



# UNIVERSITY OF RUHUNA

## Faculty of Engineering

Mid-Semester 4 (Repeat) Examination in Engineering: November 2014

Module Number: IS4307

Module Name: Probability and Statistics

[Two hours]

[Answer all questions, each question carries five marks]

- Q1. a) Suppose that in Colombo city, the probability that a rainy fall day is followed by a rainy day is 0.80 and the probability that a sunny fall day is followed by a rainy day is 0.60. Find the probabilities that a rainy fall day is followed by
- a rainy day, a sunny day, and another rainy day;
  - two sunny days and then a rainy day;
  - two rainy days and then two sunny days.
- [3 Marks]
- b) A statistics class contains 60% male and 40% female students. It is known that in a test, 10% of males and 5% of females got an "A" grade. If one student from this class is randomly selected and observed to have an "A" grade, what is the probability that this is a male student?
- [2 Marks]
- Q2. a) Briefly explain the terms of "sample space" and "event" of an experiment.
- [1 Mark]
- b) A die is loaded (not all outcomes are equally likely) such that each even number is twice as likely to occur as each odd number. Find  $P(X)$ , where  $X$  is the event that a number greater than 2 occurs on a single roll of the die.
- [2 Marks]
- c) Assume that a noisy channel independently transmit symbol, say 0s 70% of the time and 1s 30% of the time. At the receiver, there is a 1% chance of obtaining any particular symbol distorted. What is the probability of receiving a 1, irrespective of which symbol is treated?
- [2 Marks]

- Q3. a) Let  $Y$  be a random variable with probability density function

$$f(y) = \begin{cases} \frac{3}{64}y^2(4-y) & 0 \leq y \leq 4 \\ 0 & \text{elsewhere} \end{cases}$$

- i. Find the expected value and variance of  $Y$ .
- ii. Let  $X = 300Y + 50$ , find  $E(X)$  and  $Var(X)$ .
- iii. Find  $P(X > 750)$ .

[3 Marks]

- b) Suppose that a sample of 14 strands of drapery yarn has resulted in a sample mean thread elongation of 12.48 mm. A 15<sup>th</sup> strand results in an elongation value of 11.9. What are the values of the sample mean and sample standard deviation for all 15 elongation observations?

[2 Marks]

- Q4. a) Let  $X$  be a Poisson random variable with probability function

$$f(x) = \frac{e^{-\lambda} \lambda^x}{x!}, \quad x = 0, 1, 2, \dots$$

where  $\lambda$  is the parameter. Find the moment generating function of  $X$ .

[2 Marks]

- b) On the basis of past experience, the probability that a certain electrical component will be satisfactory is 0.97. The components are sampled item by item from continuous production. In a sample of five components, what are the probabilities of finding
- i. zero,
  - ii. exactly one,
  - iii. exactly two,
  - iv. two or more
- defectives?

[3 Marks]