Week 1
Programming basics

Q1

```
x=true;
if x
        disp('True');
else
        disp('False');
end
```

Rewrite the code given above without using `else`.

Q2

```
x=23;
if x>=20
        disp('Greater than or equal to 20')
else
        disp('Less than 20');
end
```

Rewrite the code given above with using `while`.

Q3

```
coin='YY';
if coin(1)=='Y' && coin(2)=='Y'
        disp('tail tail');
elseif coin(1)=='Y' && coin(2)=='T'
        disp('tail head');
elseif coin(1)=='T' && coin(2)=='Y'
        disp('head tail');
else
        disp('head head');
end
```

Rewrite the code given above without using `elseif` nor `else`. Compare using nested `if`s and individual `if`s.

Q4

```
for x=1:1:4
        disp([num2str(x) '. student'])
end
```

Rewrite the code using `while`.

Q5 Store the following signals

$$t = 0 : 0.01 : 4\pi$$
$$x(t) = sin(t)$$

in an array. Pass the aforementioned signal through a rectifier and compare the results by plotting them.

Q6 Calculate the following formulae

$$RMS = \sqrt{\left(\frac{\sum_{i=1}^{N} x(k)^2}{N}\right)}$$

for the sine wave stored in an array.

Q7 Calculate the following formulae

$$PEAK = \max_{\forall k} x(k)$$

for the sine wave stored in an array.

Q8 Write a function named `plotSine` which plots a sine wave in the following form:

$$x(t) = Asin(2\pi ft)$$

The function should accept `t`, `A` and `f` as arguments.

Q9 Write a function named `numericDerivative` which calculates the following

$$x_{derivative}(kT) = \frac{x((k+1)T) - x(kT)}{T}$$

where the function should accept `t` and `x` as arguments and T is called the sampling time. This function returns $x_{derivative}(t)$ as output.

A1

```
x=true;
if x
        disp('True');
end
if ~x
        disp('False');
end
```

A2

```
x=23;
while x>=20
        disp('Greater than or equal to 20')
        x=0;
end
while x<20
        disp('Less than 20');
        x=20;
end
```

A3

With nested ifs the following code may be written.

```
coin='YY';
if coin(1)=='Y'
        if coin(2)=='Y'
                disp('tail tail');
        end
        if coin(2)=='T'
                disp('tail head');
        end
end
if coin(1)=='T'
        if coin(2)=='Y'
                disp('head tail');
        end
        if coin(2)=='T'
                disp('head head');
        end
end
```

And the other version is given below.

```
if coin(1)=='Y' && coin(2)=='Y'
        disp('tail tail');
end
if coin(1)=='Y' && coin(2)=='T'
        disp('tail head');
end
if coin(1)=='T' && coin(2)=='Y'
        disp('head tail');
end
if coin(1)=='T' && coin(2)=='T'
        disp('head head);
end
```

A4

```
x=1;
while x<=4
        disp([num2str(x) '. student'])
        x=x+1;
end
```

A5

```
t=0:0.01:4*pi;
x=zeros(1,length(t));
xr=zeros(1,length(t));

for i=1:length(t)
    x(i)=sin(t(i));
    if x(i)<0
        xr(i)=-x(i);
    else
        xr(i)=x(i);
    end
end


figure(1);
subplot(2,1,1);cla;hold on;grid on;
plot(t,x,'LineWidth',2);
xlabel('time (sec)');
ylabel('gain');
subplot(2,1,2);cla;hold on;grid on;
plot(t,xr,'LineWidth',2);
xlabel('time (sec)');
ylabel('gain');
```

A6

```
t=0:0.01:4*pi;
x=zeros(1,length(t));
xrms=0;
for i=1:length(t)
    xrms=xrms+x(i)^2;
end
xrms=sqrt(xrms/length(x));
```

A7

```
t=0:0.01:4*pi;
x=zeros(1,length(t));
xpeak=0;
for i=1:length(t)
    if x(i)>xpeak
       xpeak=x(i);
    end
end
```

A8

```
function plotSine(t,A,f)
    x=zeros(1,length(t));
    for i=1:length(t)
        x(i)=A*sin(2*pi*f*t(i));
    end
    plot(t,x,'LineWidth',2,'DisplayName',[num2str(A) 'sin(' num2str(2*pi*f)
        '.t)']);
    legend('show');
end
```

A9

```
function xd=numericDerivative(t,x)
    xd=zeros(size(x));
    for i=1:length(t)-1
        xd(i)=(x(i+1)-x(i))/(t(2)-t(1));
    end
    xd(end)=xd(end-1);
end
```