UNIVERSITY EXAMINATIONS

EXAMINATION FOR SEPTEMBER/DECEMBER 2015/2016 FOR BACHELOR OF SCIENCE IN COMPUTER SCIENCE

RCCS 106 PROBABILTY AND STATISTICS

DATE: 3RD DECEMBER 2015 TIME: 2 HOURS

GENERAL INSTRUCTIONS:

Students are NOT permitted to write on the examination paper during reading time.
This is a closed book examination. Text book/Reference books/notes are not permitted.

SPECIAL INSTRUCTIONS:

This examination paper consists Questions in Section A followed by section B.
Answer **Question 1 and any Other Two** questions.
QUESTIONS in ALL Sections should be answered in answer booklet(s).

1. **PLEASE start the answer to EACH question on a NEW PAGE.**
2. **Keep your phone(s) switched off at the front of the examination room and NOT on your person.**
3. **Keep ALL bags and caps at the front of the examination room and DO NOT refer to ANY unauthorized material before or during the course of the examination.**
4. **ALWAYS show your working.**
5. **Marks indicated in parenthesis i.e. ( ) will be awarded for clear and logical answers.**
6. **Write your REGISTRATION No. clearly on the answer booklet(s).**
7. **For the Questions, write the number of the question on the answer booklet(s) in the order you answered them.**
8. **DO NOT use your PHONE as a CALCULATOR.**
9. **YOU are ONLY ALLOWED to leave the exam room 30minutes to the end of the Exam.**

SECTION A (COMPULSORY)

QUESTION 1 (30 MARKS)

a). Using a scatter diagram, describe the following terms as used in correlation

i). Positive correlation. **[1 Mark]**
ii). Negative correlation. **[1 Mark]**
iii). Perfect positive correlation. **[1 Mark]**
iv). No linear correlation. **[1 Mark]**

b). Box **A** contains 5 red and 4 blue balls and box **B** contains 6 red and 9 blue balls. One box was selected at random and a red ball was drawn from it. What is the probability that the drawn ball was picked from box **B**? **[3 Marks]**

c). The personnel manager of S.W.V limited considers five criteria when interviewing a job applicant. The manager gives each applicant a score between 1 and 5 in each category, with 5 as the highest score. Each category has a weighting factor between 1 and 3, the data is as below.

Criteria	Score X	Weighting Factor W
Education	4	2
Job experience	2	2
Interpersonal skills	5	3
Communication skills	5	3
reference	4	1

i) Determine the weighted mean score for this job applicant. **[2 Marks]**
ii) How does this weighted mean differ from the un-weighted mean? **[2 Marks]**
iii) What does the weighting factor indicate about the company's hiring policy? **[1 Mark]**

d). An appliance dealer sells three different models of upright freezers having 13.5, 15.9 and 19.1 cubic feet of storage space respectively. Let X be the amount of the storage space purchased by the next customer to buy a freezer. Suppose X has the following probability mass function;

x	13.5	15.9	19.1
$p(x)$	0.2	0.5	0.3

i). Compute $E(X)$, $E(X^2)$ and $Var\ (X)$. **[3 Marks]**

ii). If the price of freezer having capacity X cubic feet is $(25X - 8.5)$, what is the expected price paid by the next customer to buy a freezer? **[2 Marks]**

iii). What is the variance of the price $(25X - 8.5)$ paid by the next customer? **[2 Marks]**

iv). Suppose that though the rated capacity of a freezer is X, the actual capacity is $h(X) = X - 0.01X^2$. What is the expected actual capacity of the freezer purchased by the next customer? **[2 Marks]**

e). Of all customers purchasing automatic garage door openers, 75 % purchase a chain-driven model. Let X be the number among 15 purchasers who selected the chain-driven model.

i). What is the probability distribution of X? **[2 Marks]**

ii). What is the probability that X is exactly 8? **[1 Marks]**

iii). What is the probability that X is at least two? **[3 Marks]**

iv). How many of them would you expect to purchase chain-driven model? **[1 Mark]**

SECTION B (Answer ANY Two Questions)

QUESTION 2 (20 MARKS)

The following data shows the frequency (MHz) denoted by X and output power (Watts) denoted by Y for a certain laser configuration generated from an investigative experiment.

x	60	63	77	100	125	157	186	222
y	16	17	19	21	22	20	15	5

Determine;

i). The equation of the regression of Y on X and interpret the coefficients. **[14 Marks]**

ii). The moment correlation coefficient. **[4 Marks]**

iii). The value of X when $Y = 26$. **[2 Marks]**

QUESTION 3 (20 MARKS)

a). Two events A and B are such that;

$$P(A \cap B) = \frac{1}{6}, \quad P(A/B) = \frac{1}{4} \quad \text{and} \quad P(B/A) = \frac{1}{3}$$

Determine;

i). $P(A)$ **[2 Marks]**

ii). $P(B)$ **[2 Marks]**

iii). $P(A \cup B)$ **[2 Marks]**

b). In a computer practical the three worst behaved students, Deadly, Shifter and Casual are allocated one particular computer numbered 4. Each student is likely to use the computer on equal basis, during the practical's. There is a probability of $\mathbf{\frac{2}{3}}$ that Deadly will use his own disk and $\mathbf{\frac{1}{3}}$ that he uses university disk. Each of the other two are equally likely to use either their own or university disk. With each of the university disk there is $\mathbf{\frac{1}{9}}$ probability it will have a virus. However there is a probability of $\mathbf{\frac{5}{9}}$ there will be a virus on any of the Deadly's own disk. The corresponding probabilities of a virus in the disks belonging to Shifter and Casual being $\mathbf{\frac{4}{9}}$ and $\mathbf{\frac{2}{9}}$ respectively.

(i). Represent the above information in a tree diagram. **[4 Marks]**

(ii). Find the probability that during the computer practical's, one of the students own disk is being used on computer number 4. **[3 Marks]**

(iii). Find the probability that during computer practical's a virus is spotted on the computer number 4. **[3 Marks]**

(iv). If a virus has been spotted on computer number 4, what is the probability that Deadly is using the computer at the time? **[2 Marks]**

(v). If the virus has been spotted on the computer number 4, what is the probability that Deadly is using the computer at the time with his own disk? **[2 Marks]**

QUESTION 4 (20 MARKS)

a). The statistics class had their marks distributed as follows

Marks	Frequency
55-59	2
60-64	4
65-69	4
70-74	4
75-79	8
80-84	8
85-89	20
90-94	17
95-99	5

Determine for the marks,

(i). The mean marks. **[4 Marks]**
(ii). The median Marks. **[3 Marks]**
(iii). The mode. **[2 Marks]**
(iv). The standard deviation. **[5 Marks]**

b). Using the above data in (a) Determine
i). The second Pearson's Coefficient of Skewness and interpret your results. **[2 Marks]**
ii). The Bowel's coefficient of Skewness. **[4 Marks]**

QUESTION 5 (20 MARKS)

a). The actual tracking weight of a stereo cartridge that is set to track at 3 grams on a particular changer can be regarded as a continuous random variable with the density

$$f(x) = \begin{cases} k(1-(x-3)^2) & 2 \le x \le 4 \\ 0 & elsewhere \end{cases}$$

i). Find the value of the constant k. **[3 Marks]**
ii). What is the probability that the actual tracking weight is greater the prescribed weight? **[2 Marks]**
iii). Determine the mean of the distribution. **[2 Marks]**

b). The number of people arriving for treatment at an emergency room can be modelled by a Poisson Process with a rate parameter of five per hour.

i). What is the probability that exactly four arrivals occur during any particular hour? **[2 Marks]**

ii). What is the probability that at least three arrivals occur during a 2 hour period? **[2 Marks]**

iii). How many people do you expect to arrive during a 45-minute period? **[2 Marks]**

c). An experiment to compare the ability of two different solvent to extract creosote impregnated in tests log involved the use of 8 different logs. The data is as below;

Log	1	2	3	4	5	6	7	8
Solvent 1	3.92	3.79	3.70	4.08	3.87	3.95	3.55	3.76
Solvent 2	4.25	4.20	4.41	3.98	4.39	3.75	4.21	3.90

(i) Determine the coefficient of variation for the 8 different logs for the two solvents. **[5 Marks]**

(ii) What conclusions can you draw from (i) above? **[2 Mark]**