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EEN 271 Quiz 3 Spring 2019

ABET OCs	A	G	K
Question No.	Q_1-a, Q_2-a,b	-	Q_1-b

50/50

Excellent

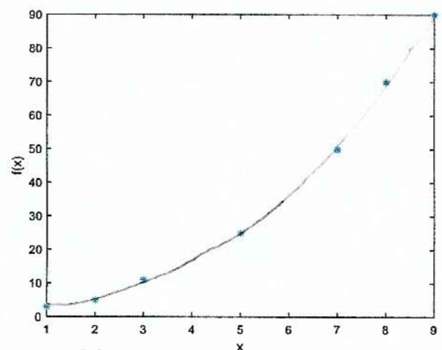
From the given data shown in table and graph below:

Q_1. (a) **Find** the regression model using **Least Square Error Criterion** with **appropriate** order. (15 marks)
(b) **Write** MATLAB code for regression the data with your approximate **polynomial** model. **Show** in your code computed error. (10 marks)

Q_2. **Interpolate** the data (at **x=4**) using the following methods:
(a) **Lagrange** interpolation method (15 marks)
(b) **Newton's divided deference** interpolation method (15 marks)

	x	f(x)
	1	3
	2	5
	3	11
	5	25
49	7	50
64	8	70
100	10	90

not Linear



$$Y = a_0 + a_1 X + a_2 X^2$$

$\sum x_i = 36$, $\sum x_i^2 = 252$, $\sum x_i^3 = 2016$

$\sum x_i^4 = 17220$; $n = 7$, $\sum f(x) = 254$

$\sum x_i f(x) = 1981$, $\sum x_i^2 f(x) = 16677$

Slop $= \frac{2-1}{5-3} = \frac{1}{2}$, $\frac{5-3}{25-11} = \frac{1}{7}$

$\frac{10-7}{90-50} = \frac{3}{40}$

$$\begin{bmatrix} n & \sum(x_i)^1 & \sum(x_i)^2 \\ \sum(x_i)^1 & \sum(x_i)^2 & \sum(x_i)^3 \\ \sum(x_i)^2 & \sum(x_i)^3 & \sum(x_i)^4 \end{bmatrix} \begin{bmatrix} a_0 \\ a_1 \\ a_2 \end{bmatrix} = \begin{bmatrix} \sum f(x) \\ \sum x_i f(x) \\ \sum x_i^2 f(x) \end{bmatrix}$$

$\therefore\ 7a_0 + 36a_1 + 252a_2 = 254$

$36a_0 + 252a_1 + 2016a_2 = 1981$

$252a_0 + 2016a_1 + 17220a_2 = 16677$

$\therefore\ a_0 = -2.49$, $a_1 = 2.8$, $a_2 = 0.677$

(b)

```
X = [1 2 3 5 7 8 10];
Y = [3 5 11 25 50 70 90];
A = Polyfit(x,y,2);
B = Fliplr(A);
```

Q2)

at $X=4$

a) Lagrange method

$$f(4) = L_0 \overset{5}{F(X_0)} + L_1 \overset{11}{(FX_1)} + L_2 \overset{25}{(FX_2)}$$

$$L_0 = \left(\frac{X - X_1}{X_0 - X_1}\right)\left(\frac{X - X_2}{X_0 - X_2}\right)$$

$$L_1 = \left(\frac{X - X_0}{X_1 - X_0}\right)\left(\frac{X - X_2}{X_1 - X_2}\right)$$

$$L_2 = \left(\frac{X - X_0}{X_2 - X_0}\right)\left(\frac{X - X_1}{X_2 - X_1}\right)$$

$X_0 = 2 \Rightarrow F(X_0) = 5$

$X_1 = 3 \Rightarrow F(X_1) = 11$

$X_2 = 5 \Rightarrow F(X_2) = 25$

$$F(4) = \left(\frac{4-3}{2-3}\right)\left(\frac{4-5}{2-5}\right)(5) + \left(\frac{4-2}{3-2}\right)\left(\frac{4-5}{3-5}\right)(11) + \left(\frac{4-2}{5-2}\right)\left(\frac{4-3}{5-3}\right)(25) = 17.67$$

at $X=4$

b) Newton's method

$$b_0 + b_1(X - X_0) + b_2(X - X_0)(X - X_1)$$

$b_0 = f(X_0)$

$$b_1 = \frac{F(X_1) - F(X_0)}{X_1 - X_0}$$

$$b_2 = \frac{\dfrac{F(X_2) - F(X_1)}{X_2 - X_1} - \dfrac{F(X_1) - F(X_0)}{X_1 - X_0}}{X_2 - X_0}$$

$X_0 = 2 \Rightarrow F(X_0) = 5$

$X_1 = 3 \Rightarrow F(X_1) = 11$

$X_2 = 5 \Rightarrow F(X_2) = 25$

$b_0 = F(X_0) = F(2) = 5$

$$b_1 = \frac{11 - 5}{3 - 2} = 6$$

$$b_2 = \frac{\dfrac{25-11}{5-3} - \dfrac{11-5}{3-2}}{5-2} = \frac{1}{3}$$

$$f(4) = 5 + 6(4-2) + \frac{1}{3}(4-2)(4-3)$$

$$= 17.67$$