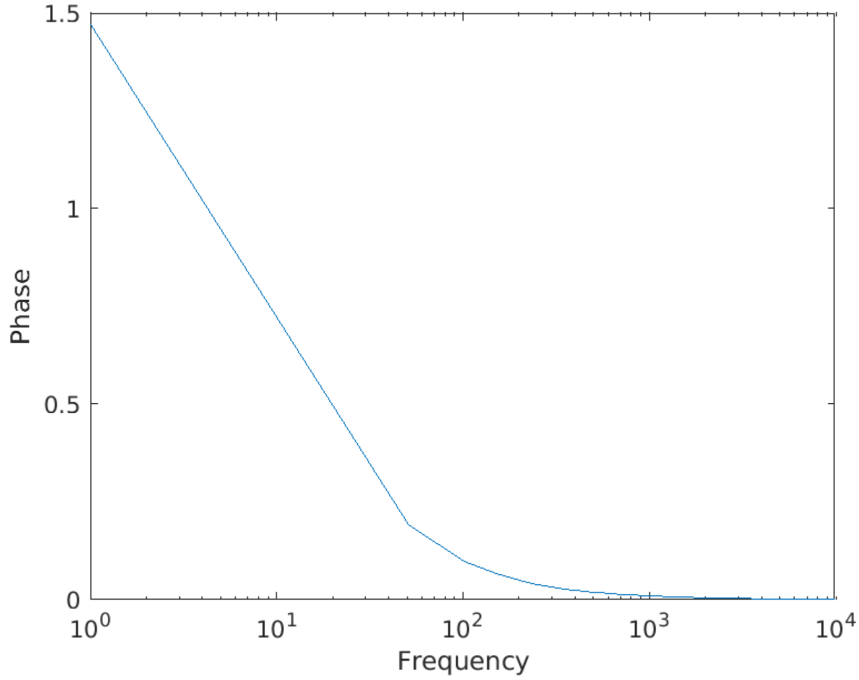
Code:

```
clc;
clear all;
close all;

vD = -1.0:0.1:0.6;
I0 = 2*10^(-6);
q = 1.602 * 10^(-19);
```

```
k = 1.38 * 10^(-23);
T = ((75 - 32) * (5/9)) + 273.15;

iD = I0 * ( exp( (q.*vD)./ k.*T ) - 1);

plot(vD,iD);
hold on;

T = ((100 - 32) * (5/9)) + 273.15;
iD = I0 * (exp((q.*vD)./k.*T) - 1);

plot(vD,iD);
hold on;

T = ((125 - 32) * (5/9)) + 273.15;
iD = I0 * (exp((q.*vD)./k.*T) - 1);

plot(vD,iD);
legend("T1 - 75","T2 - 100","T3 - 125");
xlabel("Voltage");
ylabel("Current");
```

Output:





Q-8. When a satellite orbits the Earth, the satellite's orbit will form an ellipse with the Earth located at one of the focal points of the ellipse. The satellite's orbit can be expressed in polar coordinates as

$$r = \frac{p}{1 - \varepsilon \cos\theta}$$

where r and θ are the distance and angle of the satellite from the center of the Earth, p is a parameter specifying the size of the orbit, and ε is a parameter representing the eccentricity of the orbit. A circular orbit has an eccentricity ε of 0. An elliptical orbit has an eccentricity of 0<= ε<=1. If ε >1, the satellite follows a hyperbolic path and escapes from the Earth's gravitational field.

Consider a satellite with a size parameter p =1000 km. Plot the orbit of this satellite if (*a*) ε =0; (*b*) ε =0.25; (*c*) ε =0.5. How close does each orbit come to the Earth? How far away does each orbit get from the Earth? Compare the three plots you created. Can you determine what the parameter p means from looking at the plots?

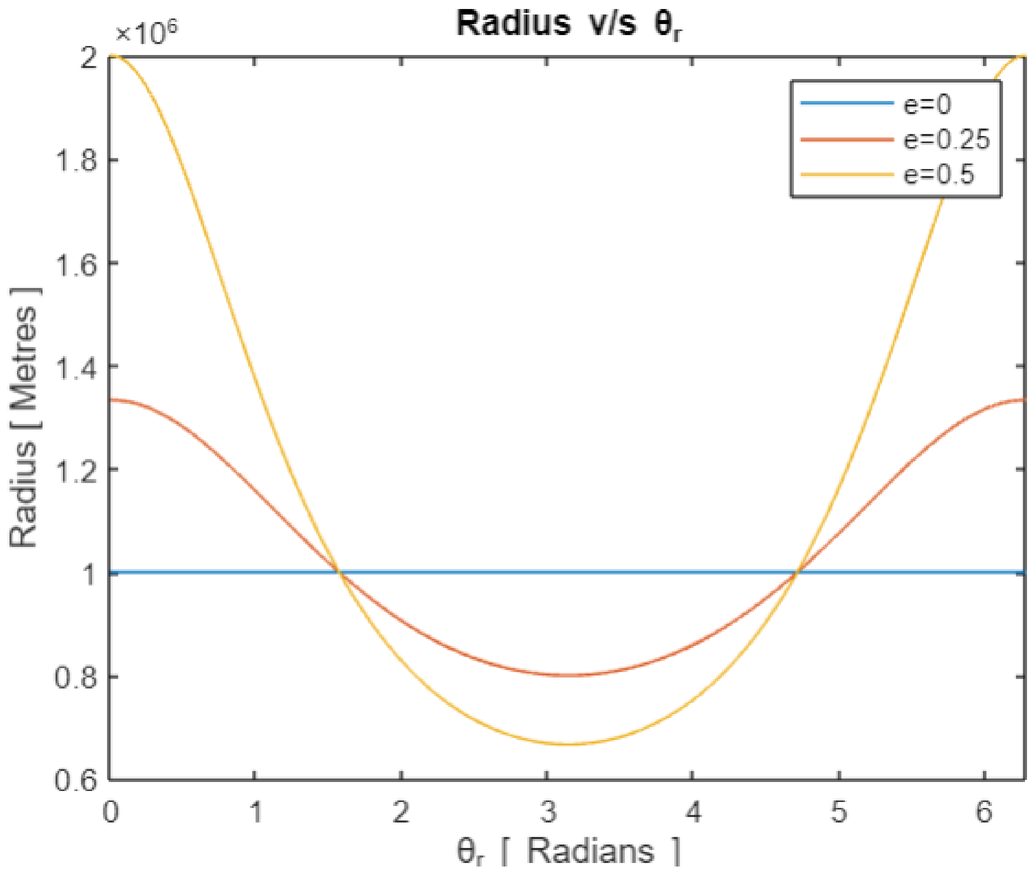
Code:

```
clc;
close all;
clear all;

p=1000000;

theta = 0:pi/180:2*pi;
c = 0;
while c < 3
    s = 'Enter your E(Eccentricity)';
    e = input(s);
    r=p./(1-e.*cos(theta));
```

```
    plot(theta,r);
    hold on;
    c = c+1;
end

legend("e=0","e=0.25","e=0.5")
title("Radius v/s \theta_{r}")
xlabel("\theta_{r} [ Radians ]")
ylabel("Radius [ Metres ]")
```

Output:

```
Command Window
Enter your E(Eccentricity)
0
Enter your E(Eccentricity)
0.25
Enter your E(Eccentricity)
Enter your E(Eccentricity)
>> 0.5
```



Reason:

The one with eccentricity 0 is the closest to the earth and 0.25 a bit far and 0.5 more. As the distance increases the theta similarly modulates.

Conclusion:

From this lab we came to understand different conditions for if-else and as well as using while and for loops. The way we used for loops and while depends upon the application. We even got acquainted with the polar graphs and switch case. Where we used multiple statements in the same condition of switch case.