BACKGROUND OF THE COMPANY

The Mall of Asia (MOA) Administration Office is the central management office for the Mall of Asia Complex, one of the largest and most popular commercial and entertainment hubs in the Philippines. Located in Pasay City, Metro Manila, the MOA Complex covers a total land area of 42 hectares, making it one of the largest mixed-use developments in Asia.

The MOA Administration Office serves as the nerve center of the MOA Complex, overseeing the operations of various departments and facilities within the complex. The office is responsible for ensuring the smooth and efficient functioning of the MOA Complex, including its world-class mall, convention center, arena, and entertainment venues.

The MOA Administration Office is headed by a team of experienced executives and managers who oversee different areas of operation, including leasing and tenant management, property management, marketing and promotions, and events management. The team works closely with the tenants, service providers, and other stakeholders within the MOA Complex to ensure that the complex runs smoothly and efficiently.

The MOA Complex is owned and managed by SM Prime Holdings, Inc., one of the largest real estate developers in the Philippines. The Mall of Asia, in particular, is the company's flagship project and has been recognized as one of the world's largest malls.

PRESENTATION OF CASE STUDY

A. Background

The study aimed to examine the job preferences of employees working at the Mall of Asia Administration Office in Pasay City, Philippines. The researchers conducted a survey of 38 participants or respondents who were selected using a purposive sampling technique. The respondents were chosen based on their willingness to participate in the study and their availability during the survey period.

The survey gathered information on the respondents' age, gender, salary, and years of experience. Additionally, the survey included ten questions that aimed to determine what employees want from their job. These questions focused on factors such as job security, work-life balance, salary and benefits, career advancement, and work environment, among others.

The survey data were analyzed using presentations, such as tabular form, pictograph, pie chart, histograph, frequency polygon and using descriptive statistics such as mean, median, mode, standard deviation, fractiles, range, percentile range, quartile deviation, variance, and correlation and regression analysis. The findings of the study provided insights into the job preferences of employees working at the Mall of Asia Administration Office.

The study is significant as it can help the management of the Mall of Asia Administration Office to better understand the job preferences of its employees and tailor its policies and programs accordingly. By addressing the needs and wants of its employees, the management can create a more satisfied and productive workforce, which can have a positive impact on the overall performance and success of the organization.

Moreover, the study can also contribute to the existing body of knowledge on job preferences and employee satisfaction, particularly in the context of the Philippines. It can serve as a reference for future studies on similar topics and can provide insights for other organizations seeking to improve their employee satisfaction and performance.

B. METHODS

1. Survey Questionnaires through Google Form

2. Tabular Form, Pictograph. Pie Graph, Histogram, Frequency Polygon and Ogive

3. Mean, Median, Mode, Weighted Mean

4. Fractiles

5. Range, Percentile Range, Quartile Deviation, Variance (s2), Standard Deviation

6. Skewness and Kurtosis

7. Correlation Analysis

8. Regression Analysis

C. RESULT OF THE STUDY

C.1 Data Presentation

C.1.1 Age Tabular Form

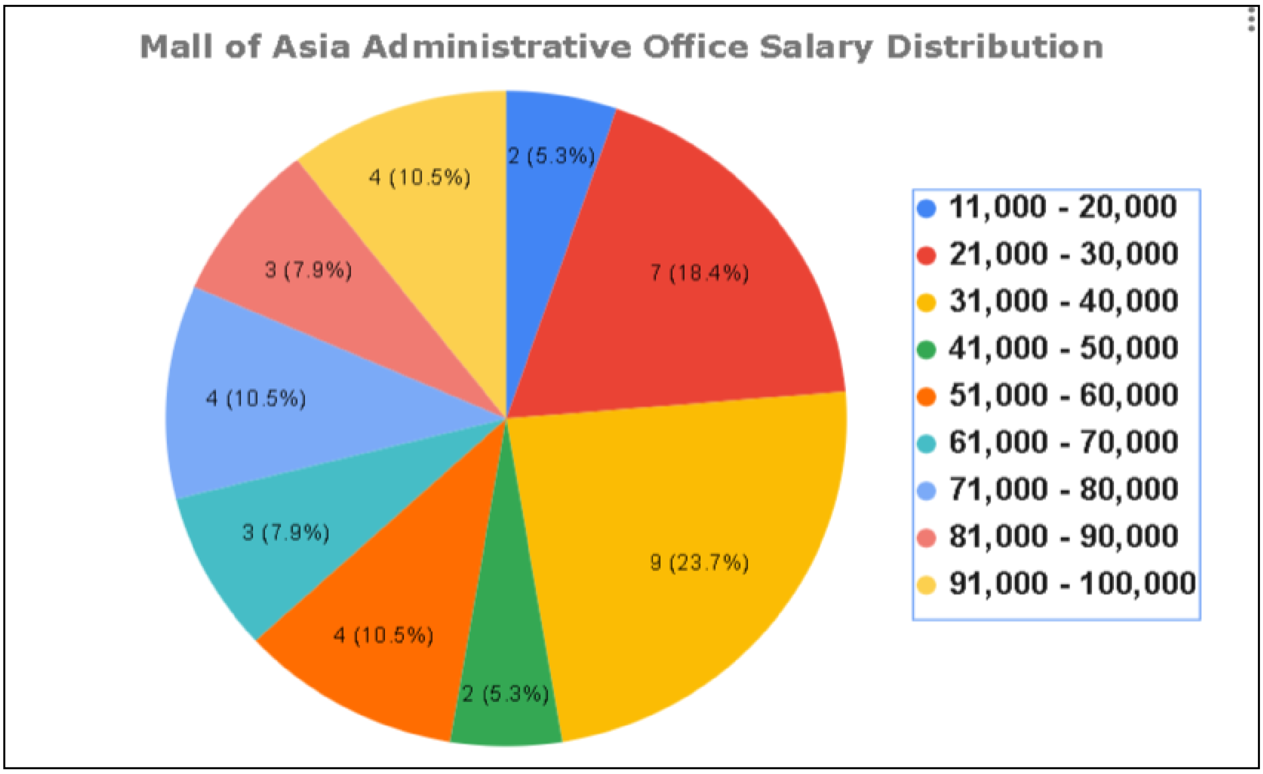
Table 1

Mall of Asia Administrative Office
Age Distribution

Class Interval	Respondents
Below 21	1
21 - 25	3
26 - 30	6
31 - 35	9
36 - 40	12
41 - 45	3
46 - 50	2
51 - 55	1
56 - 60	1
Total	38

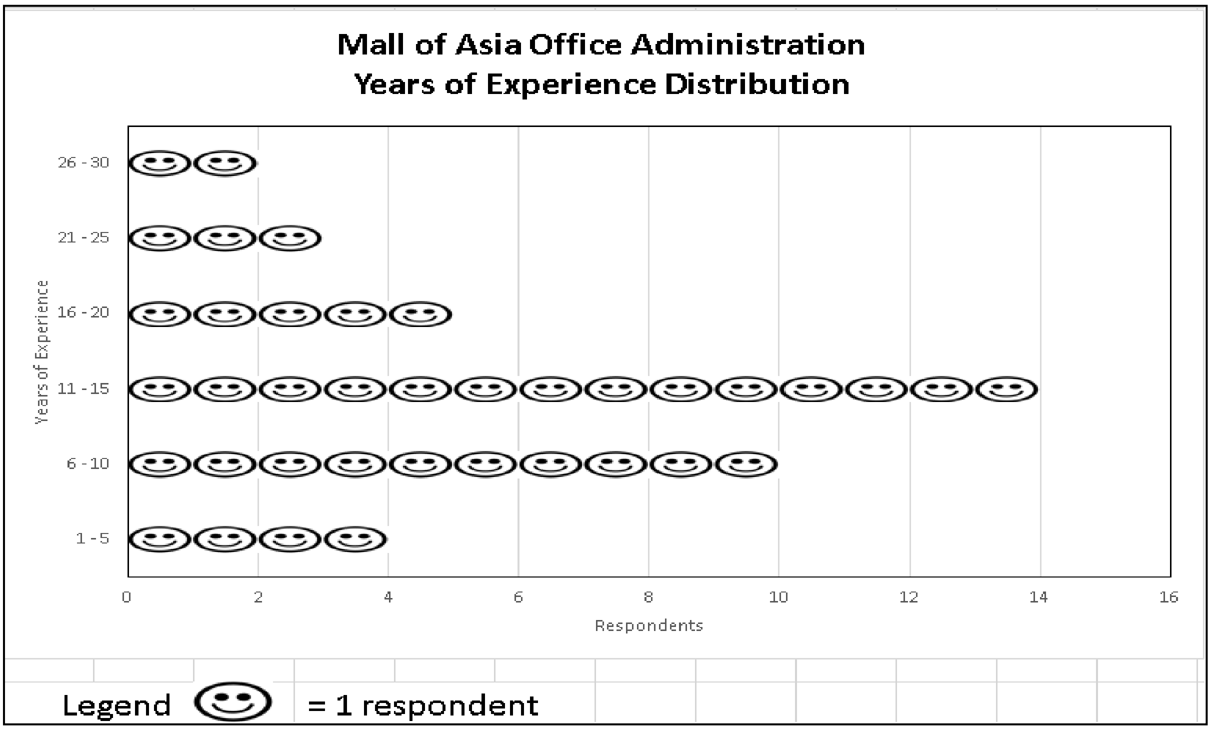
Table 1: Age Distribution

C.1.2 Salary Pie Graph

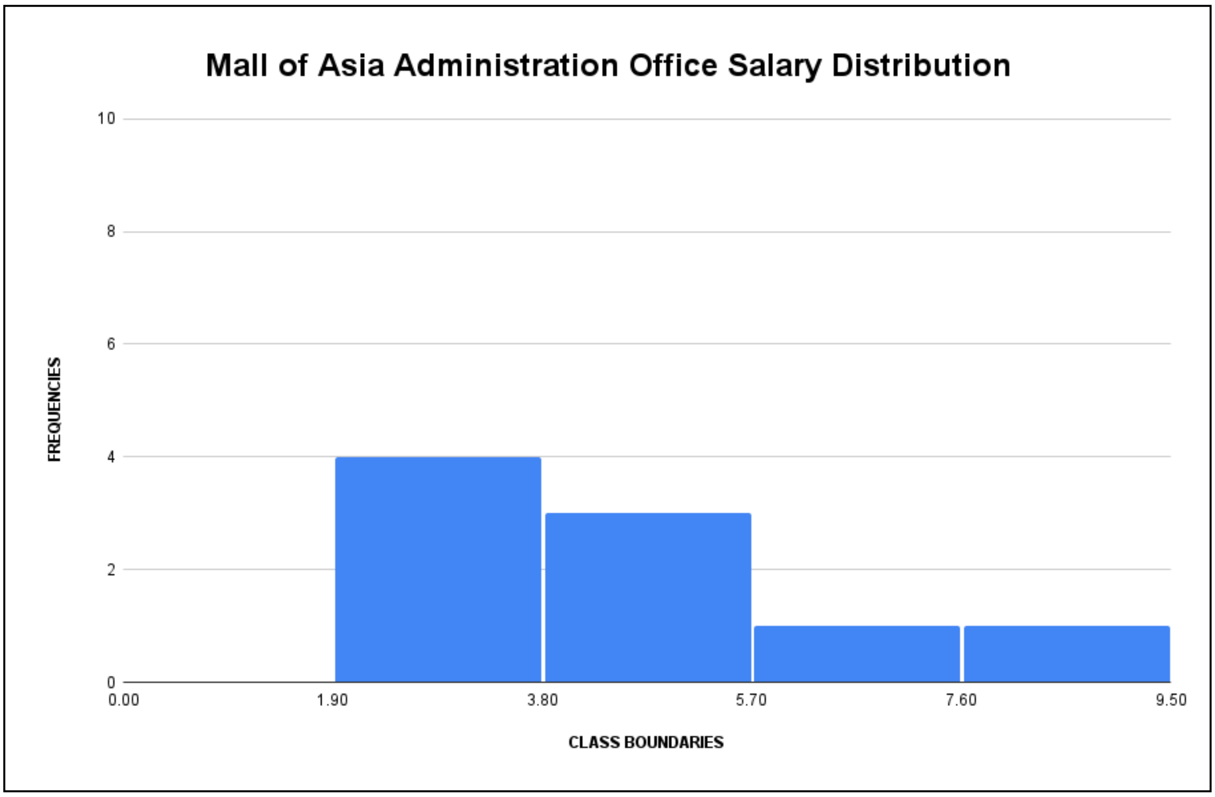


As shown in the pie graph, it shows that the salary 31,000 – 40,000 occupies the highest space on the circle with 23.7%, followed by 21,000 – 40,000 with 18.4%, 91.000 – 10,000 with 10.5%.

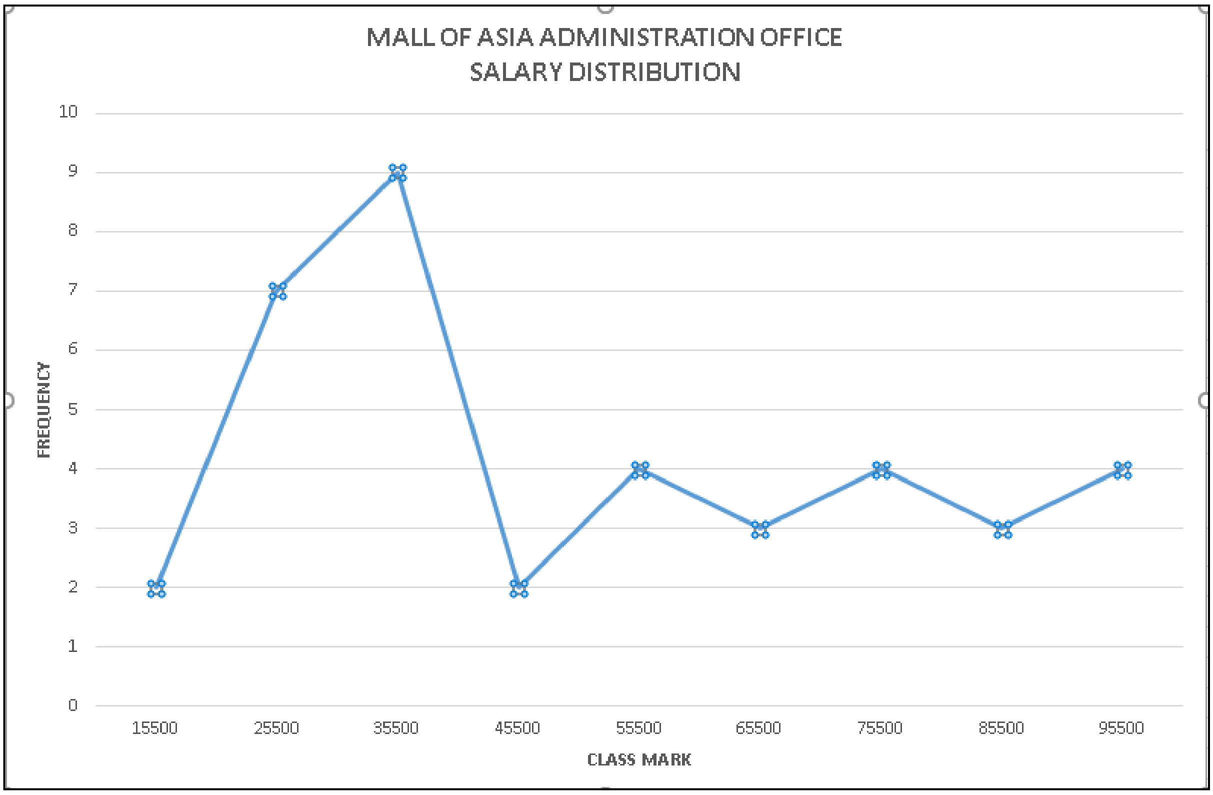
C.1.3 Years of Experience Pictograph



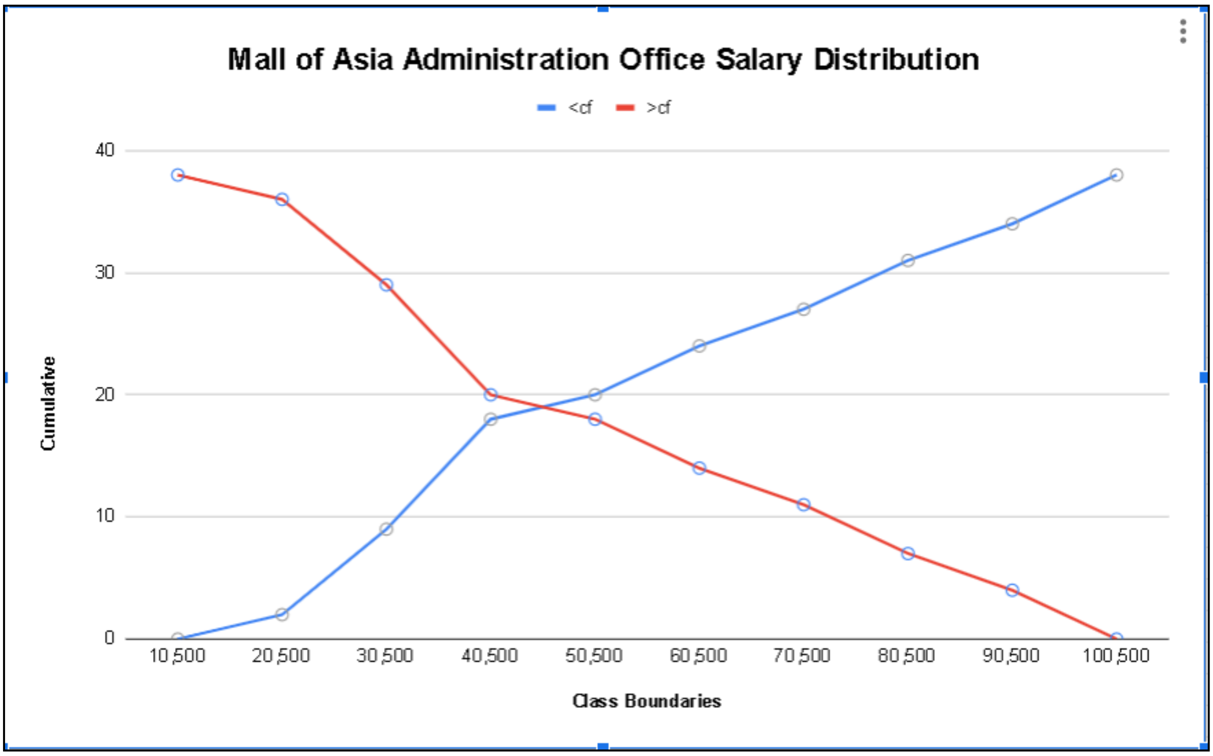
C.1.4 Salary Histogram



C.1.5 Salary Frequency Polygon



C.1.6. Salary Ogive



C.2. Measure of Central Tendency

C.2.1 Mean, Median, Mode for Ungrouped Data

C.2.1.1 Age - Mean

$$\text{Mean } \bar{x} = \frac{\sum x}{n}$$

$$= \frac{32+31+40+38+34+26+23+35+37+37+27+38+52+39+46+42+37+19+44+35+35+47+57+4}{38}$$

$$= \frac{1334}{38}$$

$$= 35.11$$

35.11 is the average age of Mall of Asia Administration Office employees.

C.2.1.2 Age - Median

Observations in the ascending order are :
19,22,23,23,26,26,27,27,29,29,31,31,32,32,34,34,35,35,**35,36**,37,37,37,
37,37,38,38,38,39,40,40,42,42,44,46,47,52,57

= (35+36) / 2

= 35.5

From the array, the age 35.5 is the Md, eighteen (18) ages lie below it and another eighteen (18) ages above it.

C.2.1.3 Age - Mode

In the given data, the age **37** occurs maximum number of times (5).

C.2.1.4 Salary - Mean

51000 52000 55000 91000 40000 32000 22000 40000 27000 91000 27000 88000 90000 81000 37000 92000 39000 11000 65000 39000 36000 95000 69000 72000 80000 76000 28000 39000 43000 29000 45000 29000 52000 62000 31000 15000 24000 75000

=(51000+52000+55000+91000+40000+32000+22000+40000+27000+91000+27000+88000+90000+81000+37000+92000+39000+11000+65000+39000+36000+95000+69000+72000+80000+76000+28000+39000+43000+29000+45000+29000+52000+62000+31000+15000+24000+75000) / 38

= 1,970,000 / 38

= 51,842.11

Php51,482.11 is the average salary of Mall of Asia Administration Office employees.

C.2.1.5 Salary - Median

Observations in the ascending order are :
11000,15000,22000,24000,27000,27000,28000,29000,29000,31000,32000,36000,37000,39000,39000,39000,40000,40000,**43000,45000**,51000,52000,52000,55000,62000,65000,69000,72000,75000,76000,80000,81000,88000,90000,91000,91000,92000,95000

= 43000+45000 / 2

= 44000 is the Md

C.2.1.6 Salary - Mode

In the given data, the salary **39000** occurs maximum number of times (3).

C.2.1.7 Years of Experience - Mean

12 13 14 16 14 9 4 9 14 15 10 10 24 14 27 23 14 4 17 13 12 25 30 19 14 14 7 8 17 9 12 7 4 14 17 2 8 9

=12+13+14+16+14+9+4+9+14+15+10+10+24+14+27+23+14+4+17+13 +12+25+30+19+14+14+7+8+17+9+12+7+4+14+17+2+8+9 / 38

=504 / 38

=13.26

13.26 is the average years of experience of Mall of Asia Administration Office employees.

C.2.1.8 Years of Experience - Median

Observations in the ascending order are:
2,4,4,4,7,7,8,8,9,9,9,9,10,10,12,12,12,13,**13,14**,14,14,14,14,14,14,14,15 ,16,17,17,17,19,23,24,25,27,30

= 13+14 / 2

= 13.5 is the Md

C.2.1.9 Years of Experience - Mode

In the given data, the 14 years of experience occurs maximum number of times (8).

C.2.2 MEAN, MEDIAN, MODE FOR GROUPED DATA

C.2.2.1 Age and Sex Disaggregated Data – Mean, Median, Mode

Table 2

Employee's Age and Sex Disaggregated Data of Mall of Asia

Age Interval	Male	Female	Class Mark	fx (male)	fx (female)	d (male)	fd (male)	d (female)	fd (female)
21 - 25	1	3	23	23	69	-3	-3	-2	-6
26 - 30	1	5	28	28	140	-2	-2	-1	-5
31 - 35	2	6	33	66	198	-1	-2	0	0
36 - 40	9	3	38	342	114	0	0	1	3
41 - 45	1	2	43	43	86	1	1	2	4
46 - 50	1	1	48	48	48	2	2	3	3
51- 55	1	0	53	53	0	3	3	4	0
56 - 60	1	0	58	58	0	4	4	5	0
Total	17	20		661	655		3		-1

Long Method	
Male (Mean)	38.88
Female (Mean)	32.75

Short Method	
Male	38.88
Female	32.75

<u>38.88 is the average age of male employees in MOA</u>

<u>32.75 is the average age of female employees in MOA</u>

Median $M = L + \frac{\frac{n}{2} - cf}{f} \cdot c$

$= 35.5 + \frac{8.5 - 4}{9} \cdot 5$

$= 35.5 + \frac{4.5}{9} \cdot 5$

$= 35.5 + 2.5$

$= 38$

$Z = L + \left(\frac{f_1 - f_0}{2 \cdot f_1 - f_0 - f_2} \right) \cdot c$

$= 35.5 + \left(\frac{9 - 2}{2 \cdot 9 - 2 - 1} \right) \cdot 5$

$= 35.5 + \left(\frac{7}{15} \right) \cdot 5$

$= 35.5 + 2.3333$

$= 37.8333$

<u>38 is the Md age of male MOA employees.</u>
<u>37.83 is the Mo age of male MOA employees.</u>

$$\text{Median } M = L + \frac{\frac{n}{2} - cf}{f} \cdot c$$

$$= 30.5 + \frac{10 - 8}{6} \cdot 5$$

$$= 30.5 + \frac{2}{6} \cdot 5$$

$$= 30.5 + 1.6667$$

$$= 32.1667$$

$$Z = L + \left(\frac{f_1 - f_0}{2 \cdot f_1 - f_0 - f_2}\right) \cdot c$$

$$= 30.5 + \left(\frac{6 - 5}{2 \cdot 6 - 5 - 3}\right) \cdot 5$$

$$= 30.5 + \left(\frac{1}{4}\right) \cdot 5$$

$$= 30.5 + 1.25$$

$$= 31.75$$

32.17 is the Md age of female MOA employees.
31.75 is the Mo age of female MOA employees.

C.2.3 Weighted Mean for Job Factor

Table 3 Interpretation for Job Factor: Interesting Job					
Rating	Male Respondents	Female Respondents	Interpretation Value	xw (male)	xw (female)
Most important	7	11	5	35	55
More important	4	7	4	16	28
Important	3	2	3	9	6
Less important	1	0	2	2	0
Least important	2	0	1	2	0
	17	20	15	64	89

Index	For Male Interpretation	For Female Interpretation
1 = Least Important 2 = Less Important 3 = Important 4 = More Important 5 = Most Important	x = Exw/Ew 3.764705882 ***4*** ***Male Interpretation: More Important***	x = Exw/Ew 4.45 ***4*** ***Female Interpretation: More Important***

The male and female interpretation for the *Job Factor: Interesting Job* is "More Important".

C.3 Fractiles for Ungrouped Data

C.3.1 Age - Q1 and Q3, D3 and D7, P35 and P75

Calculate Quartile-1&2, Deciles-3&7, Percentile-35&75 from the following age data

32,31,40,38,34,26,23,35,37,37,27,38,52,39,46,42,37,19,44,35,35,47,57,42,40,38,29,34,37,29,37,27,22,32,36,23,26,31

Solution:
Arranging age data in the ascending order, We get :
19,22,23,23,26,26,27,27,29,29,31,31,32,32,34,34,35,35,35,36,37,37,37,37,37,38,38,38,39,40,40,42,42,44,46,47,52,57

Here, *n*=38

$$Q_1 = \left(\frac{n+1}{4}\right)^{th} \text{ value of the observation}$$

$$= \left(\frac{39}{4}\right)^{th} \text{ value of the observation}$$

$$= (9.75)^{th} \text{ value of the observation}$$

$$= 9^{th} \text{ observation} + 0.75\left[10^{th} - 9^{th}\right]$$

$$= 29 + 0.75[29 - 29]$$

$$= 29 + 0.75(0)$$

$$= 29 + 0$$

$$= 29$$

$$D_3 = \left(\frac{3(n+1)}{10}\right)^{th} \text{ value of the observation}$$

$$= \left(\frac{3 \cdot 39}{10}\right)^{th} \text{ value of the observation}$$

$$= (11.7)^{th} \text{ value of the observation}$$

$$= 11^{th} \text{ observation} + 0.7\left[12^{th} - 11^{th}\right]$$

$$= 31 + 0.7[31 - 31]$$

$$= 31 + 0.7(0)$$

$$= 31 + 0$$

$$= 31$$

$$P_{35} = \left(\frac{35(n+1)}{100}\right)^{th} \text{ value of the observation}$$

$$= \left(\frac{35 \cdot 39}{100}\right)^{th} \text{ value of the observation}$$

$$= (13.65)^{th} \text{ value of the observation}$$

$$= 13^{th} \text{ observation} + 0.65\left[14^{th} - 13^{th}\right]$$

$$= 32 + 0.65[32 - 32]$$

$$= 32 + 0.65(0)$$

$$= 32 + 0$$

$$= 32$$

$$Q_2 = \left(\frac{2(n+1)}{4}\right)^{th} \text{ value of the observation}$$

$$= \left(\frac{2 \cdot 39}{4}\right)^{th} \text{ value of the observation}$$

$$= (19.5)^{th} \text{ value of the observation}$$

$$= 19^{th} \text{ observation} + 0.5\left[20^{th} - 19^{th}\right]$$

$$= 35 + 0.5[36 - 35]$$

$$= 35 + 0.5(1)$$

$$= 35 + 0.5$$

$$= 35.5$$

$$D_7 = \left(\frac{7(n+1)}{10}\right)^{th} \text{ value of the observation}$$

$$= \left(\frac{7 \cdot 39}{10}\right)^{th} \text{ value of the observation}$$

$$= (27.3)^{th} \text{ value of the observation}$$

$$= 27^{th} \text{ observation} + 0.3\left[28^{th} - 27^{th}\right]$$

$$= 38 + 0.3[38 - 38]$$

$$= 38 + 0.3(0)$$

$$= 38 + 0$$

$$= 38$$

$$P_{75} = \left(\frac{75(n+1)}{100}\right)^{th} \text{ value of the observation}$$

$$= \left(\frac{75 \cdot 39}{100}\right)^{th} \text{ value of the observation}$$

$$= (29.25)^{th} \text{ value of the observation}$$

$$= 29^{th} \text{ observation} + 0.25\left[30^{th} - 29^{th}\right]$$

$$= 39 + 0.25[40 - 39]$$

$$= 39 + 0.25(1)$$

$$= 39 + 0.25$$

$$= 39.25$$

$Q_1 = 29$ and $Q_2 = 35.5$
$D_3 = 31$ and $D_7 = 38$
$P_{35} = 32$ and $P_{75} = 39.25$

C.3.2 Salary - Q1 and Q3, D3 and D7, P35 and P75

Calculate Quartile-1&2, Deciles-3&7, Percentile-35&75 from the following salary data

51000,52000,55000,91000,40000,32000,22000,40000,27000,91000,27000,88000,90000,81000,37000,92000,39000,11000,65000,39000,36000,95000,69000,72000,80000,76000,28000,39000,43000,29000,45000,29000,52000,62000,31000,15000,24000,75000

Solution:
Arranging salary data in the ascending order, We get :
11000,15000,22000,24000,27000,27000,28000,29000,29000,31000,32000,36000,37000,39000,39000,39000,40000,40000,43000,45000,51000,52000,52000,55000,62000,65000,69000,72000,75000,76000,80000,81000,88000,90000,91000,91000,92000,95000

$$Q_1 = \left(\frac{n+1}{4}\right)^{th} \text{ value of the observation}$$

$$= \left(\frac{39}{4}\right)^{th} \text{ value of the observation}$$

$$= (9.75)^{th} \text{ value of the observation}$$

$$= 9^{th} \text{ observation} + 0.75\left[10^{th} - 9^{th}\right]$$

$$= 29000 + 0.75[31000 - 29000]$$

$$= 29000 + 0.75(2000)$$

$$= 29000 + 1500$$

$$= 30500$$

$$D_3 = \left(\frac{3(n+1)}{10}\right)^{th} \text{ value of the observation}$$

$$= \left(\frac{3 \cdot 39}{10}\right)^{th} \text{ value of the observation}$$

$$= (11.7)^{th} \text{ value of the observation}$$

$$= 11^{th} \text{ observation} + 0.7\left[12^{th} - 11^{th}\right]$$

$$= 32000 + 0.7[36000 - 32000]$$

$$= 32000 + 0.7(4000)$$

$$= 32000 + 2800$$

$$= 34800$$

$$P_{35} = \left(\frac{35(n+1)}{100}\right)^{th} \text{ value of the observation}$$

$$= \left(\frac{35 \cdot 39}{100}\right)^{th} \text{ value of the observation}$$

$$= (13.65)^{th} \text{ value of the observation}$$

$$= 13^{th} \text{ observation} + 0.65\left[14^{th} - 13^{th}\right]$$

$$= 37000 + 0.65[39000 - 37000]$$

$$= 37000 + 0.65(2000)$$

$$= 37000 + 1300$$

$$= 38300$$

$$Q_2 = \left(\frac{2(n+1)}{4}\right)^{th} \text{ value of the observation}$$

$$= \left(\frac{2 \cdot 39}{4}\right)^{th} \text{ value of the observation}$$

$$= (19.5)^{th} \text{ value of the observation}$$

$$= 19^{th} \text{ observation} + 0.5\left[20^{th} - 19^{th}\right]$$

$$= 43000 + 0.5[45000 - 43000]$$

$$= 43000 + 0.5(2000)$$

$$= 43000 + 1000$$

$$= 44000$$

$$D_7 = \left(\frac{7(n+1)}{10}\right)^{th} \text{ value of the observation}$$

$$= \left(\frac{7 \cdot 39}{10}\right)^{th} \text{ value of the observation}$$

$$= (27.3)^{th} \text{ value of the observation}$$

$$= 27^{th} \text{ observation} + 0.3\left[28^{th} - 27^{th}\right]$$

$$= 69000 + 0.3[72000 - 69000]$$

$$= 69000 + 0.3(3000)$$

$$= 69000 + 900$$

$$= 69900$$

$$P_{75} = \left(\frac{75(n+1)}{100}\right)^{th} \text{ value of the observation}$$

$$= \left(\frac{75 \cdot 39}{100}\right)^{th} \text{ value of the observation}$$

$$= (29.25)^{th} \text{ value of the observation}$$

$$= 29^{th} \text{ observation} + 0.25\left[30^{th} - 29^{th}\right]$$

$$= 75000 + 0.25[76000 - 75000]$$

$$= 75000 + 0.25(1000)$$

$$= 75000 + 250$$

$$= 75250$$

Q_1 = 30,500 and Q_2 = 44,000
D_3 = 34,800 and D_7 = 69,900
P_{35} = 38,300 and P_{75} = 75,250

C.3.3 Years of Experience - Q1 and Q3, D3 and D7, P35 and P75

Calculate Quartile-1&2, Deciles-3&7, Percentile-35&75 from the following years of experience data

12,13,14,16,14,9,4,9,14,15,10,10,24,14,27,23,14,4,17,13,12,25,30,19,14,14,7,8,17,9,12,7,4,14,17,2,8,9

Solution:
Arranging Observations in the ascending order, We get :
2,4,4,4,7,7,8,8,9,9,9,9,10,10,12,12,12,13,13,14,14,14,14,14,14,14,14,15,16,17,17,17,19,23,24,25,27,30

$$Q_1 = \left(\frac{n+1}{4}\right)^{th} \text{ value of the observation}$$

$$= \left(\frac{39}{4}\right)^{th} \text{ value of the observation}$$

$$= (9.75)^{th} \text{ value of the observation}$$

$$= 9^{th} \text{ observation} + 0.75\left[10^{th} - 9^{th}\right]$$

$$= 9 + 0.75[9 - 9]$$

$$= 9 + 0.75(0)$$

$$= 9 + 0$$

$$= 9$$

$$D_3 = \left(\frac{3(n+1)}{10}\right)^{th} \text{ value of the observation}$$

$$= \left(\frac{3 \cdot 39}{10}\right)^{th} \text{ value of the observation}$$

$$= (11.7)^{th} \text{ value of the observation}$$

$$= 11^{th} \text{ observation} + 0.7\left[12^{th} - 11^{th}\right]$$

$$= 9 + 0.7[9 - 9]$$

$$= 9 + 0.7(0)$$

$$= 9 + 0$$

$$= 9$$

$$P_{35} = \left(\frac{35(n+1)}{100}\right)^{th} \text{ value of the observation}$$

$$= \left(\frac{35 \cdot 39}{100}\right)^{th} \text{ value of the observation}$$

$$= (13.65)^{th} \text{ value of the observation}$$

$$= 13^{th} \text{ observation} + 0.65\left[14^{th} - 13^{th}\right]$$

$$= 10 + 0.65[10 - 10]$$

$$= 10 + 0.65(0)$$

$$= 10 + 0$$

$$= 10$$

$$Q_2 = \left(\frac{2(n+1)}{4}\right)^{th} \text{ value of the observation}$$

$$= \left(\frac{2 \cdot 39}{4}\right)^{th} \text{ value of the observation}$$

$$= (19.5)^{th} \text{ value of the observation}$$

$$= 19^{th} \text{ observation} + 0.5\left[20^{th} - 19^{th}\right]$$

$$= 13 + 0.5[14 - 13]$$

$$= 13 + 0.5(1)$$

$$= 13 + 0.5$$

$$= 13.5$$

$$D_7 = \left(\frac{7(n+1)}{10}\right)^{th} \text{ value of the observation}$$

$$= \left(\frac{7 \cdot 39}{10}\right)^{th} \text{ value of the observation}$$

$$= (27.3)^{th} \text{ value of the observation}$$

$$= 27^{th} \text{ observation} + 0.3\left[28^{th} - 27^{th}\right]$$

$$= 14 + 0.3[15 - 14]$$

$$= 14 + 0.3(1)$$

$$= 14 + 0.3$$

$$= 14.3$$

$$P_{75} = \left(\frac{75(n+1)}{100}\right)^{th} \text{ value of the observation}$$

$$= \left(\frac{75 \cdot 39}{100}\right)^{th} \text{ value of the observation}$$

$$= (29.25)^{th} \text{ value of the observation}$$

$$= 29^{th} \text{ observation} + 0.25\left[30^{th} - 29^{th}\right]$$

$$= 16 + 0.25[17 - 16]$$

$$= 16 + 0.25(1)$$

$$= 16 + 0.25$$

$$= 16.25$$

$Q_1 = 9$ and $Q_2 = 13.5$
$D_3 = 9$ and $D_7 = 14.3$
$P_{35} = 10$ and $P_{75} = 16.25$

C.4 Fractiles for Grouped Data

C.4.1 Salary - Q1 and Q3, D3 and D7, P35 and P75

Calculate Quartile-1&2, Deciles-3&7, Percentile-35&75 from the following years of experience data

Table 4

Salary Data of MOA Employees

Class	Frequency
11000 - 20000	2
21000 - 30000	7
31000 - 40000	9
41000 - 50000	2
51000 - 60000	4
61000 - 70000	3
71000 - 80000	4
81000 - 90000	3
91000 - 100000	4

Solution:

Class	Class Boundries	Frequency *f*	*cf*
11000 - 20000	10500 - 20500	2	2
21000 - 30000	20500 - 30500	7	9
31000 - 40000	30500 - 40500	9	18
41000 - 50000	40500 - 50500	2	20
51000 - 60000	50500 - 60500	4	24
61000 - 70000	60500 - 70500	3	27
71000 - 80000	70500 - 80500	4	31
81000 - 90000	80500 - 90500	3	34
91000 - 100000	90500 - 100500	4	38
		***n*=38**	--

Here, *n*=38

Q_1 class :

Class with $\left(\frac{n}{4}\right)^{th}$ value of the observation in cf column

$= \left(\frac{38}{4}\right)^{th}$ value of the observation in cf column

$= (9.5)^{th}$ value of the observation in cf column

and it lies in the class 31000 - 40000.

$\therefore Q_1$ class : 30500 - 40500

The lower boundary point of 30500 - 40500 is 30500.

$\therefore L = 30500$

$$Q_1 = L + \frac{\frac{n}{4} - cf}{f} \cdot c$$

$$= 30500 + \frac{9.5 - 9}{9} \cdot 10000$$

$$= 30500 + \frac{0.5}{9} \cdot 10000$$

$$= 30500 + 555.5556$$

$$= 31055.5556$$

D_3 class :

Class with $\left(\frac{3n}{10}\right)^{th}$ value of the observation in cf column

$= \left(\frac{3 \cdot 38}{10}\right)^{th}$ value of the observation in cf column

$= (11.4)^{th}$ value of the observation in cf column

and it lies in the class 31000 - 40000.

$\therefore D_3$ class : 30500 - 40500

The lower boundary point of 30500 - 40500 is 30500.

$\therefore L = 30500$

$$D_3 = L + \frac{\frac{3n}{10} - cf}{f} \cdot c$$

$$= 30500 + \frac{11.4 - 9}{9} \cdot 10000$$

$$= 30500 + \frac{2.4}{9} \cdot 10000$$

$$= 30500 + 2666.6667$$

$$= 33166.6667$$

P_{35} class :

Class with $\left(\frac{35n}{100}\right)^{th}$ value of the observation in cf column

$= \left(\frac{35 \cdot 38}{100}\right)^{th}$ value of the observation in cf column

$= (13.3)^{th}$ value of the observation in cf column

and it lies in the class 31000 - 40000.

$\therefore P_{35}$ class : 30500 - 40500

The lower boundary point of 30500 - 40500 is 30500.

$\therefore L = 30500$

$$P_{35} = L + \frac{\frac{35n}{100} - cf}{f} \cdot c$$

$$= 30500 + \frac{13.3 - 9}{9} \cdot 10000$$

$$= 30500 + \frac{4.3}{9} \cdot 10000$$

$$= 30500 + 4777.7778$$

$$= 35277.7778$$

Q_2 class :

Class with $\left(\frac{2n}{4}\right)^{th}$ value of the observation in cf column

$= \left(\frac{2 \cdot 38}{4}\right)^{th}$ value of the observation in cf column

$= (19)^{th}$ value of the observation in cf column

and it lies in the class 41000 - 50000.

$\therefore Q_2$ class : 40500 - 50500

The lower boundary point of 40500 - 50500 is 40500.

$\therefore L = 40500$

$$Q_2 = L + \frac{\frac{2n}{4} - cf}{f} \cdot c$$

$$= 40500 + \frac{19 - 18}{2} \cdot 10000$$

$$= 40500 + \frac{1}{2} \cdot 10000$$

$$= 40500 + 5000$$

$$= 45500$$

D_7 class :

Class with $\left(\frac{7n}{10}\right)^{th}$ value of the observation in cf column

$= \left(\frac{7 \cdot 38}{10}\right)^{th}$ value of the observation in cf column

$= (26.6)^{th}$ value of the observation in cf column

and it lies in the class 61000 - 70000.

$\therefore D_7$ class : 60500 - 70500

The lower boundary point of 60500 - 70500 is 60500.

$\therefore L = 60500$

$$D_7 = L + \frac{\frac{7n}{10} - cf}{f} \cdot c$$

$$= 60500 + \frac{26.6 - 24}{3} \cdot 10000$$

$$= 60500 + \frac{2.6}{3} \cdot 10000$$

$$= 60500 + 8666.6667$$

$$= 69166.6667$$

P_{75} class :

Class with $\left(\frac{75n}{100}\right)^{th}$ value of the observation in cf column

$= \left(\frac{75 \cdot 38}{100}\right)^{th}$ value of the observation in cf column

$= (28.5)^{th}$ value of the observation in cf column

and it lies in the class 71000 - 80000.

$\therefore P_{75}$ class : 70500 - 80500

The lower boundary point of 70500 - 80500 is 70500.

$\therefore L = 70500$

$$P_{75} = L + \frac{\frac{75n}{100} - cf}{f} \cdot c$$

$$= 70500 + \frac{28.5 - 27}{4} \cdot 10000$$

$$= 70500 + \frac{1.5}{4} \cdot 10000$$

$$= 70500 + 3750$$

$$= 74250$$

Q_1 = 31,055.57 and Q_2 = 45,500
D_3 = 33,166.67 and D_7 = 69,166.67
P_{35} = 35,277.78 and P_{75} = 74,250

C.5 Measures of Variability for Ungrouped Data

C.5.1 Age - Range, Percentile Range, Quartile Deviation, Sample Variance, Standard Deviation

Calculate Sample Variance (*S*2), Sample Standard deviation (*SD*), Quartile deviation, Range, Percentile Range from the following age data

32,31,40,38,34,26,23,35,37,37,27,38,52,39,46,42,37,19,44,35,35,47,57, 42,40,38,29,34,37,29,37,27,22,32,36,23,26,31

Solution:

Quartile deviation:

Arranging Observations in the ascending order, We get:
19,22,23,23,26,26,27,27,29,29,31,31,32,32,34,34,35,35,35,36,37,37,37, 37,37,38,38,38,39,40,40,42,42,44,46,47,52,57

Here, *n*=38

$$Q_1 = \left(\frac{n+1}{4}\right)^{th} \text{ value of the observation}$$

$$= \left(\frac{39}{4}\right)^{th} \text{ value of the observation}$$

$$= (9.75)^{th} \text{ value of the observation}$$

$$= 9^{th} \text{ observation} + 0.75\left[10^{th} - 9^{th}\right]$$

$$= 29 + 0.75[29 - 29]$$

$$= 29 + 0.75(0)$$

$$= 29 + 0$$

$$= 29$$

$$Q_3 = \left(\frac{3(n+1)}{4}\right)^{th} \text{ value of the observation}$$

$$= \left(\frac{3 \cdot 39}{4}\right)^{th} \text{ value of the observation}$$

$$= (29.25)^{th} \text{ value of the observation}$$

$$= 29^{th} \text{ observation} + 0.25\left[30^{th} - 29^{th}\right]$$

$$= 39 + 0.25[40 - 39]$$

$$= 39 + 0.25(1)$$

$$= 39 + 0.25$$

$$= 39.25$$

$$\text{Quartile deviation } = \frac{Q_3 - Q_1}{2} = \frac{39.25 - 29}{2} = \frac{10.25}{2} = 5.12$$

QD = 5.12

Range:

Solution:

Minimum = 19
Maximum = 57

Range = Maximum – Minimum = 57 – 19 = 38

Range = 38

Percentile Range:

90th Percentile = 46.1
10th Percentile = 23

Percentile Range = $P_{90} - P_{10}$ = 46.1 – 23 = 23.1

Percentile Range = 23.1

Sample Variance S^2

$$\text{Sample Variance } S^2 = \frac{\sum dx^2 - \frac{(\sum dx)^2}{n}}{n - 1}$$

$$= \frac{2458 - \frac{(4)^2}{38}}{37}$$

$$= \frac{2458 - 0.42}{37}$$

$$= \frac{2457.58}{37}$$

$$= 66.42$$

S^2 = 66.42

<u>Sample Standard Deviation</u>

Solution:

Sample Standard deviation $S = \sqrt{\text{Sample Variance } S^2}$

$= \sqrt{66.42}$

$= 8.15$

Or
Second method

Sample Standard deviation $S = \sqrt{\dfrac{\sum dx^2 - \dfrac{(\sum dx)^2}{n}}{n - 1}}$

$= \sqrt{\dfrac{2458 - \dfrac{(4)^2}{38}}{37}}$

$= \sqrt{\dfrac{2458 - 0.42}{37}}$

$= \sqrt{\dfrac{2457.58}{37}}$

$= \sqrt{66.42}$

$= 8.15$

SD = 8.15

C.5.2 Salary - Range, Percentile Range, Quartile Deviation, Sample Variance, Standard Deviation

Calculate Sample Variance (*S*2), Sample Standard deviation (*SD*), Quartile deviation, Range, Percentile Range from the following salary data

51000,52000,55000,91000,40000,32000,22000,40000,27000,91000,27000,88000,90000,81000,37000,92000,39000,11000,65000,39000,36000,95000,69000,72000,80000,76000,28000,39000,43000,29000,45000,29000,52000,62000,31000,15000,24000,75000

Solution:

Here, *n*=38

<u>Quartile Deviation</u>

*Q*1 = (*n* + 1 / 4)*th* value of the observation

= (39 / 4)*th* value of the observation

= (9.75)*th* value of the observation

= 9*th* observation +0.75[10*th*-9*th*]

= 29000+0.75[31000-29000]

= 29000+0.75(2000)

= 29000+1500

= 30500

$Q3$ = (3(n+1) / 4)th value of the observation

= (3·39 / 4)th value of the observation

= (29.25)th value of the observation

= 29th observation +0.25[30th-29th]

= 75000+0.25[76000-75000]

= 75000+0.25(1000)

= 75000+250

= 75250

Quartile deviation = $Q3$-$Q1$ / 2

= 75250-30500 / 2

= 44750 / 2

= 22375

QD = 22,375

<u>Range</u>

Minimum =11000

Maximum =95000

Range = Maximum-Minimum

= 95000 – 11000

= 84000

<u>Range is 84,000</u>

<u>Percentile Range</u>

10th percentile = 21,400

90th percentile = 89,600

Percentile Range = Value at p90 - Value at p10

Percentile Range = 89,600 - 21,400

Percentile Range = 68,200

Therefore, the 10th to 90th percentile range for the given data set is 68,200.

<u>Sample Variance S^2</u>

$$\text{Sample Variance } S^2 = \frac{\sum dx^2 - \frac{(\sum dx)^2}{n}}{n - 1}$$

$$= \frac{22793052632 - \frac{(4)^2}{38}}{37}$$

$$= \frac{22793052632 - 0.42}{37}$$

$$= \frac{22793052631.58}{37}$$

$$= 616028449.5$$

S^2 = 616,028,449.5

<u>Sample Standard Deviation</u>

Solution:

Sample Standard deviation $S = \sqrt{\text{Sample Variance } S^2}$

$= \sqrt{616028449.5}$

$= 24819.92$

Or
Second method

Sample Standard deviation $S = \sqrt{\dfrac{\sum dx^2 - \dfrac{(\sum dx)^2}{n}}{n - 1}}$

$$= \sqrt{\dfrac{22793052632 - \dfrac{(4)^2}{38}}{37}}$$

$$= \sqrt{\dfrac{22793052632 - 0.42}{37}}$$

$$= \sqrt{\dfrac{22793052631.58}{37}}$$

$= \sqrt{616028449.5}$

$= 24819.92$

SD = 24,819.92

C.5.3 Years of Experience - Range, Percentile Range, Quartile Deviation, Sample Variance, Standard Deviation

Calculate Sample Variance ($S2$), Sample Standard deviation (SD), Quartile deviation, Range, Percentile Range from the following years of experience data

2,4,4,4,7,7,8,8,9,9,9,9,10,10,12,12,12,13,13,14,14,14,14,14,14,14,14,15,16,17,17,17,19,23,24,25,27,30

Solution:

Here, n=38

<u>Quartile Deviation</u>

$Q1$ = (n+1 / 4)*th* value of the observation

= (39 / 4)*th* value of the observation

= (9.75)*th* value of the observation

= 9*th* observation +0.75[10*th*-9*th*]

= 9+0.75[9-9]

= 9+0.75(0)

= 9+0

= 9

$Q3$ = (3(n+1) / 4)*th* value of the observation

= (3·39 / 4)*th* value of the observation

= (29.25)*th* value of the observation

= 29*th* observation +0.25[30*th*-29*th*]

= 16+0.25[17-16]

= 16+0.25(1)

= 16+0.25

= 16.25

Quartile deviation = $Q3$-$Q1$ / 2

= 16.25 - 9 / 2

= 7.25 / 2

= 3.62

QD = 3.62

Range

Minimum = 2

Maximum = 30

Range = Maximum-Minimum

= 30 – 2

= 28

Range is 28

Percentile Range

10th percentile = 4
90th percentile = 25.

Percentile Range = Value at p90 - Value at p10

Percentile Range = 25 - 4

Percentile Range = 21

Therefore, the 10th to 90th percentile range for the given series is 21.

<u>Sample Variance S^2</u>

$$\text{Sample Variance } S^2 = \frac{\sum dx^2 - \frac{(\sum dx)^2}{n}}{n - 1}$$

$$= \frac{1526 - \frac{(10)^2}{38}}{37}$$

$$= \frac{1526 - 2.63}{37}$$

$$= \frac{1523.37}{37}$$

$$= 41.17$$

S^2 = 41.17

<u>Sample Standard Deviation</u>

Solution:

Sample Standard deviation $S = \sqrt{\text{Sample Variance } S^2}$

$= \sqrt{41.17}$

$= 6.42$

Or
Second method

Sample Standard deviation $S = \sqrt{\dfrac{\sum dx^2 - \dfrac{(\sum dx)^2}{n}}{n - 1}}$

$= \sqrt{\dfrac{1526 - \dfrac{(10)^2}{38}}{37}}$

$= \sqrt{\dfrac{1526 - 2.63}{37}}$

$= \sqrt{\dfrac{1523.37}{37}}$

$= \sqrt{41.17}$

$= 6.42$

SD = 6.42

C.6 Measures of Variability for Grouped Data

C.6.1 Salary - Range, Percentile Range, Quartile Deviation, Sample Variance, Standard Deviation

Calculate Sample Variance (*S*2), Sample Standard deviation (*S*), Quartile deviation, Range, Percentile Range from the following grouped salary data

Class	Frequency
11000 - 20000	2
21000 - 30000	7
31000 - 40000	9
41000 - 50000	2
51000 - 60000	4
61000 - 70000	3
71000 - 80000	4
81000 - 90000	3
91000 - 100000	4

Range

Range = Highest Value - Lowest Value

Range = 100,000 - 11,000

Range = 89,000

Percentile Range

Value at 10th percentile = L + (N/100) x W

Value at 10th percentile = 11000 + (4/100) x 9000

Value at 10th percentile = 11000 + 360

Value at 10th percentile = 11360

Value at 90th percentile = L + (N/100) x W

Value at 90th percentile = 91000 + (36/100) x 9000

Value at 90th percentile = 91000 + 3240

Value at 90th percentile = 94240

Percentile Range = Value at 90th percentile - Value at 10th percentile

Percentile Range = 94240 - 11360

Percentile Range = 82880

Percentile range is 82,880.

Quartile Deviation

Using the same data from the previous computation:

Q1 = 32000

Q3 = 88000

Then, we can compute for the quartile deviation using the formula:

QD = (Q3 - Q1) / 2

Substituting the values:

QD = (88000 - 32000) / 2

QD = 28000

Therefore, the quartile deviation for the grouped salary data is 28,000.

Sample Variance S^2

$$\text{Sample Variance } S^2 = \frac{\sum f \cdot x^2 - \frac{(\sum f \cdot x)^2}{n}}{n - 1}$$

$$= \frac{126919500000 - \frac{(1979000)^2}{38}}{37}$$

$$= \frac{126919500000 - 103064236842.105}{37}$$

$$= \frac{23855263157.8947}{37}$$

$$= 644736842.1053$$

S^2 = 644,736,842.11

<u>Sample Standard Deviation</u>

Solution:

Sample Standard deviation $S = \sqrt{\text{Sample Variance } S^2}$

$= \sqrt{644736842.1053}$

$= 25391.6688$

Or
Second method

Sample Standard deviation $S = \sqrt{\dfrac{\sum f \cdot x^2 - \dfrac{(\sum f \cdot x)^2}{n}}{n - 1}}$

$$= \sqrt{\frac{126919500000 - \dfrac{(1979000)^2}{38}}{37}}$$

$$= \sqrt{\frac{126919500000 - 103064236842.105}{37}}$$

$$= \sqrt{\frac{23855263157.8947}{37}}$$

$= \sqrt{644736842.1053}$

$= 25391.6688$

SD = 25,391.67

C.7 Skewness and Kurtosis for Ungrouped Data

C.7.1 Age

Mean = 35.11

SD = 8.15

x	$(x-\bar{x})$ =(x-35.11)	$(x-\bar{x})2$ =(x-35.11)2	$(x-\bar{x})3$ =(x-35.11)3	$(x-\bar{x})4$ =(x-35.11)4
32	-3.11	9.64	-29.94	92.98
31	-4.11	16.85	-69.19	284.03
40	4.89	23.96	117.27	574.01
38	2.89	8.38	24.26	70.22
34	-1.11	1.22	-1.35	1.49
26	-9.11	82.91	-754.88	6873.37
23	-12.11	146.54	-1773.87	21473.21
35	-0.11	0.01	0	0
37	1.89	3.59	6.8	12.89
37	1.89	3.59	6.8	12.89
27	-8.11	65.7	-532.48	4315.87
38	2.89	8.38	24.26	70.22
52	16.89	285.43	4822.3	81471.5
39	3.89	15.17	59.08	230.1
46	10.89	118.7	1293.15	14088.57
42	6.89	47.54	327.76	2259.8
37	1.89	3.59	6.8	12.89
19	-16.11	259.38	-4177.38	67277.73
44	8.89	79.12	703.72	6259.4
35	-0.11	0.01	0	0
35	-0.11	0.01	0	0
47	11.89	141.48	1682.92	20017.94
57	21.89	479.38	10495.89	229804.71
42	6.89	47.54	327.76	2259.8
40	4.89	23.96	117.27	574.01
38	2.89	8.38	24.26	70.22
29	-6.11	37.27	-227.57	1389.37
34	-1.11	1.22	-1.35	1.49

37	1.89	3.59	6.8	12.89
29	-6.11	37.27	-227.57	1389.37
37	1.89	3.59	6.8	12.89
27	-8.11	65.7	-532.48	4315.87
22	-13.11	171.75	-2250.8	29497.35
32	-3.11	9.64	-29.94	92.98
36	0.89	0.8	0.72	0.64
23	-12.11	146.54	-1773.87	21473.21
26	-9.11	82.91	-754.88	6873.37
31	-4.11	16.85	-69.19	284.03
---	---	---	---	---
1334	0	2457.58	6847.88	523451.29

$$\text{Sample Skewness} = \frac{\sum (x - \bar{x})^3}{(n - 1) \cdot S^3}$$

$$= \frac{6847.88}{37 \cdot (8.15)^3}$$

$$= \frac{6847.88}{37 \cdot 541.33}$$

$$= 0.34$$

$$\text{Sample Kurtosis} = \frac{\sum (x - \bar{x})^4}{(n - 1) \cdot S^4}$$

$$= \frac{523451.29}{37 \cdot (8.15)^4}$$

$$= \frac{523451.29}{37 \cdot 4411.76}$$

$$= 3.21$$

Skewness = 0.34
Kurtosis = 3.21

C.7.2 Salary

Mean = 51842.11

SD = 24,819.92

x	(*x*-¯*x*) =(*x*-51842.11)	(*x*-¯*x*)2 =(*x*-51842.11)2	(*x*-¯*x*)3 =(*x*-51842.11)3	(*x*-¯*x*)4 =(*x*-51842.11)4
51000	-842.11	709141.27	-597171599.36	502881346828.21
52000	157.89	24930.75	3936433.88	621542191.97
55000	3157.89	9972299.17	31491471059.92	99446750715541
91000	39157.89	1533340720.22	60042394518151.3	2351133764289720000
40000	-11842.11	140235457.06	-1660683044175.54	19665983417868200
32000	-19842.11	393709141.27	-7812018224230.94	155006887922898000
22000	-29842.11	890551246.54	-26575924041405.4	793081522709310000
40000	-11842.11	140235457.06	-1660683044175.54	19665983417868200
27000	-24842.11	617130193.91	-15330813238081.3	380849676230231000
91000	39157.89	1533340720.22	60042394518151.3	2351133764289720000
27000	-24842.11	617130193.91	-15330813238081.3	380849676230231000
88000	36157.89	1307393351.8	47272591194051.6	1709277376332290000
90000	38157.89	1456024930.75	55558846041697	2120008598959490000
81000	29157.89	850182825.48	24789541332555.8	722810836749258000
37000	-14842.11	220288088.64	-3269538999854.21	48526841997836100
92000	40157.89	1612656509.7	64760890363026.7	2600661018262600000
39000	-12842.11	164919667.59	-2117915731156.14	27198496758005200
11000	-40842.11	1668077562.33	-68127799387665.8	2782482753938350000
65000	13157.89	173130193.91	2278028867181.81	29974064041865900
39000	-12842.11	164919667.59	-2117915731156.14	27198496758005200
36000	-15842.11	250972299.17	-3975929581571.66	62987094950161500
95000	43157.89	1862603878.12	80386062108179	3469293206774040000
69000	17157.89	294393351.8	5051170141420.03	86667445584364800
72000	20157.89	406340720.22	8190973465519.76	165112780910214000
80000	28157.89	792867036.01	22325466540312	628638136792996000
76000	24157.89	583603878.12	14098641055547.5	340593486552436000
28000	-23842.11	568445983.38	-13552948972153.4	323130836020288000
39000	-12842.11	164919667.59	-2117915731156.14	27198496758005200
43000	-8842.11	78182825.48	-691300772707.39	6112554200781140

29000	-22842.11	521761772.85	-11918137337804.3	272235347610899000
45000	-6842.11	46814404.43	-320309082956.7	2191588462335310
29000	-22842.11	521761772.85	-11918137337804.3	272235347610899000
52000	157.89	24930.75	3936433.88	621542191.97
62000	10157.89	103182825.48	1048120279924.19	10646695475019400
31000	-20842.11	434393351.8	-9053671963843.12	188697584088520000
15000	-36842.11	1357340720.22	-50007289692375	1842373830771710000
24000	-27842.11	775182825.48	-21582721825339	600908412926543000
75000	23157.89	536288088.64	12419303105409	287604914019997000
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1970000	0	22793052631.58	189152858725762	25106253452689900000

$$\text{Sample Skewness} = \frac{\sum (x - \bar{x})^3}{(n-1) \cdot S^3}$$

$$= \frac{189152858725762}{37 \cdot (24819.92)^3}$$

$$= \frac{189152858725762}{37 \cdot 15289777091200.2}$$

$$= 0.33$$

$$\text{Sample Kurtosis} = \frac{\sum (x - \bar{x})^4}{(n-1) \cdot S^4}$$

$$= \frac{25106253452689900000}{37 \cdot (24819.92)^4}$$

$$= \frac{25106253452689900000}{37 \cdot 379491050596003000}$$

$$= 1.79$$

Skewness = 0.33
Kurtosis = 1.79

C.7.3 Years of Experience

Mean = 13.26

SD = 6.42

x	(*x*-¯*x*) =(*x*-13.26)	(*x*-¯*x*)2 =(*x*-13.26)2	(*x*-¯*x*)3 =(*x*-13.26)3	(*x*-¯*x*)4 =(*x*-13.26)4
12	-1.26	1.6	-2.02	2.55
13	-0.26	0.07	-0.02	0
14	0.74	0.54	0.4	0.29
16	2.74	7.49	20.5	56.1
14	0.74	0.54	0.4	0.29
9	-4.26	18.17	-77.48	330.31
4	-9.26	85.81	-794.84	7362.69
9	-4.26	18.17	-77.48	330.31
14	0.74	0.54	0.4	0.29
15	1.74	3.02	5.24	9.1
10	-3.26	10.65	-34.75	113.38
10	-3.26	10.65	-34.75	113.38
24	10.74	115.28	1237.74	13289.43
14	0.74	0.54	0.4	0.29
27	13.74	188.7	2592.15	35608
23	9.74	94.81	923.11	8988.2
14	0.74	0.54	0.4	0.29
4	-9.26	85.81	-794.84	7362.69
17	3.74	13.96	52.18	194.99
13	-0.26	0.07	-0.02	0
12	-1.26	1.6	-2.02	2.55
25	11.74	137.75	1616.79	18976.02
30	16.74	280.12	4688.36	78468.27
19	5.74	32.91	188.81	1083.16
14	0.74	0.54	0.4	0.29
14	0.74	0.54	0.4	0.29
7	-6.26	39.23	-245.69	1538.77
8	-5.26	27.7	-145.79	767.34
17	3.74	13.96	52.18	194.99

9	-4.26	18.17	-77.48	330.31
12	-1.26	1.6	-2.02	2.55
7	-6.26	39.23	-245.69	1538.77
4	-9.26	85.81	-794.84	7362.69
14	0.74	0.54	0.4	0.29
17	3.74	13.96	52.18	194.99
2	-11.26	126.86	-1428.83	16093.14
8	-5.26	27.7	-145.79	767.34
9	-4.26	18.17	-77.48	330.31
---	---	---	---	---
504	0	1523.37	6450.65	201414.68

$$\text{Sample Skewness} = \frac{\sum (x - \bar{x})^3}{(n - 1) \cdot S^3}$$

$$= \frac{6450.65}{37 \cdot (6.42)^3}$$

$$= \frac{6450.65}{37 \cdot 264.18}$$

$$= 0.66$$

$$\text{Sample Kurtosis} = \frac{\sum (x - \bar{x})^4}{(n - 1) \cdot S^4}$$

$$= \frac{201414.68}{37 \cdot (6.42)^4}$$

$$= \frac{201414.68}{37 \cdot 1695.14}$$

$$= 3.21$$

Skewness = 0.66
Kurtosis = 3.21

C.8 Skewness and Kurtosis for Grouped Data

C.8.1 Salary

Mean = 52078.95

SD = 25391.67

Class (1)	Mid value (x) (2)	f (3)	$f \cdot x$ (4)=(2)×(3)	$(x-\bar{x})$ (5)	$f \cdot (x-\bar{x})^2$ (6)=(3)×(5)	$f \cdot (x-\bar{x})^3$ (7)=(5)×(6)	$f \cdot (x-\bar{x})^4$ (8)=(5)×(7)
11000 - 20000	15500	2	31000	-36578.95	2676038781.16	-97886681732030.9	3580591779145340000
21000 - 30000	25500	7	178500	-26578.95	4945083102.49	-131435103513632	3493406698651790000
31000 - 40000	35500	9	319500	-16578.95	2473753462.6	-41012228458959	679939577082742000
41000 - 50000	45500	2	91000	-6578.95	86565096.95	-569507216795.45	3746758005233230
51000 - 60000	55500	4	222000	3421.05	46814404.43	160154541478.35	547897115583827
61000 - 70000	65500	3	196500	13421.05	540373961.22	7252387374252.81	97334672654445600
71000 - 80000	75500	4	302000	23421.05	2194182825.48	51390071438985.3	1203609567913080000
81000 - 90000	85500	3	256500	33421.05	3350900277.01	111990614521067	3742844222151460000
91000 - 100000	95500	4	382000	43421.05	7541551246.54	327462093599650	14218748801037400000
---	---	---	---	---	---	---	---
--	--	n=38	$\sum f \cdot x$=1979000	`--	=23855263157.89	=227351800554017	=27020769973757100000

$$\text{Sample Skewness} = \frac{\sum (x - \bar{x})^3}{(n - 1) \cdot S^3}$$

$$= \frac{227351800554017}{37 \cdot (25391.67)^3}$$

$$= \frac{227351800554017}{37 \cdot 16370944328140.4}$$

$$= 0.38$$

$$\text{Sample Kurtosis} = \frac{\sum (x - \bar{x})^4}{(n - 1) \cdot S^4}$$

$$= \frac{27020769973757100000}{37 \cdot (25391.67)^4}$$

$$= \frac{27020769973757100000}{37 \cdot 415685595567867000}$$

$$= 1.76$$

Skewness = 0.38
Kurtosis = 1.76

C.9 Correlation Analysis

Correlate salary and years of experience using Spearman Rack Difference and Pearson Product Moment Formula

C.9.1 Spearman Rack Difference

Solution:

Salary	***Years of Experience***	***Rx***	***Ry***	***d=Rx-Ry***	***d2***
51000	12	18	23	-5	25
52000	13	16.5	20.5	-4	16
55000	14	15	15.5	-0.5	0.25
91000	16	3.5	10	-6.5	42.25
40000	14	21.5	15.5	6	36
32000	9	28	28.5	-0.5	0.25
22000	4	36	36	0	0
40000	9	21.5	28.5	-7	49
27000	14	33.5	15.5	18	324
91000	15	3.5	11	-7.5	56.25
27000	10	33.5	25.5	8	64
88000	10	6	25.5	-19.5	380.25
90000	24	5	4	1	1
81000	14	7	15.5	-8.5	72.25
37000	27	26	2	24	576
92000	23	2	5	-3	9
39000	14	24	15.5	8.5	72.25
11000	4	38	36	2	4
65000	17	13	8	5	25
39000	13	24	20.5	3.5	12.25
36000	12	27	23	4	16
95000	25	1	3	-2	4
69000	30	12	1	11	121
72000	19	11	6	5	25
80000	14	8	15.5	-7.5	56.25
76000	14	9	15.5	-6.5	42.25
28000	7	32	33.5	-1.5	2.25

39000	8	24	31.5	-7.5	56.25
43000	17	20	8	12	144
29000	9	30.5	28.5	2	4
45000	12	19	23	-4	16
29000	7	30.5	33.5	-3	9
52000	4	16.5	36	-19.5	380.25
62000	14	14	15.5	-1.5	2.25
31000	17	29	8	21	441
15000	2	37	38	-1	1
24000	8	35	31.5	3.5	12.25
75000	9	10	28.5	-18.5	342.25
---	---	---	---	---	---
--	--	--	--	--	3440

$$r = 1 - \frac{6 \cdot \sum d^2}{n\left(n^2 - 1\right)}$$

$$= 1 - \frac{6 \cdot 3440}{38 \cdot \left(38^2 - 1\right)}$$

$$= 1 - \frac{6 \cdot 3440}{38 \cdot (1444 - 1)}$$

$$= 1 - \frac{20640}{54834}$$

$$= 1 - 0.38$$

$$= 0.62$$

Or

Repeated ranks:

$$r = 1 - \frac{6 \cdot \left(\sum d^2 + \sum \frac{m(m^2-1)}{12} \right)}{n(n^2-1)}$$

$$= 1 - \frac{6 \cdot \left(3440 + \frac{2 \cdot (2^2-1)}{12} + \frac{2 \cdot (2^2-1)}{12} + \frac{2 \cdot (2^2-1)}{12} + \frac{3 \cdot (3^2-1)}{12} + \frac{2 \cdot (2^2-1)}{12} + \frac{2 \cdot (2^2-1)}{12} + \frac{3 \cdot (3^2-1)}{12} + \frac{8 \cdot (8^2-1)}{12} + \frac{2 \cdot (2^2-1)}{12} + \frac{3 \cdot (3^2-1)}{12} + \frac{2 \cdot (2^2-1)}{12} + \frac{4 \cdot (4^2-1)}{12} + \frac{2 \cdot (2^2-1)}{12} + \frac{2 \cdot (2^2-1)}{12} + \frac{3 \cdot (3^2-1)}{12}\right)}{38 \cdot (38^2-1)}$$

$$= 1 - \frac{6 \cdot (3440 + 0.5 + 0.5 + 0.5 + 2 + 0.5 + 0.5 + 2 + 42 + 0.5 + 2 + 0.5 + 5 + 0.5 + 0.5 + 2)}{38 \cdot (1444 - 1)}$$

$$= 1 - \frac{20997}{54834}$$

$$= 1 - 0.38$$

$$= 0.62$$

R = 0.62

<u>This denotes a substantial positive correlation between the data salary and years of experience of MOA employees.</u>

C.9.2 Pearson Product Moment Formula

Solution:

X - Mx	Y - My	(X - Mx)2	(Y - My)2	(X - Mx)(Y - My)
-842.105	-1.263	709141.274	1.596	1063.712
157.895	-0.263	24930.748	0.069	-41.551
3157.895	0.737	9972299.169	0.543	2326.87
39157.895	2.737	1533340720	7.49	107168.975
-11842.105	0.737	140235457.1	0.543	-8725.762
-19842.105	-4.263	393709141.3	18.175	84590.028
-29842.105	-9.263	890551246.5	85.806	276432.133
-11842.105	-4.263	140235457.1	18.175	50484.765
-24842.105	0.737	617130193.9	0.543	-18304.709
39157.895	1.737	1533340720	3.017	68011.08
-24842.105	-3.263	617130193.9	10.648	81063.712
36157.895	-3.263	1307393352	10.648	-117988.92
38157.895	10.737	1456024931	115.28	409695.291
29157.895	0.737	850182825.5	0.543	21484.765
-14842.105	13.737	220288088.6	188.701	-203883.657
40157.895	9.737	1612656510	94.806	391011.08
-12842.105	0.737	164919667.6	0.543	-9462.604
-40842.105	-9.263	1668077562	85.806	378326.87
13157.895	3.737	173130193.9	13.964	49168.975
-12842.105	-0.263	164919667.6	0.069	3379.501
-15842.105	-1.263	250972299.2	1.596	20011.08
43157.895	11.737	1862603878	137.753	506537.396
17157.895	16.737	294393351.8	280.122	287168.975
20157.895	5.737	406340720.2	32.911	115642.659
28157.895	0.737	792867036	0.543	20747.922
24157.895	0.737	583603878.1	0.543	17800.554
-23842.105	-6.263	568445983.4	39.227	149326.87
-12842.105	-5.263	164919667.6	27.701	67590.028
-8842.105	3.737	78182825.49	13.964	-33041.551
-22842.105	-4.263	521761772.9	18.175	97379.501
-6842.105	-1.263	46814404.43	1.596	8642.659
-22842.105	-6.263	521761772.9	39.227	143063.712
157.895	-9.263	24930.748	85.806	-1462.604
10157.895	0.737	103182825.5	0.543	7484.765
-20842.105	3.737	434393351.8	13.964	-77883.657
-36842.105	-11.263	1357340720	126.859	414958.449
-27842.105	-5.263	775182825.5	27.701	146537.396
23157.895	-4.263	536288088.6	18.175	-98725.762
Mx: 51842.105	My: 13.263	Sum: 22793052631.579	Sum: 1523.368	Sum: 3357578.947

Key

X: X Values

Y: Y Values

Mx: Mean of X Values

My: Mean of Y Values

X - Mx & Y - My: Deviation scores

$(X - Mx)^2$ & $(Y - My)^2$: Deviation Squared

(X - Mx)(Y - My): Product of Deviation Scores

X Values

$\sum = 1970000$

Mean = 51842.105

$\sum(X - Mx)^2 = SSx = 22793052631.579$

Y Values

$\sum = 504$

Mean = 13.263

$\sum(Y - My)^2 = SSy = 1523.368$

X and Y Combined

N = 38

$\sum(X - Mx)(Y - My) = 3357578.947$

R Calculation

$r = \sum((X - My)(Y - Mx)) / \sqrt{((SSx)(SSy))}$

r = 3357578.947 / √((22793052631.579)(1523.368)) = 0.5698

Meta Numerics (cross-check)

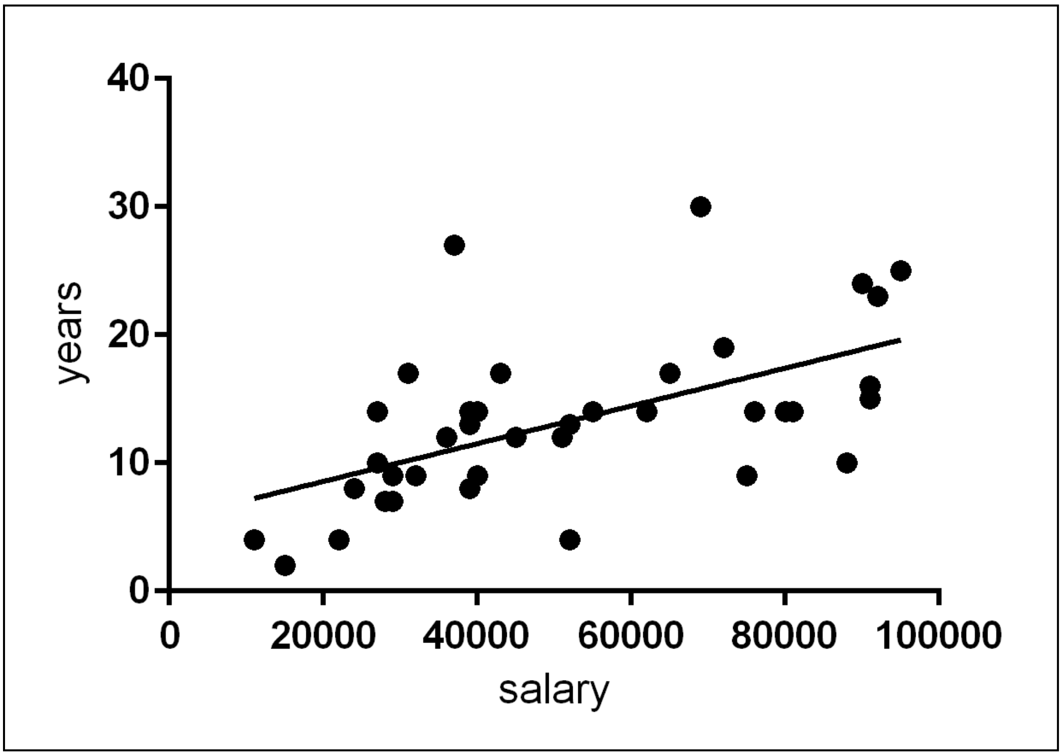
r = 0.5698

The value of R is 0.5698.

This is a moderate positive correlation, which means there is a tendency for high salary variable scores go with high years of experience variable scores (and vice versa).

C.10 REGRESSION ANALYSIS

C.10.1 Years of Experience vs. Salary



Best-fit values	
Slope	0.0001473 ± 3.541e-005
Y-intercept	5.626 ± 2.030
X-intercept	-38195
1/Slope	6789
95% Confidence Intervals	
Slope	7.545e-005 to 0.0002192
Y-intercept	1.506 to 9.746
X-intercept	-125550 to -7072
Goodness of Fit	
R square	0.3247
Sy.x	5.346
Is slope significantly non-zero?	
F	17.31
DFn,DFd	1,36
P Value	0.0002
Deviation from horizontal?	Significant
Data	
Number of XY pairs	38
Equation	Y = 0.0001473*X + 5.626

SELF REFLECTION

1. Why is it important to study Statistics in Public Governance? Site at least five areas of application.

Studying statistics is important in public governance because it helps policymakers and public administrators to make informed decisions based on data-driven insights. Here are five areas of application where statistics plays a crucial role in public governance:

Public Health: Statistics is essential in monitoring and evaluating public health programs, tracking trends, and identifying risk factors. For instance, statistical analysis can help to identify areas with high prevalence rates of diseases, monitor the effectiveness of vaccination programs, and evaluate the impact of health policies.

Education: In public governance, statistics is used to evaluate the effectiveness of education programs, measure student achievement, and identify areas for improvement. Statistical analysis can help policymakers to identify achievement gaps, measure teacher effectiveness, and evaluate the effectiveness of education policies.

Social Welfare: Statistics plays a crucial role in public governance by monitoring social welfare programs, evaluating the effectiveness of such programs, and measuring the impact of policies aimed at reducing poverty. For example, statistical analysis can help policymakers to identify areas with high poverty rates, measure the effectiveness of social welfare programs, and evaluate the impact of policies aimed at reducing poverty.

Criminal Justice: Statistics is used in public governance to monitor crime trends, evaluate the effectiveness of criminal justice policies, and identify areas for improvement. Statistical analysis can help policymakers to identify crime hotspots, measure the effectiveness of law enforcement strategies, and evaluate the impact of criminal justice policies.

Environmental Policy: Statistics plays an important role in public governance by monitoring environmental conditions, evaluating the effectiveness of environmental policies, and identifying areas for improvement. For instance, statistical analysis can help policymakers to identify areas with high pollution levels, evaluate the effectiveness of pollution control measures, and measure the impact of policies aimed at reducing greenhouse gas emissions.

2. Site your negative and positive experiences in learning the course.

Negative experiences in learning statistics:

Lack of interest: Many students find statistics to be a dry and boring subject, which can lead to a lack of interest and motivation to learn.

Math anxiety: Statistics involves a lot of mathematical calculations, which can be intimidating for some students who struggle with math anxiety.

Difficulty in understanding concepts: Statistics involves many abstract concepts that can be difficult to grasp for some students.

Overwhelming workload: Statistics courses often have a heavy workload, with multiple assignments and exams, which can be overwhelming for students.

Inadequate instruction: Poor teaching and inadequate instruction can make it difficult for students to understand the material and perform well in the course.

Positive experiences in learning statistics:

Useful in real-life applications: Learning statistics can help students to understand and analyze data in real-life applications, such as public health, business, and social sciences.

Improved critical thinking skills: Statistics requires students to think critically and analyze data to draw conclusions, which can improve their overall critical thinking skills.

Career advancement: Statistics is a highly sought-after skill in many industries, and learning statistics can open up opportunities for career advancement.

Increased confidence: As students gain a better understanding of statistics concepts and techniques, they may feel more confident in their ability to analyze data and make informed decisions.

Sense of accomplishment: Successfully learning statistics can give students a sense of accomplishment and satisfaction, especially if they previously found the subject difficult.

3. Did the formative test and case study improve your high order thinking skills such as computation skills, analysis and interpretation of data, acquaintance in reading statistical literature? In what ways?

Yes, doing formative tests and case studies can help improve high order thinking skills such as computation skills, analysis, and interpretation of data, and acquaintance in reading statistical literature in the following ways:

Computation skills: Formative tests and case studies often require students to perform calculations and solve problems. Through practice and repetition, students can improve their computation skills, which are essential for understanding and analyzing statistical data.

Analysis and interpretation of data: Formative tests and case studies require students to analyze and interpret data in a variety of contexts. By practicing these skills, students can develop a deeper understanding of statistical concepts and how to apply them to real-life situations.

Acquaintance with reading statistical literature: Formative tests and case studies often require students to read and interpret statistical literature, including research articles and reports. Through practice, students can improve their ability to read and understand statistical literature, which is essential for success in many fields.

Critical thinking: Formative tests and case studies require students to think critically about data and information presented to them. By practicing these skills, students can improve their ability to think critically and make informed decisions based on data.

Problem-solving: Formative tests and case studies often require students to solve complex problems and challenges. By practicing problem-solving skills in a statistical context, students can improve their ability to solve problems in a variety of contexts, which is essential for success in many fields.

4. Your opinion on self-reflection.

I can say that statistics is a very important field that is used in a wide range of industries, including healthcare, finance, social sciences, and engineering.

Many people find statistics to be a challenging subject, but with patience and practice, it can be mastered. One of the biggest challenges in learning statistics is understanding the abstract concepts and terminology that are used, but once you grasp these concepts, you can begin to analyze and interpret data with greater accuracy and confidence.

Another key aspect of learning statistics is the importance of hands-on practice and application of the concepts learned. By working on real-life case studies and projects, students can gain a deeper understanding of how statistical methods can be applied to solve problems and make informed decisions.

Overall, while learning statistics can be challenging, it is also a highly rewarding field that provides valuable skills and knowledge that can be applied in a variety of contexts.

5. Your references, sources.

Sources:

https://google.com
https://google.com/sheets
https://atozmath.com
https://www.socscistatistics.com/
https://www.graphpad.com/

Basic Course In Statistical Method – Bernardo G. Rivas

ATTACHMENTS

Survey Form

Participants’ Responses