Index

Unit – 4 ⇝ Basic Statistics 3

1) Method 1 ⇝ Measure of Central Tendency 3
2) Method 2 ⇝ Measure of Dispersion 10
3) Method 3 ⇝ Covariance 13
4) Method 4 ⇝ Correlation Coefficient 14
5) Method 5 ⇝ Rank Correlation Coefficient 16
6) Method 6 ⇝ Linear Regression 17
7) Method 7 ⇝ Curve Fitting 19
8) Method 8 ⇝ Moving Average Method 23

Unit – 4 ⇝ Basic Statistics

Method 1 ⇝ Measure of Central Tendency

Example of Method-1.1: Examples of Mean

<table>
<tr><td>A</td><td>1</td><td>Find mean of following data:
(a) 2, 8, 4, 6, 10, 12, 4, 8, 14, 16
(b) 10, 9, 21, 16, 14, 18, 20, 18, 14, 18, 23, 16, 18, 4

Answer: (a) 8.4, (b) 15.6429</td></tr>
<tr><td>A</td><td>2</td><td>Find the mean for following data:

<table>
<tr><td>Weight of students</td><td>18</td><td>22</td><td>30</td><td>35</td><td>39</td><td>42</td><td>45</td><td>47</td></tr>
<tr><td>Number of students</td><td>4</td><td>5</td><td>8</td><td>8</td><td>16</td><td>4</td><td>2</td><td>3</td></tr>
</table>
Answer: 34.5</td></tr>
<tr><td>A</td><td>3</td><td>Find the mean for following data:

<table>
<tr><td>x</td><td>10</td><td>20</td><td>36</td><td>40</td><td>50</td><td>56</td><td>60</td><td>70</td><td>72</td><td>80</td><td>88</td><td>92</td><td>95</td></tr>
<tr><td>f</td><td>1</td><td>1</td><td>3</td><td>4</td><td>3</td><td>2</td><td>4</td><td>4</td><td>1</td><td>1</td><td>2</td><td>3</td><td>1</td></tr>
</table>
Answer: 59.3</td></tr>
<tr><td>B</td><td>4</td><td>Find the mean if survey regarding the weights (kg) of 45 students of class X of a school was conducted and the following data was obtained:

<table>
<tr><td>x</td><td>20 – 25</td><td>25 – 30</td><td>30 – 35</td><td>35 – 40</td><td>40 – 45</td><td>45 – 50</td><td>50 – 55</td></tr>
<tr><td>f</td><td>2</td><td>5</td><td>8</td><td>10</td><td>7</td><td>10</td><td>3</td></tr>
</table>
Answer: 38.83</td></tr>
</table>

B	5	The following data represents the no. of foreign visitors in a multinational company in every 10 days during last 2 months. Use the data to find the mean. Class: 0 – 10 | 10 – 20 | 20 – 30 | 30 – 40 | 40 – 50 | 50 – 60 No. of visitors: 12 | 18 | 27 | 20 | 17 | 06 **Answer: 28**
B	6	Find the missing frequency from the following data if mean is 19.92. Class: 4 – 8 | 8 – 12 | 12 – 16 | 16 – 20 | 20 – 24 f: 11 | 13 | 16 | 14 | ? 24 – 28 | 28 – 32 | 32 – 36 | 36 – 40 9 | 17 | 6 | 4 **Answer: 10**
B	7	Find the mean of the following frequency distribution: Mid value: 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 Frequency: 2 | 22 | 19 | 14 | 3 | 4 | 6 | 1 | 1 Cumulative: 2 | 24 | 43 | 57 | 60 | 64 | 70 | 71 | 72 **Answer: 27.8472**

Example of Method-1.2: Median

<table>
<tr><td>A</td><td>1</td><td>Find the median of following data:
(a) 6, 20, 43, 50, 19, 53, 0, 37, 78, 1, 15.
(b) 10, 34, 27, 24, 12, 27, 20, 18, 15, 30.
(c) 110, 115, 108, 112, 120, 116, 140, 135, 128, 132.

Answer: (a) 20, (b) 22, (c) 118</td></tr>
<tr><td>A</td><td>2</td><td>If the median of the data is 2, find the value of a: −9, −4, a, 5, 8, 11.

Answer: − 1</td></tr>
<tr><td>A</td><td>3</td><td>Obtain the median size of shoes sold from the following data:

<table>
<tr><td>Size</td><td>5</td><td>5.5</td><td>6</td><td>6.5</td><td>7</td><td>7.5</td><td>8</td></tr>
<tr><td>Pair</td><td>30</td><td>40</td><td>50</td><td>150</td><td>300</td><td>600</td><td>950</td></tr>
</table>
Answer: 7.5</td></tr>
<tr><td>B</td><td>4</td><td>Calculate the missing frequency from the following distribution, it is being given that the median of the distribution is 24.
<table>
<tr><td>Marks</td><td>0 – 10</td><td>10 – 20</td><td>20 – 30</td><td>30 – 40</td><td>40 – 50</td></tr>
<tr><td>No. of students</td><td>5</td><td>25</td><td>x</td><td>18</td><td>7</td></tr>
</table>
Answer: x = 25</td></tr>
<tr><td>B</td><td>5</td><td>The following table gives the marks obtained by 50 students in mathematics. Find the median.
<table>
<tr><td>x</td><td>10–14</td><td>15–19</td><td>20–24</td><td>25–29</td><td>30–34</td><td>35–39</td><td>40–44</td><td>45–49</td></tr>
<tr><td>f</td><td>4</td><td>6</td><td>10</td><td>5</td><td>7</td><td>3</td><td>9</td><td>6</td></tr>
</table>
Answer: 29.5</td></tr>
</table>

Example of Method-1.3: Mode

A 1 Find the mode of following data:

x	1	2	3	4	5	6	7	8	9
f	8	10	11	16	20	25	15	9	6

Answer: 6

A 2 Find the mode from the following frequency distribution:

x	8	9	10	11	12	13	14	15
f	5	6	8	7	9	8	9	6

Answer: 12 & 14

B 3 Find the mode of following data:

Class	200 – 220	220 – 240	240 – 260	260 – 280
f	7	15	21	19

280 – 300	300 – 320	320 – 340
6	4	2

Answer: 255

B 4 Find the mode of following data:

Class	400 – 500	500 – 600	600 – 700	700 – 800	800 – 900
f	8	16	20	17	3

Answer: 657.14

B 5 The mode of the following data is 67. Find the missing frequency x.

Amount	40 – 50	50 – 60	60 – 70	70 – 80	80 – 90
Frequency	5	x	15	12	7

Answer: 8

B 6 An insurance company obtained the following data for accident claims (in thousand rupees) from a particular region. Find its mean, median and mode.

Amount	1 – 3	3 – 5	5 – 7	7 – 9	9 – 11	11 – 13
Frequency	6	47	75	46	18	8

Answer: $\bar{x} = 6.47$, $M = 6.2533$, $Z = 5.9825$

C	7	Obtain the mean, median and mode for the following information:

Marks	0 <	10 <	20 <	30 <
Number of Students	50	38	20	5

Answer: $\bar{x} = 17.6$, $M = 17.2222$, $Z = 16.6667$

Example of Method-1.4: Quartiles

A	1	Find the quartiles of the data:23, 13, 37, 16, 26, 35, 26, 35. **Answer: 15.25, 26, 35**
A	2	Compute Q_1, and Q_3 for the data relating to the marks of 8 students in an examination given below 25, 48, 32, 52, 21, 64, 29, 57. **Answer: 26, 55.75**
B	3	Find the quartile Q_1, and Q_3. x: 45, 47, 49, 51, 53, 55 f: 4, 8, 5, 3, 3, 5 **Answer: 47, 53**
B	4	Find the quartile Q_1, and Q_3. x: 153, 155, 157, 159, 161, 163, 165, 167, 169 f: 8, 2, 4, 6, 3, 4, 7, 1, 4 **Answer: 155, 163**
B	5	Find the quartile Q_1, and Q_3. x: 0 – 5, 5 – 10, 10 – 15, 15 – 20, 20 – 25, 25 – 30 f: 6, 18, 30, 46, 60, 40 **Answer: 14.33, 24.16**
B	6	Find the quartile Q_1, and Q_3. x: 0 – 10, 10 – 20, 20 – 30, 30 – 40, 40 – 50, 50 – 60 f: 4, 3, 5, 1, 8, 2 **Answer: 15.83, 45.31**
B	7	Find the quartile Q_1, and Q_3. x: 4 – 8, 9 – 13, 14 – 18, 19 – 23, 24 – 28 f: 6, 18, 30, 46, 60 **Answer: 9.75, 23.5**

Example of Method-1.5: Percentiles

<table>
<tr><td>A</td><td>1</td><td>Find Percentile - 56 of the data: 23, 13, 37, 16, 26, 35, 26, 35.

Answer: 26.36</td></tr>
<tr><td>A</td><td>2</td><td>The scores obtained by 10 students are 38, 47, 49, 58, 60, 65, 70, 79, 80, 92.
Find the 70th Percentile.

Answer: 76.3</td></tr>
<tr><td>B</td><td>3</td><td>Find the 91th Percentile.
<table><tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr><tr><td>f</td><td>8</td><td>2</td><td>4</td><td>6</td><td>3</td><td>4</td><td>7</td><td>1</td><td>4</td></tr></table>
Answer: 9</td></tr>
<tr><td>B</td><td>4</td><td>Find the 40th Percentile and 50th Percentile.
<table><tr><td>x</td><td>45</td><td>47</td><td>49</td><td>51</td><td>53</td><td>55</td></tr><tr><td>f</td><td>4</td><td>8</td><td>5</td><td>3</td><td>3</td><td>5</td></tr></table>
Answer: 47, 47</td></tr>
<tr><td>B</td><td>5</td><td>Find the 38th Percentile and 64th Percentile:
<table><tr><td>Marks</td><td>0 – 10</td><td>10 – 20</td><td>20 – 30</td><td>30 – 40</td><td>40 – 50</td></tr><tr><td>No. of students</td><td>5</td><td>10</td><td>40</td><td>20</td><td>25</td></tr></table>
Answer: 25.75, 34.5</td></tr>
<tr><td>B</td><td>6</td><td>Find the 68th Percentile:
<table><tr><td>Marks</td><td>1 – 5</td><td>6 – 10</td><td>11 – 15</td><td>16 – 20</td><td>21 – 25</td></tr><tr><td>No. of students</td><td>5</td><td>10</td><td>40</td><td>20</td><td>25</td></tr></table>
Answer: 18.75</td></tr>
</table>

Method 2 ⇝ Measure of Dispersion

Example of Method-2: Measure of Dispersion

<table>
<tr><td>A</td><td>1</td><td>Find the interquartile range for the following data:
56, 14, 84, 21, 85, 2, 35, 74, 66, 52, 45.

Answer: 53</td></tr>
<tr><td>A</td><td>2</td><td>Find the interquartile range for the following distribution:
<table><tr><td>x</td><td>5</td><td>15</td><td>25</td><td>30</td></tr><tr><td>f</td><td>2</td><td>1</td><td>1</td><td>3</td></tr></table>
Answer: 10.6104</td></tr>
<tr><td>B</td><td>3</td><td>Find the interquartile range for the following distribution:
<table><tr><td>x</td><td>0 – 10</td><td>10 – 20</td><td>20 – 30</td><td>30 – 40</td><td>40 – 50</td></tr><tr><td>f</td><td>5</td><td>7</td><td>4</td><td>8</td><td>10</td></tr></table>
Answer: 26.5</td></tr>
<tr><td>A</td><td>4</td><td>Find the standard deviation for the following distribution:
<table><tr><td>x</td><td>5</td><td>15</td><td>25</td><td>30</td></tr><tr><td>f</td><td>2</td><td>1</td><td>1</td><td>3</td></tr></table>
Answer: 10.6104</td></tr>
<tr><td>B</td><td>5</td><td>Find the standard deviation for the following distribution:
<table><tr><td>Class</td><td>0 – 100</td><td>100 – 200</td><td>200 – 300</td><td>300 – 400</td></tr><tr><td>f</td><td>6</td><td>10</td><td>18</td><td>20</td></tr><tr><td></td><td>400 – 500</td><td>500 – 600</td><td>600 – 700</td><td>700 – 800</td></tr><tr><td></td><td>15</td><td>12</td><td>10</td><td>9</td></tr></table>
Answer: 196.21</td></tr>
</table>

B	6	Find the standard deviation and variance of the mark distribution of 30 students at mathematics examination in a class as below: <table><tr><td>Class</td><td>10 – 25</td><td>25 – 40</td><td>40 – 55</td><td>55 – 70</td><td>70 – 85</td><td>85 – 100</td></tr><tr><td>f</td><td>2</td><td>3</td><td>0</td><td>14</td><td>8</td><td>3</td></tr></table> **Answer: $\sigma = 19.3391$, $V = 374.0008$**
A	7	Runs scored by two batsmen A, B in 9 consecutive matches is given below: <table><tr><td>A</td><td>85</td><td>20</td><td>62</td><td>28</td><td>74</td><td>5</td><td>69</td><td>4</td><td>13</td></tr><tr><td>B</td><td>72</td><td>4</td><td>15</td><td>30</td><td>59</td><td>15</td><td>49</td><td>27</td><td>26</td></tr></table> Which of the batsman is more consistent? **Answer: Batsman B is more consistent.**
A	8	Goals scored by two team A and B in a football season were as shown in the table. Find out which team is more consistent. <table><tr><td>Number of goals in a match</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>Team A</td><td>27</td><td>9</td><td>8</td><td>5</td><td>4</td></tr><tr><td>Team B</td><td>17</td><td>9</td><td>6</td><td>5</td><td>3</td></tr></table> **Answer: Team B is more consistent.**
A	9	An analysis of monthly wages paid to the workers of two firms A and B belonging to the same industry gives the following results: <table><tr><td></td><td>Firm A</td><td>Firm B</td></tr><tr><td>Number of workers</td><td>500</td><td>600</td></tr><tr><td>Average daily wage</td><td>186</td><td>175</td></tr><tr><td>Variance of distribution of wages</td><td>81</td><td>100</td></tr></table> (1) Which firm has a larger wage bill? (2) In which firm, is there greater variability in individual wages? (3) Calculate average daily wages of all the workers in the firms A & B taken together. **Answer: (1) Firm B, (2) Firm B, (3) 180**

<table>
<tr><td>B</td><td>10</td><td>Lives of two models of refrigerators turned in for new models in a recent survey are given in the adjoining table.
<table>
<tr><td>Life (in year)</td><td>0 – 2</td><td>2 – 4</td><td>4 – 6</td><td>6 – 8</td><td>8 – 10</td><td>10 – 12</td></tr>
<tr><td>Model A</td><td>5</td><td>16</td><td>13</td><td>7</td><td>5</td><td>4</td></tr>
<tr><td>Model B</td><td>2</td><td>7</td><td>12</td><td>19</td><td>9</td><td>1</td></tr>
</table>
(1) What is the average life of each model of these refrigerators?
(2) Which model shows more uniformity?

Answer: (1) 5.12 & 6.16, (2) Model B</td></tr>
<tr><td>A</td><td>11</td><td>Find the mean deviation about the mean and median for the following data:
2, 4, 7, 8, 9.

Answer: $MD(\bar{x}) = 2.4$, $MD(M) = 2.2$</td></tr>
<tr><td>A</td><td>12</td><td>Find the mean deviation about the mean, median and mode for the following data:
5, 10, 17, 20, 23, 20.

Answer: $MD(\bar{x}) = 5.5556$, $MD(M) = 5.1667$, $MD(Z) = 5.1667$</td></tr>
<tr><td>A</td><td>13</td><td>Find mean deviation about the mean, median and mode for the following data:
<table>
<tr><td>x</td><td>2</td><td>5</td><td>6</td><td>8</td><td>10</td><td>12</td></tr>
<tr><td>f</td><td>2</td><td>8</td><td>10</td><td>7</td><td>8</td><td>5</td></tr>
</table>
Answer: $MD(\bar{x}) = MD(M) = MD(Z) = 2.3$</td></tr>
<tr><td>B</td><td>14</td><td>Find mean deviation about the mean, median and mode for the following data:
<table>
<tr><td>Class</td><td>10 – 20</td><td>20 – 30</td><td>30 – 40</td><td>40 – 50</td><td>50 – 60</td></tr>
<tr><td>f</td><td>5</td><td>10</td><td>20</td><td>9</td><td>6</td></tr>
</table>
Answer: $MD(\bar{x}) = 8.28$, $MD(M) = 8.20$, $MD(Z) = 8.30$</td></tr>
</table>

Method 3 ⇝ Covariance

Example of Method-3: Covariance

<table>
<tr><td>A</td><td>1</td><td>Find the covariance of the following data:
(1,6), (2,9), (3,6), (4,7), (5,8), (6,5), (7,12), (8,3), (9,17), (10,1).

Answer: 0.4</td></tr>
<tr><td>A</td><td>2</td><td>Find covariance for the data X = { 6, 5, 3, 4, 2 }, Y = { 12, 10, 8, 6, 4 }

Answer: 3.2</td></tr>
<tr><td>A</td><td>3</td><td>Determine $\sum x$ if n = 5, cov(X, Y) = 13.6, $\sum xy = 2783$, $\sum y = 181$

Answer: 75</td></tr>
<tr><td>B</td><td>4</td><td>Compute the covariance between x and y using the following data:
<table><tr><td>x</td><td>2</td><td>4</td><td>6</td><td>8</td><td>10</td></tr><tr><td>y</td><td>20</td><td>12</td><td>18</td><td>10</td><td>40</td></tr></table>
Answer: 15.2</td></tr>
<tr><td>B</td><td>5</td><td>Compute the covariance between x and y using the following data:
<table><tr><td>x</td><td>35</td><td>34</td><td>40</td><td>43</td><td>56</td><td>20</td><td>38</td></tr><tr><td>y</td><td>33</td><td>20</td><td>53</td><td>32</td><td>31</td><td>20</td><td>33</td></tr></table>
Answer: 85.71</td></tr>
<tr><td>B</td><td>6</td><td>Compute the covariance between x and y using the following data:
<table><tr><td>x</td><td>21</td><td>23</td><td>30</td><td>54</td><td>57</td><td>58</td><td>72</td><td>78</td><td>87</td><td>90</td></tr><tr><td>y</td><td>60</td><td>71</td><td>72</td><td>83</td><td>110</td><td>84</td><td>100</td><td>92</td><td>113</td><td>135</td></tr></table>
Answer: 459.4</td></tr>
</table>

Method 4 ⇝ Correlation Coefficient

Example of Method-4: Correlation Coefficient

B 1 Calculate the coefficient of correlation between the given series:

x	54	57	55	57	56	52	59
y	36	35	32	34	36	38	35

Answer: $r = -0.4575$

B 2 Calculate the coefficient of correlation between the age of husband and wife for below:

Age of husband	35	34	40	43	56	20	38
Age of wife	32	30	31	32	53	20	33

Answer: $r = 0.9371$

B 3 Compute Karl Pearson's coefficient of correlation between x and y for the following data:

x	100	98	78	85	110	93	80
y	85	90	70	72	95	81	74

Answer: $r = 0.9603$

B 4 Calculate the coefficient of correlation for the following series:

x	65	66	67	67	68	69	70	72
y	67	68	65	68	72	72	69	71

Answer: $r = 0.6030$

B 5 Calculate the coefficient of correlation for the following series:

x	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
y	0.30	0.29	0.29	0.25	0.24	0.24	0.24	0.29	0.18	0.15

Answer: $r = -0.7906$

<table>
<tr><td>B</td><td>6</td><td>Find the correlation coefficient between the serum diastolic B.P. and serum cholesterol levels of 10 randomly selected data of 10 persons.
<table>
<tr><td>Person</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr>
<tr><td>Cholesterol</td><td>307</td><td>259</td><td>341</td><td>317</td><td>274</td><td>416</td><td>267</td><td>320</td><td>274</td><td>336</td></tr>
<tr><td>B.P.</td><td>80</td><td>75</td><td>90</td><td>74</td><td>75</td><td>110</td><td>70</td><td>85</td><td>88</td><td>78</td></tr>
</table>
Answer: $r = 0.8088$</td></tr>
<tr><td>C</td><td>7</td><td>Find r_{xy} from given data if $n = 10, \sum(x - \bar{x})(y - \bar{y}) = 66, \sigma_x = 5.4,$ $\sigma_y = 6.2.$
Answer: $r = 0.1971$</td></tr>
<tr><td>C</td><td>8</td><td>Find r_{xy} from given data $n = 10, \sum(x - \bar{x})(y - \bar{y}) = 1650, \sigma_x^2 = 196,$ $\sigma_y^2 = 225.$
Answer: $r = 0.7857$</td></tr>
<tr><td>C</td><td>9</td><td>Determine the coefficient of correlation if $n = 8, \bar{x} = 0.5, \bar{y} = 0.5,$ $\sum x^2 = 44, \quad \sum y^2 = 44, \sum xy = -40.$
Answer: $r = -1$</td></tr>
</table>

Method 5 ⇝ Rank Correlation Coefficient

Example of Method-5: Rank Correlation Coefficient

A **1**

Two Judges in a beauty contest rank the 12 contestants as follows:

1st judge	1	2	3	4	5	6	7	8	9	10	11	12
2nd judge	12	9	6	10	3	5	4	7	8	2	11	1

What degree of agreement is there between the judges?

Answer: $\rho = -0.4545$

C **2**

Ten competitors in a musical test were ranked by the three judges A, B, and C in the following order:

Rank by A	1	6	5	10	3	2	4	9	7	8
Rank by B	3	5	8	4	7	10	2	1	6	9
Rank by C	6	4	9	8	1	2	3	10	5	7

Using the rank correlation method, find which pair of judges has the nearest approach to common linking in music.

Answer: **Judges A and C has nearest approach**

$[\ \rho_{AB} = -0.2121, \rho_{BC} = -0.2970, \rho_{AC} = 0.6364\ ]$

C **3**

Obtain the rank correlation coefficient for the following data:

x	68	64	75	50	64	80	75	40	55	64
y	62	58	68	45	81	60	68	48	50	70

Answer: $\rho = 0.5455$

C **4**

From the following data of the marks obtained by 8 students in Computer Networking (CN) and Compiler Design (CD) papers, compute rank coefficient of correlation.

CN	15	20	28	12	40	60	20	80
CD	40	30	50	30	20	10	30	60

Answer: $\rho = 0$

Method 6 ⇝ Linear Regression

Example of Method-6: Linear Regression

B	1	Find the regression line of y on x for the following data: x: 2, 3, 4, 4, 5, 6, 6, 7, 7, 8, 10, 10 y: 1, 3, 2, 4, 4, 4, 6, 4, 6, 7, 9, 10 **Answer: $y = 0.9891x - 0.9166$**
B	2	Obtain two regression lines from the following data: x: 65, 66, 67, 67, 68, 69, 70, 72 y: 67, 68, 65, 68, 72, 72, 69, 71 **Answer: $x = 0.5455y + 30.3605$; $y = 0.6667x + 23.6644$**
B	3	The amount of chemical compound (y), which were dissolved in 100 grams of water at various temperatures (x): x: 15, 15, 30, 30, 45, 45, 60, 60 y: 12, 10, 25, 21, 31, 33, 44, 39 Find the equation of the regression line of y on x and estimate y if $x = 50°C$. **Answer: $y = 0.67x + 1.75$, 35.25**
C	4	For following data calculate the regression line of performing rating on experience and also estimate the probable performance if an operator has 11 years' experience. Operator: 1, 2, 3, 4, 5, 6 Performance rating: 78, 36, 98, 25, 75, 82 Experience: 84, 51, 91, 60, 68, 62 **Answer: $y = 0.4094\,x + 42.4494$; 46.9528 ; x = Experience**
C	5	The following values are available for the variable x & y. Obtain regression lines. $n = 10, \sum x = 30, \sum y = 40, \sum x^2 = 222, \sum y^2 = 985, \sum xy = 384.$ **Answer: $y = 2x - 2$; $x = 0.32y + 1.72$**

<table>
<tr><td>C</td><td>6</td><td>Find the lines of regression of y on x if $n = 9, \sum x = 30.3, \sum y = 91.1, \sum xy = 345.09, \sum x^2 = 115.11$. Also, find value of y(1.5) and y(5.0).

Answer: $y = 2.93x + 0.2568$; $y(1.5) = 4.6523$; $y(5.0) = 14.9083$</td></tr>
<tr><td>C</td><td>7</td><td>Find the regression lines from the following data. where, r = 0.5.
<table><tr><td></td><td>x</td><td>y</td></tr><tr><td>Mean</td><td>60</td><td>67.5</td></tr><tr><td>Standard deviation</td><td>15</td><td>13.5</td></tr></table>Answer: $y = 0.45x + 40.5$; $x = 0.5556y + 22.4970$</td></tr>
<tr><td>C</td><td>8</td><td>Find the regression equation showing the capacity utilization on production from the following data:
<table><tr><td></td><td>Average</td><td>Standard deviation</td></tr><tr><td>Production (lakh units)</td><td>35.6</td><td>10.5</td></tr><tr><td>Capacity utilization (%)</td><td>84.8</td><td>8.5</td></tr><tr><td>Correlation coefficient</td><td colspan="2">r = 0.62</td></tr></table>Estimate the production when capacity utilization is 70%.

Answer: $x = 0.5019y + 66.9324$; $y = 0.7659x - 29.3483$; 24.2627

x = Capacity utilization ; y = Production</td></tr>
</table>

Method 7 ⇝ Curve Fitting

Example of Method-7.1: Fitting a Stright Line

B 1 By the method of least square, find the straight line that best fits the following data:

x	1	2	3	4	5
y	14	27	40	55	68

Answer: $y = 13.6x$

B 2 Fit a straight line for following data. Also, find y when x = 2.8

x	2	5	6	9	11
y	2	4	6	9	10

Answer: $y = -0.0244 + 0.9431x$; $y(2.8) = 2.6163$

B 3 Fit a straight line to the following data:

x	71	68	73	69	67	65	66	67
y	69	72	70	70	68	67	68	68

Answer: $y = 46.9394 + 0.3232x$

B 4 The weight of a calf taken at weekly intervals are given below. Fit a straight-line using method of least squares.

Age (x)	1	2	3	4	5	6	7	8	9	10
Weight (y)	52.5	58.7	65	70.2	75.4	81.1	87.2	95.5	102.5	108.4

Answer: $y = 45.6867 + 6.1752x$

B 5 The following show the gain in reading speed of 3 students in a speed-reading program, and the number of weeks they have been in the program:

No. of weeks	3	5	2	8	6	9	3	4
Speed gain	86	118	49	193	164	232	73	109

Find a straight line by the method of least squares.

Answer: $y = 3.3409 + 24.9318x$

C	6	If P is the pull required to lift a load W by means of a pulley block, find a linear approximation of the form $P = mW + c$ connecting P and W, using the following data:

P	13	18	23	27
W	51	75	102	119

Answer: $P = 0.2028W + 2.6580$

Example of Method-7.2: Fitting a Parabola

B | 1

Fit a second-degree polynomial of y on x to the following data:

x	50	70	100	120
y	12	15	21	25

Answer: $\mathbf{y = 5.5259 + 0.1029x + 0.0005x^2}$

B | 2

Fit a parabola to the following observations:

x	1	2	3	4	5	6
y	3.13	3.76	6.94	12.62	20.86	31.53

Answer: $\mathbf{y = 4.982 - 3.1199x + 1.2579x^2}$

B | 3

Fit a parabola $y = a + bx + cx^2$ to the following data:

x	1	2	3	5	6
y	1.1	5.8	17.5	55.9	86.7

Answer: $\mathbf{y = 2.7227 - 4.5528x + 3.0771x^2}$

B | 4

Fit a second-degree parabola $y = a + bx + cx^2$ to the following data:

x	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	1.1	1.3	1.6	2.0	2.7	3.4	4.1

Answer: $\mathbf{y = 1.0357 - 0.1929\,x + 0.2429\,x^2}$

C | 5

For 10 randomly selected observations, the following data were recorded.

Observation Number	1	2	3	4	5	6	7	8	9	10
Overtime Hours (x)	1	1	2	2	3	3	4	5	6	7
Additional units (y)	2	7	7	10	8	12	10	14	11	14

Determine the coefficient of regression using the non-linear $y = a + b_1x + b_2x^2$.

Answer: $\mathbf{y = 1.8022 + 3.4823x - 0.2690x^2}$

<table>
<tr>
<td>C</td>
<td>6</td>
<td>The following are the data on the drying time of a certain varnish and the amount of an additive that is intended to reduce the drying time?
<table>
<tr><td>Amount of varnish additive(grams)”x”</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>Drying time(hr.) “y”</td><td>12</td><td>10.5</td><td>10</td><td>8</td><td>7</td><td>8</td><td>7.5</td><td>8.5</td><td>9</td></tr>
</table>
Fit a second-degree polynomial by the method of least square.
Use the result to predict the drying time of the varnish when 6.5 gm of the additive is being used.

Answer: $y = 12.1848 - 1.8465x + 0.1829x^2$; $y(6.5) = 7.9101$</td>
</tr>
<tr>
<td>B</td>
<td>7</td>
<td>Fit a second – degree parabola $y = ax^2 + bx + c$ to the following data:
<table>
<tr><td>x</td><td>−1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>y</td><td>5</td><td>6</td><td>21</td><td>50</td><td>93</td></tr>
</table>
Answer: $y = 7x^2 + 8x + 6$</td>
</tr>
</table>

Method 8 ⇝ Moving Average Method

Example of Method-8: Moving Average Method

A 1 Calculate 3 yearly moving averages of the following data.

Years	1971	1972	1973	1974	1975	1976	1977
Value	2	6	1	5	3	7	2

Answer: 3, 4, 3, 5, 4

A 2 Calculate 3 yearly moving averages of the following data.

Years	1971	1972	1973	1974	1975	1976	1977
Value	5	8	1	3	4	7	9

Answer: 4.666, 4, 2.666, 4.666, 6.666

A 3 Calculate 3 yearly moving averages of the following data.

Years	1971	1972	1973	1974	1975
Sales	120	80	100	160	140

Answer: 100, 113.33, 133.33

B 4 Calculate 4 yearly moving averages of the following data.

Years	1971	1972	1973	1974	1975	1976	1977
Value	2	6	1	5	3	7	2

Answer: 3.625, 3.875, 4.125

B 5 Compute the trends by the method of moving averages, assuming that 4-year cycle is present in the following series.

Year	1998	1999	2000	2001	2002	2003
Value	154	140.5	147	148.5	142.9	142.1

2004	2005	2006	2007	2008
136.6	142.7	145.7	145.1	137.8

Answer: 146.11, 144.92, 143.82, 141.8, 141.42, 142.15, 142.67

B	6	Calculate 4 yearly moving averages of the following data. <table><tr><td>Year</td><td>1998</td><td>1999</td><td>2000</td><td>2001</td><td>2002</td><td>2003</td></tr><tr><td>Value</td><td>75</td><td>60</td><td>54</td><td>69</td><td>86</td><td>65</td></tr><tr><td></td><td>2004</td><td>2005</td><td>2006</td><td>2007</td><td></td><td></td></tr><tr><td></td><td>63</td><td>80</td><td>90</td><td>72</td><td></td><td></td></tr></table> **Answer: 65.87, 67.87, 69.62, 72.12, 74, 75.37**
A	7	Calculate 5 yearly moving averages of the following data. <table><tr><td>Years</td><td>2001</td><td>2002</td><td>2003</td><td>2004</td><td>2005</td><td>2006</td><td>2007</td><td>2008</td><td>2009</td></tr><tr><td>Value</td><td>124</td><td>120</td><td>135</td><td>140</td><td>145</td><td>158</td><td>162</td><td>170</td><td>175</td></tr></table> **Answer: 132.8, 139.6, 148, 155, 162**
A	8	Calculate 5 yearly moving averages of the following data. <table><tr><td>Years</td><td>1991</td><td>1992</td><td>1993</td><td>1994</td><td>1995</td><td>1996</td><td>1997</td><td>1998</td></tr><tr><td>Value</td><td>100</td><td>120</td><td>150</td><td>160</td><td>190</td><td>210</td><td>350</td><td>415</td></tr></table> **Answer: 144, 166, 212, 265**
B	9	Calculate 6 yearly moving averages of the following data. <table><tr><td>Years</td><td>1971</td><td>1972</td><td>1973</td><td>1974</td><td>1975</td><td>1976</td><td>1977</td><td>1978</td><td>1979</td></tr><tr><td>Value</td><td>25</td><td>49</td><td>55</td><td>12</td><td>52</td><td>40</td><td>88</td><td>12</td><td>44</td></tr></table> **Answer: 44.083, 46.25, 42.25**
B	10	Calculate 6 yearly moving averages of the following data. <table><tr><td>Years</td><td>1991</td><td>1992</td><td>1993</td><td>1994</td><td>1995</td><td>1996</td><td>1997</td><td>1998</td></tr><tr><td>Value</td><td>100</td><td>120</td><td>150</td><td>160</td><td>190</td><td>210</td><td>350</td><td>415</td></tr></table> **Answer: 175.83, 221.25**
A	11	Calculate 7 yearly moving averages of the following data. <table><tr><td>Years</td><td>2001</td><td>2002</td><td>2003</td><td>2004</td><td>2005</td><td>2006</td><td>2007</td><td>2008</td><td>2009</td></tr><tr><td>Value</td><td>124</td><td>120</td><td>135</td><td>140</td><td>145</td><td>158</td><td>162</td><td>170</td><td>175</td></tr></table> **Answer: 140.57, 147.14, 155**

A	12	Calculate 7 yearly moving averages of the following data.

Years	1971	1972	1973	1974	1975	1976	1977	1978	1979
Value	25	49	55	12	52	40	88	12	44

Answer: 45.85, 44, 43.28

*** * * * * End of the Unit * * * * ***