



## Probability & Statistics

## Quiz #01

## Section-BSE (A)

### Question 1:

By using properties of arithmetic mean, find the missing age in the following set of four student ages.

Student	Age	Deviation from the Mean ( $x_i - \bar{x}$ )
A	19	-4
B	20	-3
C	?	1
D	29	6

Answer: 24

### Question 2:

Write the suitable answer against each statement:

- We travel 10 km at 60 km/h, than another 10 km at 20 km/h, what is our average speed?  $\frac{10+10}{6+2} = 2.5$   
Answer: 2.5 km/h
- What is the suitable average of the annual percentage growth rate of profits in business corporate from the year 2000 to 2005  
Answer: geometric mean
- The mean of 14 numbers is 6. If 3 is added to every number, what will be the new mean?  
Answer: 6+3 = 9

### Question 3:

If a student is ranked eight out of ten in a competition, what is the student's percentile rank?

$$\frac{x}{100} \times 100 = 8$$

$$x = 80$$

### Question 4:

The mean of the number of sales of cars over a 3-month period is 87, and the standard deviation is 5. The mean of the commissions is \$5225, and the standard deviation is \$773. Compare the variations of the two.

sales	commissions
$C.V = \frac{s}{\bar{x}}$ $= \frac{5}{87} \times 100$ $= 5.75\%$	$C.V = \frac{s}{\bar{x}}$ $= \frac{773}{5225} \times 100$ $= 14.8\%$

The commissions have higher variation than car sales, and thus less consistency.

Question #01

A shipment of 20 similar laptop computers to a retail outlet contains 3 that are defective. If a school makes a random purchase of 2 of these computers, find the probability distribution for the number of defectives. Also find Mean and Variance.

Solution:

Total

$$n = 20$$

defective

$$p = \frac{3}{20}$$

$$q = \frac{17}{20}$$

 $x = \text{no. of defective}$ 

$x$	$P(x)$	$x P(x)$	$x^2 P(x)$
0	$\frac{68}{95}$	0	0
1	$\frac{51}{190}$	$\frac{51}{190}$	$\frac{51}{190}$
2	$\frac{3}{190}$	$\frac{3}{95}$	$\frac{6}{95}$

$$P(0) = \frac{{}^3C_0 {}^{17}C_2}{{}^{20}C_2} = \frac{68}{95}$$

$$P(1) = \frac{{}^3C_1 {}^{17}C_1}{{}^{20}C_2} = \frac{51}{190}$$

$$P(2) = \frac{{}^3C_2 {}^{17}C_0}{{}^{20}C_2} = \frac{3}{190}$$

$$E(X) = \sum x P(x)$$

$$= 0 + \frac{51}{190} + \frac{3}{95}$$

$$= \frac{3}{10} = 0.3$$

$$\text{var}(X) = \sum x^2 P(x) - (\sum x P(x))^2$$

$$= \left( \frac{51}{190} + \frac{6}{95} \right) - \left( \frac{3}{10} \right)^2$$

$$= 0.2416$$



### Question #02

An investment firm offers its customers municipal bonds that mature after varying numbers of years. Given that the cumulative distribution function of  $T$ , the number of years to maturity for a randomly selected bond, is

$$F(t) = \begin{cases} 0, & t < 1, \\ \frac{1}{4}, & 1 \leq t < 3, \\ \frac{1}{2}, & 3 \leq t < 5, \\ \frac{3}{4}, & 5 \leq t < 7, \\ 1, & t \geq 7, \end{cases}$$

Find

- (a)  $P(T = 5)$
- (b)  $P(T > 3)$
- (c)  $P(1.4 < 6)$
- (d)  $P(T \leq 5 | T \geq 2)$ .

Solution:


$$\begin{aligned} \textcircled{a} \quad P(T=5) &= F(5) - F(4) \\ &= \frac{3}{4} - \frac{1}{2} \\ &= \frac{1}{4} \end{aligned}$$

$$\begin{aligned} \textcircled{b} \quad P(T > 3) &= 1 - F(T \leq 3) \\ &= 1 - \frac{1}{2} \\ &= \frac{1}{2} \end{aligned}$$

$$\begin{aligned} \textcircled{c} \quad P(1.4 < T < 6) &= F(6) - F(1) \\ &= \frac{3}{4} - \frac{1}{4} \\ &= \frac{1}{2} \end{aligned}$$

$$\begin{aligned} \textcircled{d} \quad P(T \leq 5 | T \geq 2) &= \frac{P(2 \leq T \leq 5)}{P(T \geq 2)} \\ &= \frac{F(5) - F(2)}{1 - F(2)} = \frac{\frac{3}{4} - \frac{1}{4}}{1 - \frac{1}{4}} = \frac{\frac{1}{2}}{\frac{3}{4}} = \frac{2}{3} \end{aligned}$$

# National University of Computer and Emerging Sciences, Lahore Campus

	Course Name:	Probability & Statistics	Course Code:	MT2005
	Degree Program:	BS CS/SE	Semester:	Spring 2022
	Exam Duration:	60 Minutes	Total Marks:	40
	Paper Date:	22-03-22	Weight	15
	Section:	ALL	Page(s):	2
	Exam Type:	Midterm-I		

Student : Name: \_\_\_\_\_ Roll No. \_\_\_\_\_ Section: \_\_\_\_\_

- Instruction/Notes:
1. Attempt all the questions on the answer book and show proper working.
  2. Use of Scientific calculator is allowed but Exchange of calculators or use of programmable calculators is not allowed.
  3. Students are not allowed to write anything on the question paper except roll number.
  4. If you have any ambiguity in the data then do not ask anything from invigilator, just make assumption and continue solving your paper.

[Points = 5 + 5]

Q 1.

(A) Choose the correct answer.

$$\frac{\sum (x - \bar{x})^2}{n}$$

$$\sqrt{\text{kg}^2}$$

(kg)<sup>2</sup>

i. Which of the following is not the characteristic of the arithmetic mean?

- It is influenced by the extreme values.
- Sum of the deviations taken from mean is zero. ✓
- Fifty percent of the observations will always larger than the mean.
- Sum of squared deviations from mean is always minimum.

ii. If a distribution has zero standard deviation, then which of the following is true?

- All observations are positive
- All observations are Negative
- All observations are equal
- Number of positive and negative values are equal.

iii. If the original unit of the data is measured in kilogram (kg), then variance is measured in

- Pounds
- kg
- kg<sup>2</sup>
- Dimensionless form
- None of the above.

iv. Which of the following is not a measure of dispersion?

- Range
- Standard Deviation
- Second Quartile
- Coefficient of variation

v. If both the dependent and independent variables increase simultaneously, the coefficient of correlation will be in the range of

- 0 to 1
- 0 to -1
- 1 to 2
- None

(B) Choose True / False in the following statements.

i. Arithmetic mean is not affected by extreme values.

True / False

ii. The value which occurs most frequently in the data is known as median.

True / False

iii. If the distribution of the scores is symmetric, then median and mode will be same. True / False

iv. If the distribution is skewed to left, then generally mean > median > mode. True / False

v. The coefficient of variation is absolute measure of dispersion.

True / False

Probability & Stats

2 2 -3 -4

3 mean -  
3 med

2 3 1 2 3

1 2 3 3

1 2

med = 2 mode = 2  
mean = 14/5 = 2.8

mean =  $-\frac{3}{4} = -0.75$   
 $\frac{(-0.75)^2}{4}$  not zero.



Q 2.

(A) Find *Median*, *sixth Percentile* and *Mode* of the following data.

Earnings	18-25	25-40	40-46	46-50	50-60	60-70	70-75
Workers	35	25	28	30	20	18	5

(B) A manufacturer of laptops is interested in determining the life time of a certain type of laptop battery. A sample of 10 Dell laptops battery having life in hours are:

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

- Compute variation in data given related to batteries of Dell laptops.
- If similar sample of 10 HP laptops batteries showed an average life in hours 121.7 with standard deviation of 19.8.

Suppose a person is interested to buying a laptop which is more consistent in its life time of a battery, which laptop would you suggest to buy and why?

[Points = 5 + 5]

Q 3.

(A) For 5 pair of observations, it is given that A.M. of  $X$  series is 2 and A.M. of  $Y$  series is 15. It is also known that  $\sum xy = 242$ ,  $\sum x^2 = 30$ . Fit an appropriate curve for the data taking  $X$  as the independent variable.

(B) Following data is recorded on a random sample of 6 students who took admission in the university. The data includes their grades obtained in pre-admission exam and in the final exam in their first semester.

Pre Admission Test Grade	25	10	15	25	15	30
Final exam Grade	24	14	16	30	25	35

Calculate the co-efficient of correlation between grades of both exams and interpret its value.

Hint: Formula for coefficient of correlation is:

$$r = \frac{n \sum XY - \sum X \sum Y}{\sqrt{[n \sum X^2 - (\sum X)^2] [n \sum Y^2 - (\sum Y)^2]}}$$



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Program:	BS CS-SE	Semester:	Spring 2022
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Exam:	Sessional - II	Time:	9:00 - 10:00

Instruction/Notes: Attempt All Questions. Show complete working (steps) in the solutions.

Q1. ✓(a) A student's score on a 10-point quiz is equally likely to be any integer between 0 and 10. What is the probability of an A, which requires the student to get a score of 9 or more? What is the probability the student gets an F by getting less than 4? **Points (2.5)**

✓(b) There is a 1% probability for a hard drive to crash. Therefore, it has two backups, each having a 2% probability to crash, and all three components are independent of each other. The stored information is lost only in an unfortunate situation when all three devices crash. What is the probability that the information is saved? **Points (2.5)**

✓(c) There are 20 computers in a store. Among them, 15 are brand new and 5 are refurbished. Six computers are purchased for a student lab. From the first look, they are indistinguishable, so the six computers are selected at random. Compute the probability that among the chosen computers, two are refurbished. **Points (05)**

$$P(B_2|A) = \frac{P(A|B_2)}{P(A|B_1) + P(A|B_2)}$$

✓(d) A problem on a multiple-choice quiz is answered correctly with probability 0.9 if a student is prepared. An unprepared student guesses between 4 possible answers, so the probability of choosing the right answer is 1/4. Seventy-five percent of students prepare for the quiz. If Mr. X gives a correct answer to this problem, what is the chance that he did not prepare for the quiz? **Points (05)**

$$P|C = \frac{C|P}{C|P + C|\bar{P}}$$

$$C|P = 0.9$$

$$\bar{P}|C = ?$$

Q2. (a) An internet router can send packets via route 1 or route 2. The packet delays on each route are independent  $\exp(\lambda)$  random variables, and the difference in delay between route 1 and route 2 is denoted by  $X$ , has the following Laplacian density function. **Points (05)**

$$f_X(x) = \frac{\lambda}{2} e^{-\lambda|x|}, \quad -\infty < x < \infty$$

Find  $P(-3 \leq X \leq -2 \text{ or } 0 \leq X \leq 3)$ .

✓(b) The waiting time, in hours, between successive speeders spotted by a radar unit is a continuous random variable with cumulative distribution function **Points (05)**

$$F(x) = \begin{cases} 0, & x < 0 \\ 1 - e^{-8x}, & x \geq 0 \end{cases}$$

- Find the probability density function of  $X$ .
- Find  $P(x < 0.2)$  by using the probability density function.
- Find  $P(x < 0.2)$  by using the cumulative distribution function.

✓(c) A dangerous computer virus attacks a folder consisting of 50 files. Files are affected by the virus independently of one another. Each file is affected with the probability 0.2. What is the probability that more than 5 files are affected by this virus? **Points (05)**