Class Test #1
Dept. of CSE, RUET
Time: 20 minutes

1. Suppose the marks of 30 students of a subject are as follows

30 35 45 65 70 39 46 55 30 45 70 40 46 55 38 36 53 43 47 53 63
65 60 45 55 57 65 45 55 1.

i. Find the five-number summary of data
ii. Draw a box-and-whisker diagram
iii. Find the 90^{th} percentile.
iv. Are there any suspected outlier? If yes then how?
v. Find the median, mode, sample mean, and ~~sample standard deviation~~?
vi. Which of above measures (sample mean, median and mode) do you feel is the best measure of central tendency of the data? Why?

~~$A \cup B = A + B$~~

~~$A \cap (B \cup B')$~~

Class Test #2
Mark: 20, Time: 30 minutes

1 a) State Bayes theorem and prove it. 10

b) A bag contains 4 red, 6 black and 7 white marbles. A marble is chosen at random from the bag. If the marble is not white, what is the probability that it is red? 5

c) Prove "If A and B are any two events, then $P(A \cup B) = P(A) + P(B) - P(A \cap B)$." 5

Class Test #3
Mark: 20, Time: 30 minutes

c) What is a Stochastic Process? Classify and explain each category of Stochastic Processes with example.

d) Design a simple weather forecasting model. Show the procedure and formula to find the probability that it will still be clear in 4 days with an example, given that it is clear today.

Class Test #4, Statistics
Mark: 20 Time: 20 minutes

a) Explain the standard Notation of Kendall for queuing system.
b) How will you mitigate the effects of long queues?
c) Consider the following scenario: the inter-arrival time is exponentially distributed with a mean of 10 minutes and the service time is also exponentially distributed with a mean of 8 means, find the (i) mean wait in the queue, (ii) mean number in the queue,(iii) the mean wait in the system, (iv) mean number in the system and (v) proportion of time the server is idle

$\rho = \frac{\lambda}{\mu}$ $L = W\lambda$

Heaven's Light Is Our Guide

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
3rd Year ODD Semester Examination 2019

COURSE NO: **CSE 3107** COURSE TITLE: **Applied Statistics and Queuing Theory**

FULL MARKS: **72** TIME: **3 HRS**

N.B. (i) Answer any **SIX** questions taking any **THREE** from each section.
(ii) Figures in the right margin indicate full marks. 56
(iii) Use separate answer script for each section.

SECTION : A 29

Q.1. (a) Find out which types of data is, of the followings: 4
i) Number of shares sold each day in the stock market.
ii) Lifetimes of television tubes produced by a company.
iii) Yearly income of college professors.
iv) Lengths of 1000 bolts produced in a factory.

(b) Which things are need to consider when choosing a data collection method for statistical analysis? What are the differences between observational and experimental data collection technique? 4

(c) Define the followings: 4
i) Response variable
ii) Explanatory variable
iii) Confounding variable
What is the relation between Response variable and Explanatory variable?

Q.2. (a) What do you mean by measures of dispersion? Write the advantages and disadvantages of the following measure of dispersion: 5 5
i) Range ii) Inter-quartile range iii) Standard deviation.

8 (b) Derive the formula to find the skewness and kurtosis of the distribution. 4

(c) Show graphically the approximate position of mean, median and mode when the distribution is i) negatively skewed, ii) positively skewed and iii) symmetrical. 3 3

Q.3 (a) Suppose the marks of 30 students of a subject are as follows – 8 8
30 35 45 65 70 39 46 55 50 45 70 40 46 55 38 36 51 43 47 53
63 65 60 45 53 57 65 45 55 80
i) Find the five-number summary of data.
12 ii) Draw a box-and-whisker diagram.
iii) Construct an ordered stem-and-leaf displays.
iv) Find the 90th percentile.

(b) What do you mean by outlier? How can you find outlier from a set of data? Explain with an example. 4 4

Q.4 (a) Define probability. If A and B are any two events, then prove 4 3
$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

(b) What do you mean by conditional probability? Explain independent events with example. 3 3

9 (c) Let A and B be two events. 5 3
i) If the events A and B are mutually exclusive, are A and B always independent? If the answer is no, can they ever be independent? Explain.
ii) if $A \subset B$, can A and B ever be independent? Explain.

SECTION : B 27

Q.5. (a) A continuous random variable X having values only between 0 and 4 has a density function given by $P(X) = \frac{1}{2} - aX$, where a is a constant. 4
i) Calculate a.
ii) Find Pr $\{1<X<2\}$.

(b) When are events A, B and C called mutually independent? Flip an unbiased coin five independent times; compute the probability of three heads occurring in the five trials. 4

(c) Let X is the number of the accidents per week in a factory. Let, the pmf of X be 4
$$f(x) = \frac{1}{(x+1)(x+2)} = \frac{1}{x+1} - \frac{1}{x-2} \qquad x = 0, 1, 2$$
Find the conditional probability of $x \geq 4$, given that $x \geq 1$.

4 4

Q.6. (a) Find the mean and variance for the following distributions:

i) $f(x) = \frac{4!}{x!(4-x)!}\left(\frac{1}{2}\right)^4$, $x = 0, 1, 2, 3$ 2, 1

ii) $f(x) = \frac{2x-1}{16}$, $x = 1, 2, 3, 4$ 3.125, 0.859

8 (b) A random variable X has a binomial distribution with mean 6 and variance 3.6. Find $P(X=4)$. 0.1339 3 3

(c) What do you mean by moment generating function? Find the moment generating function of normal distribution and find the mean and variance from the moment generating function. 5 1

Q.7 (a) What is stochastic process? Explain each type of stochastic processes with examples. 4 4

(b) A meteorologist studying the weather in a region decides to classify each day as simply sunny or cloudy. After analyzing several years of weather records, he finds: 4 4

- The day after a sunny day is sunny 80% of the time, and cloudy 20% of the time.
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- The day after a cloudy day is sunny 60% of the time, and cloudy 40% of the time.

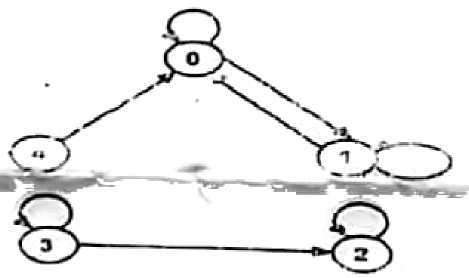
Now, setup a Markov chain to model this process. Find the probability that it will still be sunny in 4 days, given that it is sunny today?

(c) What is memory-less property? What do you mean by transition probability? How can you find t-step transition probability? 4 1

Q.8 (a) Describe the components of a Queuing system. 4 2

(b) What are the mitigating effects of long queue? Explain. 4 4

10 (c) What is the transition matrix of the following graph? Find out recurrent class and transient class of the graph. 4 4



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$\frac{\lambda^x e^{-\lambda}}{x!}$ $\lambda = np$

$(A \cap A') \cup B$ $\emptyset \cup B$

$= (A \cup B) \cap (A' \cup B)$

$A(B+C)$

$= AB + C$

$(A \cup A') \cap (A \cup B)$

$= S \cap (A \cup B)$

$= A \cup B$

$S \cap B$

$= (A \cup A') \cap B$

$= (A \cap B) \cup (A' \cap B)$