Muhideen Ogunlowo math 426 Homework 3

Question 2.1.1

a) There are n = 5 points, so I should expect the polynomial to be of n-1 = 4 four degrees

b) P(x) = $a_0 + a_1 x + a_2 x^2 + a_3 x^3 + a_4 x^4$ %This is the linear equation that represents a polynomial of 4 degrees

For the point (-1,0)

$a_0 - a_1 + a_2 - a_3 + a_4 = 0$ % %This is the linear equation at point (-1,0)

For the point (0,1)

$a_0 = 1$ %This is the linear equation at point (0,1)

For the point (2,0)

$a_0 + 2a_1 + 4a_2 + 8a_3 + 16a_4 = 0$ %This is the linear equation at point (2,0)

For the point (3,1)

$a_0 + 3a_1 + 9a_2 + 27a_3 + 81a_4 = 1$ %This is the linear equation at point (3,1)

For the point (4,2)

$a_0 + 4a_1 + 16a_2 + 64a_3 + 256a_4 = 2$ %This is the linear equation at point (4,2)

```
y= [0;1;0;1;2]; %this is the column vector of all y-values
x=[-1,0,2,3,4]; %This is the column vector of all x-values
V=zeros(5,5); %Set Up of Vandermode Matrix
for i= 1:5 %start of for loop
    V(i,:)=[1 x(i) x(i)^2 x(i)^3 x(i)^4]; %specifies the co-efficient of
each column corresponding to the x values
end %end of for loop
V %display of V output
```

```
V = 5×5
     1    -1     1    -1     1
     1     0     0     0     0
     1     2     4     8    16
     1     3     9    27    81
     1     4    16    64   256
```

```
a= V\y %a is the vector of polynomial co-efficents
```

```
a = 5×1
   0.999999999999999
  -0.450000000000000
  -0.824999999999999
   0.550000000000000
```

```
    -0.075000000000000
```

Question 2.1.2 (b)

```
year=(1980:10:2010)'%This shows the gap from 1980 to 2010, spaced out by 10 year intervals
```

```
year = 4×1
        1980
        1990
        2000
        2010
```

```
pop=[227.225; 249.643; 282.172; 308.282]; %population of US data from textbook
x= year-1980;%x is each year considered - 1980

y=pop;

V= zeros(4,4); %set up of Vandermode matrix
for i = 1:4 %set up of for loop
    V(i,:) = [1 x(i) x(i)^2 x(i)^3];
end %end of for loop

V %Output of Vandermode matrix
```

```
V = 4×4
           1           0           0           0
           1          10         100        1000
           1          20         400        8000
           1          30         900       27000
```

```
m= V\y %m is the vector of polynomial co-efficents
```

```
m = 4×1
10^2 ×
   2.272250000000000
   0.011852500000000
   0.001332050000000
  -0.000027550000000
```

```
m=m(end:-1:1); %reverse the ordering
polyval(m,1984-1980) %application of 1984 timeshift: This gives us the estimated population at 1984 at 233.92096 million
```

```
ans =
    2.339209600000000e+02
```

Question 1.3.2 : test on sample vectors

```
x=[4,5,6,7,8,9,10]; %sample vector for variance
```

```
samplevar(x)%called function for samplevar(x)
```

```
ans =
   4.666666666666667
```

```
var(x)%output of built in MATLAB variance function
```

```
ans =
   4.666666666666667
```

```
x=[5,8,10,23,41,54];%sample vector for variance
samplevar(x)%called function for samplevar(x)
```

```
ans =
     4.003000000000000e+02
```

```
var(x)
```

```
ans =
     4.003000000000000e+02
```

Observation: The function s2= samplevar(x) produces an output that is very similar to the output gotten from the built in MATLAB function for a sample vector (x)

Question 1.3.7 : test on sample vectors

```
format long
x=[1e6,1+1e6,2+1e6];
a= variance(x)
```

```
a =
     1
```

```
b= var(x)
```

```
b =
     1
```

```
x=[1e9,1+1e9 2+1e9];
p= variance(x)
```

```
p =
     0
```

```
q= var(x)
```

```
q =
     1
```

Observation: The function s2= samplevar(x) produces an output that is very similar to the output gotten from the built in MATLAB function for the vector x=[1e6,1+1e6,2+1e6] but for the vector [1e9, 1+1e9, 2+1e9], the output given by the "one-pass" formula is 0, output gotten from the built in MATLAB function for the vector is 1

Question 1.3.2

```
function s2= samplevar(x) %function definition
% x = sample vector
% n = sample size
% q= sample mean
% s2= sample variance
n=length(x); %this is to determine the sample size
q=mean(x); %this is to determine the mean
s2= sum((x-q).^2)/(n-1); %This is the formula given as code in MATLAB and
determines s2
end %end of code
```

Question 1.3.7

```
function s2= variance(x)%function definition
% x = sample vector
% u = sum of (x^2)
% v = sum of x
% s2 = sample variance
n=length(x); %this is to determine the sample size
u=sum(x.^2); %This is to dtermine the sum of x^2
v=sum(x);    %This is to determine the sum of x
s2=(u-((v.^2)/n))/(n-1); %This is the formula given as code in MATLAB and
determines s2
end %end of code
```