National University

of Computer & Emerging Sciences

Probability & Statistics ***Quiz #01*** ***Section-BSE (A)***

[redacted]

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

$= 19 - 23 = -4$

$20 - 23 = -3$

$\boxed{24} - 23 = 1$

$29 - 23 = 6$

Answer: 24

Question 2:

Write the suitable answer against each statement:

$v = \frac{d}{t}$

$t = 6h$ $t = 2h$

1. We travel 10 km at 60 km/h, than another 10 km at 20 km/h, what is our average speed? $= \frac{10+10}{6+2} =$

   Answer: 2.5 km/h

2. What is the suitable average of the annual percentage growth rate of profits in business corporate from the year 2000 to 2005 geometric mean

   Answer:

3. The mean of 14 numbers is 6. If 3 is added to every number, what will be the new mean?

   Answer: $6+3 = 9$ new mean $= 9$.

Question 3:

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

$\frac{x}{100} \times 10 = 8$

$x = 80$

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.

$\bar{x}$ $s = 5$

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

$= 5.75\%$

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

Quiz #02

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

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

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

8

x = no. of defective

x	$P(x)$	$xP(x)$	$x^2 P(x)$
0	68/95	0	0
1	51/190	51/190	51/190
2	3/190	3/~~1~~95	6/95

4

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

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

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

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

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

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

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

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

$$= 0.2416$$

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

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

Find

(a) P(T = 5)

(b) P(T > 3)

(c) P(1.4 < 6)

(d) P(T ≤ 5 | T ≥ 2).

Solution:

(a) $P(T=5) = F(5) - F(4)$

$= \frac{3}{4} - \frac{1}{2}$

$= 1/4$

4

(b) $P(T>3) = 1 - F(T<3)$

$= 1 - \frac{1}{2}$

$= \frac{1}{2}$

(c) $P(1.4 < T < 6) = F(6) - F(1)$

$= \frac{3}{4} - \frac{1}{4}$

$= \frac{1}{2}$

(d) $P(T \le 5 \mid T \ge 2) = \dfrac{P(2 \le T \le 5)}{P(T \ge 2)}$

$= \dfrac{F(5) - F(2)}{1 - F(2)} = \dfrac{3/4 - 1/4}{1 - 1/4} = \dfrac{1/2}{3/4} = \dfrac{2}{3}$

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

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.

Q 1. [Points = 5 + 5]

(A) Choose the correct answer.

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

$\sqrt{kg^2}$

$(kg)^2$

✓ i. Which of the following is not the characteristic of the arithmetic mean?
- a) It is influenced by the extreme values.
- b) Sum of the deviations taken from mean is zero. ✓
- c) Fifty percent of the observations will always larger than the mean.
- d) Sum of squared deviations from mean is always minimum.

ii. If a distribution has zero standard deviation, then which of the following is true?
- a) All observations are positive
- b) All observations are Negative
- c) All observations are equal
- d) Number of positive and negative values are equal.

2 2 2 2
2
= 0

iii. If the original unit of the data is measured in kilogram (kg), then variance is measured in
- a) Pounds
- b) kg
- c) kg^2
- d) Dimensionless form
- e) None of the above.

✓ iv. Which of the following is not a measure of dispersion?
- a) Range - yes
- b) Standard Deviation
- c) Second Quartile
- d) Coefficient of variation yes

v. If both the dependent and independent variables increase simultaneously, the coefficient of correlation will be in the range of
- a) 0 to 1
- b) 0 to -1
- c) 1 to 2
- d) 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

mean $= \frac{-3}{4} = -0.75$ 1/2

3 mean
3 med

2 3 1 2 3

1 2 2 3 3

1 2

med = ~~x~~ = 2 mode = 2
mean 14/5 =

$\frac{(0.75)^2}{4}$ not zero.

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[Points = 15 + 5]

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.

i. Compute variation in data given related to batteries of Dell laptops.
ii. 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:

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

National University of Computer and Emerging Sciences, Lahore Campus

Course:	Probability & Stats	Course Code:	MT2005
Program:	BS CS-SE	Semester:	Spring 2022
Duration:	1 hour	Total Marks:	30
Paper Date:	May 07; 2022	Weight	15%
Section:	All	Page(s):	01
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)**

7. (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)**

✓ 0.3522

$P(B_2|A) = \dfrac{P(A|B_3)}{P(A|B_3) + P(A|B_2)}$

$C|P = 0.9,$

(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)**

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

$(0.25)(0.25)$

$\bar{P}|C = ?$

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)**

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

Find $P(-3 \le X \le -2 \ or \ 0 \le X \le 3)$.

✓ (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)**

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

i. Find the probability density function of X. F
ii. Find P (x < 0.2) by using the probability density function.
iii. 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)**

National University of Computer and Emerging Sciences, Lahore Campus

Course:	**Probability & Stats**	**Course Code:**	**MT2005**
Program:	**BS CS-SE**	**Semester:**	**Spring 2022**
Duration:	**1 hour**	**Total Marks:**	**30**
Paper Date:	**May 07; 2022**	**Weight**	**15%**
Section:	**All**	**Page(s):**	**01**
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)**

(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)**

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)**

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

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

(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)**

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

i. Find the probability density function of X.
ii. Find P ($x < 0.2$) by using the probability density function.
iii. 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)**

National University of Computer and Emerging Sciences, Lahore Campus

Course Name:	Probability and Statistics	Course Code:	MT2005
Program:	BSE/BSCS/BDS	Semester:	Fall 2023
Duration:	60 Minutes	Total Marks:	40
Paper Date:	11-11-2023	Weight	15%
Section:	ALL SECTIONS	Page(s):	7
Exam Type:	MID-II	Moderator	Ms. Sarah Ahmad

Student : Name: Ahmad Abdullah **Roll No.** 22L-7503 **Section:** BDS-3A

Instruction/Notes:

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. **Pencil Work wouldn't be marked. Necessary Statistical tables are attached. You are not allowed to bring any statistical table.**
3. 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).**
4. 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.
5. Believe in yourself & do not waste your time by looking in answer sheets of your fellows and copying them.
6. Now if you regret not being prepared for this exam then Crying is allowed but do it so quietly in order to avoid disturbance.
7. 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.

Marks Obtained
26

2.5

Question 1: **[CLO-5, Marks: 07]**

The amount of time in hours that a computer functions before breaking down is a continuous random variable with probability density function given by

Question is ambigious

$$F(x) = \begin{cases} 1 - e^{-x/100} & x \geq 0 \\ 0 & x < 0 \end{cases}$$

(i) Obtain probability density function (pdf). **(3)**

1.5

$$F(x) = \int_0^x 1 - e^{-x/100} \cdot dx$$

$$= \int_0^x 1 - e^{-t/100} \cdot dt$$

$$= |x| - \int_0^x e^{-t/100} \cdot dt = x - \int_0^x (e^t)^{-1/100} \cdot dt$$

$$= x - (-100) \cdot \frac{e^{x(\frac{-1}{100}+1)}}{101} \times 100$$

$$= x + \frac{99 e^{\frac{x}{100}+1}}{101}$$

$$-e^{-x/100} \times \frac{-1}{100}$$

$$\frac{e^{-x/100}}{100}$$

0070

(ii) What is the probability that a computer will function between 50 and 150 hours before breaking down? **(4)**

1

$= F(150) - F(50)$

$1 - e^{\frac{150}{100}} - (1 - e^{-50/100})$

$=$

$f'(x) = \dfrac{-xe^{\frac{-x}{100}} + 1}{100}$?

Question 2: 5 **[CLO-4, Marks: 09]**

On the average, 1 in 800 computers crashes during a severe thunderstorm. A certain company had 4,000 working computers when the area was hit by a severe thunderstorm.

4

a) Compute the expected value and variance of the number of crashed computers. **(4)**

$n = 4000$

$p = 1/800 = 0.00125$

$q = 0.99875$

$E(x) = np = 5.0$ 1 1

$Var(x) = npq = 4.99375$ 1 1

1

b) Compute the probability that at least three computers crashed. **(5)**

$P(x \geq 3)$

$1 - P(x < 3)$ 1

$\dfrac{\binom{5}{x}\binom{3995}{3-x}}{^{4000}C_3}$

$P(x<3) = \sum_{x=0}^{n=3} b(x, n, p)$ < 2

$P(X=0) = ?$

$P(X=1) = ?$

$P(X=2) = ?$

$= 0.14$ $X > 2$

$P(x \geq 3) = 1 - 0.14$

$= 0.859$

$P(X \geq 3) = 1 - P(X \leq 2)$?

0070

Question 3: 14

[CLO-4, Marks: 15]

A small-business website contains 100 pages. It was found that 60%, 30%, and 10% of the pages contain low, moderate, and high graphic content, respectively. A sample of two pages is selected without replacement. Let X and Y denote the number of pages with moderate and high graphics output respectively in the sample. Determine:

a) The joint probability function **(2)**

$$p(x,y) = \frac{\binom{60}{2-x-y}\binom{30}{x}\binom{10}{y}}{\binom{10}{C2}}$$

2

b) The joint probability distribution of X and Y **(3)**

3

Y \ X	0	1	2
0	59/165	4/11	29/330
1	4/33	2/33	0
2	1/110	0	0

0.5 each Prob

0070

c) P (Y=1 | X = 1) (3)

$= \dfrac{2/33}{14/33}$

$= 0.42$

formula? $\dfrac{f(1,1)}{g(1)}$

2

d) Verify whether E (XY) = E(X) E(Y) or not? (7)

7

&

$E(X) = \sum x \cdot g(x)$ 1

$E(Y) = \sum y \cdot h(y)$ 1

$E(X) = 0(0.487) + 1(0.424) + 2(0.087) = 0.598$ 1

$E(Y) = 0(0.80) + 1(0.18) + 2(0.00909) = 0.189$ 1

$E(XY) = \dfrac{2}{33} = 0.06$ 2

$E(X)E(Y) = 0.1130$

Difference = 0.053 (Yes, they are unequal) 1

0070

Question 4: 4.5 **[CLO-5, Marks: 09]**

a) Consumer test ratings for a new line of products have averaged 67.5 with a standard deviation of 23.3 follows normal distribution. Jeff Erickson has developed a new device which he wishes to market. His supervisor tells him that in order to put it into production, the device must receive a rating of at least 70. How likely is that Jeff's product is will reach the assembly line? (5)

3

$\mu = 67.5$

$\sigma = 23.5$

~~x ≤ 70~~

$\boxed{\text{z-score of } 70 = 0.106}$ 1

$P(x \geq 70)$ or $1 - P(x \leq 70)$ 1

$P(x < 70) = \int_0^{70} \frac{e^{-\frac{1}{2}z^2}}{\sigma\sqrt{2\pi}} \cdot dx$ 0.5438

0.5438.

$P(x \geq 70) = 1 - 0.5398$

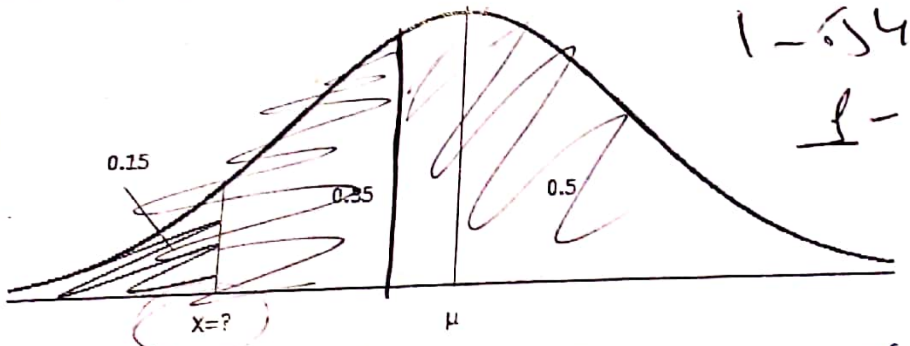
$= 0.46$ 1 $P(z \geq 70)$ 0.4562

b) Let X be normally distributed with mean = $11,151 million and standard deviation = $3,550 million. Consider the diagram given below and compute the required solution. (4)

1 − .5438

1 −

1.5



$\mu = 11,151$

$\sigma = 3550$

$z = 0.15$

$z = \frac{x - \mu}{\sigma}$ 1

$(0.15)_z = \frac{x - 11151}{3550}$

~~$x = 11683.8$~~

$x = (0.5596)3550 + 11151$ 1/2

$x = 13137$

7494.5

0070

National University of Computer and Emerging Sciences

Lahore Campus

Probability and Statistics (MT2005)

Sessional-II Exam

Date: April 3rd 2024

Total Time (Hrs): 1

Total Marks: 45

Total Questions: 03

Course Instructors

Ms. Sarah Ahmad

Ms. Kanwal Saleem

Ms. Huma Akbar

Mr. Mudassir Jamil

Mr. Awais Inayat

Roll No   Section   Student Signature

Do not write below this line

Attempt all the questions on answer book.

CLO 4: Determine the type of discrete distribution and evaluate its probability distribution.

Q 1: [Marks:4+4=8]

An article in *Information Security Technical Report* ["Malicious Software—Past, Present and Future" (2004, Vol. 9, pp. 6–18)] provided the following data on the top ten malicious software instances for 2002. The clear leader in the number of registered incidences for the year 2002 was the Internet worm "Klez," and it is still one of the most widespread threats. This virus was first detected on 26 October 2001, and it has held the top spot among malicious software for the longest period in the history of virology. The ten most widespread malicious programs for 2002 are:

Place	Name	% Instances
1	I-Worm.Klez	61.22%
2	I-Worm.Lentin	20.52%
3	I-Worm.Tanatos	2.09%
4	I-Worm.BadtransII	1.31%
5	Macro.Word97.Thus	1.19%
6	I-Worm.Hybris	0.60%
7	I-Worm.Bridex	0.32%
8	I-Worm.Magistr	0.30%
9	Win95.CIH	0.27%
10	I-Worm.Sircam	0.24%

Suppose that 20 malicious software instances are reported. The malicious sources are assumed to be independent.

a) What is the probability that at least two instances are "Klez"?

b) What are the expected value and standard deviation of the number of "Klez" instances among the 20 reported?

CLO 4: **Determine the type of discrete distribution and evaluate its probability distribution.**

Q 2: [Marks:5+3+17=25]

Test two integrated circuits one after the other. On each test, the possible outcomes are *a* (accept) and *r* (reject) with sample space; S= {aa, ar, ra, rr}. Assume that all circuits are acceptable with probability 0.9 and that the outcomes of successive tests are independent. Count the number of acceptable circuits *X* with values (x = 0, 1, 2) and count the number of successful tests before you observe the first reject *Y* with values (y = 0, 1, 2). (If both tests are successful, let *y* = 2.)

a) Complete the following joint probability distribution of *X* and *Y*.
b) Find the marginal probability distributions for the random variables *X* and *Y*.
c) Calculate the correlation between number of acceptable circuits (X) and number of tests before observing the first reject (Y). Also interpret the result.

$f(x,y)$		Y		
		0	1	2
X	0		0	0
	1			
	2	0		0.81

CLO 5: **Determine the type of continuous distribution and evaluate its probability distribution.**

Q3: [Marks:4+4+4=12]

In a data science project focused on analyzing the sizes of files stored in a database, you're examining the file sizes with varying magnitudes. The size of each file, represented by the continuous random variable *X*, follows a probability density function (pdf) given by

$$f(x) = \begin{cases} Cx^2, & 1 < x < 4 \\ 0, & Otherwise \end{cases}$$

Where *X* represents the file size in kilobytes (KB) and *C* is a constant.

a) Determine the value of *C*.
b) Derive the Cumulative Distribution Function and show the complete CDF properly.
c) Calculate the probability that the file size lies between 1.5 KB and 3.5 KB.

UNIVERSITY OF COMPUTER & EMERGING SCIENCES LAHORE

ANSWER

FAST 40.5

Course Probability and Statistics

Student's Name Talha Ahmed

Answer Sheet No. 54039

Roll No. 221-0504

Signature

Section BCS-4A

Date 3/04/2024.

(Q1)

(a) Using the hypergeometric distribution.

$$P(x) = \frac{\binom{a}{x}\binom{N-a}{n-x}}{\binom{N}{n}}$$

$P(k1e2) = 0.6122$

a = 2

N =

n =

Using the Binomial distribution

$$P(x) = \binom{n}{x} p^x q^{n-x}$$

$p = 0.6122$

$q = 1-p = 0.3878$

$n = 20$

$x = 2$

4

For atleast 2:

$P(x \geq 2) = 1 - P(x<2)$

~~P<2~~

$P(x<2) = P(0) + P(1)$

$P(0) = \binom{20}{0} p^0 q^{20} = (1)(0.6122)^0(0.3878)^{20} = 5.9\times10^{-9}$

$P(1) = \binom{20}{1} p^1 q^{19} = (20)(0.6122)^1(0.3878)^{19} = 1.86\times10^{-7}$

art No.

Rough Work

$5.9\times10^{-9} + 1.86\times10^{-7} = 1.927\times10^{-7}$

$P(x<2) = 1.927\times10^{-7}$

$1 - P(x<2) = 1 - 1.927\times10^{-7}$

$= 0.9999$

$\boxed{P(x\geq 2) = 99.99\ \%}$

(b)

$E(x) = np$

$= (20)(0.6122)$

$\boxed{E(x) = 12.244}$

2

$\sigma^2 = \text{variance} = npq$

$= \cancel{12.244}\,(12.244)(0.3878)$

$\sigma^2 = 4.7482$

$\boxed{\sigma = 2.1790}$

2

Question: 03

$$f(x) = \begin{cases} cx^2, & 1<x<4 \\ 0, & \text{otherwise} \end{cases}$$

(a) value of c

we know that

$$\int_{-\infty}^{\infty} f(x)\,dx = 1$$

1

$$\int_1^4 cx^2\,dx = 1$$

$\Rightarrow [c] \left.\dfrac{x^3}{3}\right|_1^4$

$\Rightarrow c\left[\dfrac{(4)^3}{3} - \dfrac{(1)^3}{3}\right]$

$\Rightarrow c\left[\dfrac{64}{3} - \dfrac{1}{3}\right]$

2

$\Rightarrow c\left[\dfrac{63}{3}\right]$

$\Rightarrow c\,[21] = 1$

1

$\boxed{c = \dfrac{1}{21}}$

rt No.

$$F(x) = \int_x^4 \frac{x^2}{21} = \left.\frac{x^3}{21}\right|_x^4$$

$$= \frac{(4)^3}{21} - \frac{x^3}{21}$$

$$= \frac{1}{21}(64 - x^3) \quad , x \le 4$$

$$F(x) = \begin{cases} \frac{1}{21}(64 - x^3) & , x \le 4 \\ 0 & , x \le 1 \end{cases}$$

0.5

Q / Part No.

Rough Work

Question. 02

X = num of accept. circuits
y = num of succes. tests by first reject.

S = { aa, ar, ra, rr }

(a)

		Y 0	1	2
X	0	0.01	0	0
	1	0.09	0.09	~~X~~ 0
	2	0	0	0.81

5

(b) Marginal prob distributions (y next page)

x	0	1	2
g(x)	0.01	0.18	0.81

1.5

(a) working

~~(a) f(x) = $\binom{n}{x}(0.9)^x(0.1)^{n-x}$~~

aa ; X = 2 , y = 2
ar ; X = 1 , y = 1
ra ; X = 1 ; y = 0
rr ; X = 0 ; y = 0
P(aa) = 0.9 x 0.9
P(ar) = 0.9 x 0.1
P(ra) = 0.1 x 0.9
P(rr) = 0.1 x 0.1

Part No. | Rough Work

(b) Marginal

y	0	1	2
$h(y)$	0.1	0.09	0.81

1.5

(c) $\text{corr}(X,Y) = \dfrac{\text{cov}(X,Y)}{\sigma_x \sigma_y}$ 1

$\text{cov}(X,Y) = E(XY) - E(X).E(Y).$

$E(XY) = (0)(0)(0.01) + \cdots (0).$

$(1)(1)(0.09) + (2)(1)(0)$
$+ (1)(2)(0) + (2)(2)(0.81)$

$= 0.09 + 4(\cancel{0.8} \; 0.81)$

$E(XY) = 3.33$ 2

$E(X) = 0.18 + 2(0.81)$
$E(X) = 1.8$
$E(Y) = 0.09 + 1.62$
$E(Y) = 1.71$ 2

$\text{cov}(X,Y) = 3.33 - (1.8)(1.71)$
$= 3.33 - 3.078$
$\boxed{\text{cov}(X,Y) = 0.252}$ 2

$\sigma^2 x = 0.18$ 2
$\boxed{\sigma x = 0.4242}$

$\sigma_x^2 = E(x^2)^2 - (E\,X)^2$
$\sigma_y^2 = E(y^2) - (E\,Y)^2$

$\sigma^2 x = 0.18 + 4(0.81) - (1.8)^2$
$\sigma^2 x = 3.42$ 2 $- \cancel{(1.8)^2}$
$\cancel{\sigma^2 x = 1.84 - (1.8)^2 = 1.4}$

$\sigma^2 y = E(Y^2) - (EY)^2$
$= 0.09 + 3.24$
$= 3.33 - 2.9241$
$\sigma^2 = 0.4059$
$\boxed{\sigma_y = 0.6371}$ 2

formula?

$\text{corr}(X,Y) = \dfrac{0.252}{(0.4242)(0.6371)} \Rightarrow \dfrac{0.252}{0.27029} \Rightarrow = 0$ 1

Q / Part No.

Rough Work

$e = 0.9323$ 1

interpretation ?