[redacted] Roll No [redacted] Section: [redacted]

Instruction/Notes:

Marks Obtained
38.5

1. It is great to have choices in life but here all the questions are compulsory. So attempt all the **subsections properly (Utilize the given space for each section)*Write Roll no. on each page. You can use the last page to extend any part if needed. No extra sheets allowed to attach for marking. However, you can demand for one rough sheet but do not attach it.**
2. We know, sharing is caring but here exchange of calculators is not allowed. You can only use **your own scientific calculator (programmable calculators are not allowed).**
3. Don't get panic. If you found any ambiguity in the data then do not ask anything to the invigilator, just make assumption and continue solving your paper.
4. Believe in yourself & do not waste your time by looking in answer sheets of your fellows and copying them.
5. Now if you regret not being prepared for this exam then Crying is allowed but do it so quietly in order to avoid disturbance.
6. If you are thinking that it's a revenge. No, it is not. It is just an exam. We want you to be a most successful person in life. All the Best!

Don't Hurry. Don't Worry. Do your Best and Let it rest. 👍

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Question 1:

[CLO-1, Marks: (4+4)+3+4+5=20]

Sorting through unsolicited e-mail and spam affects the productivity of software developers. A survey was conducted to monitor software developers to determine the unproductive time per day devoted to unsolicited e-mail and spam. The following frequency distribution of time in minutes consumed for this task is as follows.

a) Enlist the Relative Frequency and Cumulative Frequency in the blank columns provided below.

$(m_if_i' - \bar{x})^2$	Time in minutes	Frequency $(m-x)^2$	RF (Part a)	CF (Part a)	$m_i f$
90.25	1-5 3	132.25 8 1058	0.177	8	24
3306.25	6-10 8	42.25 9 380.25	0.2	17	~~64~~ 72
13340.25	11-15 13	2.25 10 22.5	$0.\overline{2}$	27	~~104~~ 130
12432.25	16-20 18	12.25 7 85.75	0.155	34	~~144~~ 126
10100.25	21-25 23	72.25 5 361.25	$0.\overline{1}$	39	~~184~~ 115
4830.25	26-30 28	182.25 3 546.75	0.066	42	84
2652.25	31-35 33	342.25 2 684.5	0.044	44	66
552.25	36-40 38	552.25 1 552.25	0.022	45	38
47304		2634.83 45			655

8

3691

b) Calculate average amount of time consumed in sorting unsolicited e-mail and spam.

$$\text{Mean} = \Sigma \frac{(x)}{n}$$

For grouped Data

$$\text{Mean} = \frac{\Sigma f_i(m_i)}{\Sigma f_i}$$ where m_i=midpoint of a class.

$$= \frac{655}{45}$$

= 14.5 minutes - average

③

c) Quantify the dispersion in the time devoted to unsolicited e-mail and spam.

Dispersion can be calculated through variance or standard deviation

①

$$s = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$$

For grouped data

$$s = \sqrt{\frac{\Sigma(f_i m_i - \bar{x})^2}{\Sigma f_i - 1}}$$

$$\text{variance} = \frac{\Sigma(f_i m_i - \bar{x})^2}{\Sigma f_i - 1}$$

$$= \frac{47304}{44}$$

$$= 1075.09$$

$$s = \sqrt{1075.09}$$

$$s = 32.7$$

Dispersion in time = 32.7 minutes

?

$$\sqrt{83.8889}$$
$$= 9.1591$$

13.5

Question 2: **[CLO-1, Marks: 8+(4+5+1)=18]**

In the quest for ensuring the utmost reliability of their laptops, a leading manufacturer, specializing in Lenovo products, embarks on an investigation into the endurance of a particular battery variant. Within a carefully curated sample set, comprising 10 Lenovo laptop batteries, the recorded lifespan (hours) unfold as follows:

117, 118, 111, 125, 126, 171, 110, 122, 116, 132

a) Show a five-point summary of the recorded lifespan (hours) of the batteries

Sorted Data

~~110~~ ~~111~~ ~~117~~ ~~118~~

110
111
116
117
118

122
125
126
132
171

Min Value = 110 ①

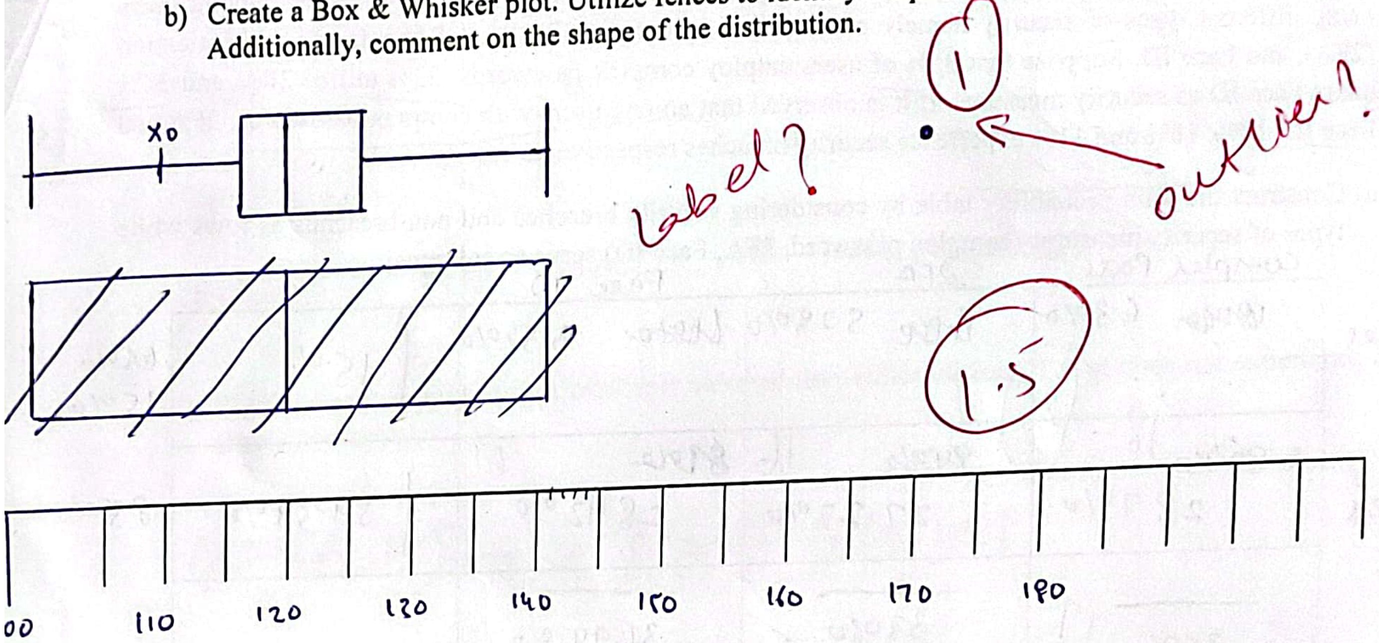
$Q_1 = \frac{n+1}{4}$ = 3rd value = 116 ②

$Q_2 = \frac{n+1}{2} = \frac{\left(\frac{n}{2} + \frac{n}{2}+1\right)}{2} = \frac{118+122}{2} = 120$ ②

$Q_3 = n+1 \times \frac{3}{4}$ = 8th value = 126 ②

Max Value = 171 ①

b) Create a Box & Whisker plot. Utilize fences to identify the presence of any outliers in the dataset. Additionally, comment on the shape of the distribution.



SCALE: Box & Whisker

$IQR = Q_3 - Q_1 = 126 - 116 = 10$

$U.L = Q_3 + 1.5(IQR) = 126 + (1.5)(10)$
$= \boxed{141.}$ ①

$L.L = Q_1 - 1.5(IQR) = \boxed{101.}$ ①

The distribution is very slightly skewed to the right, almost symmetric distribution ②

8

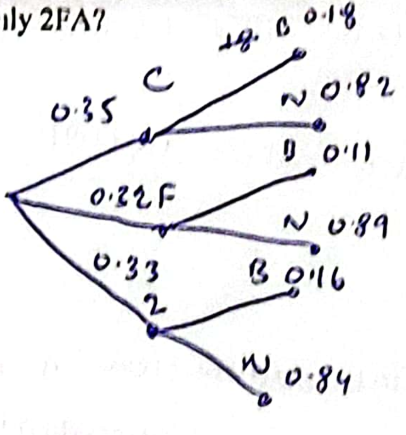
Question 3: [CLO-2, Marks: 3+3+2+4=12]

In a network security analysis, researchers investigate the prevalence of security breaches among users using different types of security namely password complexity, utilization of two-factor authentication (2FA), and Face ID. Suppose that 35% of users employ complex passwords, 33% utilize 2FA, and 32% adopt Face ID as security measures. If it is observed that among users with complex passwords, 2FA and Face ID, 18%, 16% and 11% experience security breaches respectively.

a) Construct the joint probability table by considering security breaches and non-breaches as rows while types of security measures (complex password, 2FA, Face ID) serve as columns.

	Complex Pass	2FA	Face ID		
Breaches	6.3% (2)	5.28%	3.52%	15%	15%
Non Breaches =	18 28.7%	16 27.72%	11 28.42%	84.39%	85%
	35% 17	33%	31.94%		
	35.	33.	32		

b) Suppose it is given that a randomly selected user experienced a security breach, what is the probability that the attempt was made on an account employing only 2FA?



$$P(2|B) = \frac{P(2 \cap B)}{P(B)}$$

$$= \frac{0.0528}{0.18\times0.35 + 0.11\times0.32 + 0.16\times0.33}$$

$$= 0.352$$

$P(2|B) =$ 35.2% chance

3

c) Using part (b), Is security breach independent of type of security measure? Justify your answer.

Security Breach is independent if $P(B|2) = P(B)$ ①

$P(B|2) = 5.28\,\%$

$P(B) = 15\,\%$

$P(B|2) \neq P(B)$ Hence not independant.

?

d) What is the probability that a randomly selected user either utilizes 2FA or does not experience a security breach?

~~$P(2 \text{ or } B') = P(2) - P(2 \cap B')$~~

~~$= 33\% - 5.28\%$~~

~~$= 27.2\,\%$~~

①

~~$P(A \cup B)$~~

$P(2 \cup B') = P(2) + P(B') - P(2 \cap B')$

$= 33\% + 84.39\% - 27.72\%$

$= 89.67\,\%$

d) Construct a histogram using relative frequencies and comment on the shape of the distribution.

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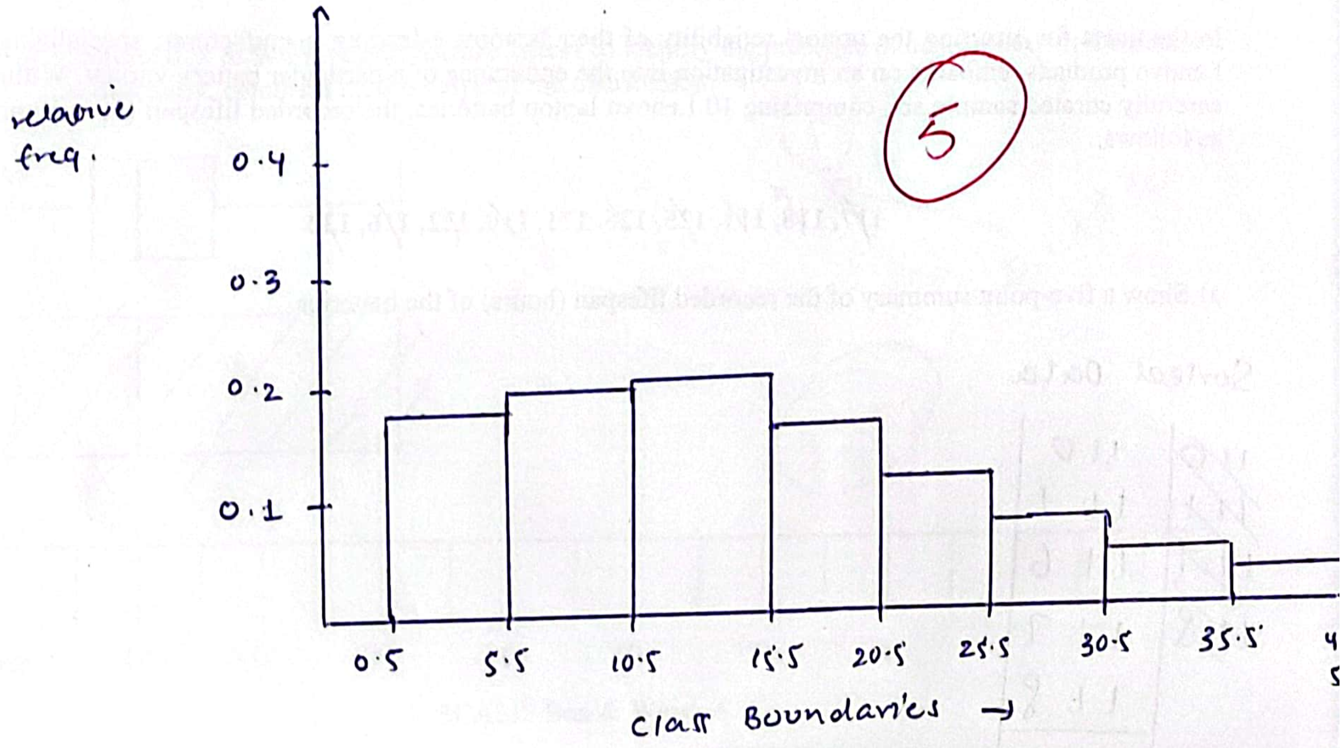

Comment: The distribution is [illegible] Skewed to the right.

already given in total