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UNIVERSITY OF ESWATINI



MAIN EXAMINATION, 2018/2019

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B.Sc. IT

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**Title of Paper** : Probability and Statistics

**Course Number** : CSC205

**Time Allowed** : Three (3) Hours

**Instructions**

1. This paper consists of FOUR (4) questions, answer ALL of them.
2. Each question is worth 25%.
3. Show all your working.
4. Start each new major question on a new page and clearly indicate the question number at the top of the page.
5. You can answer questions in any order.

**Special Requirements: NONE**

**ANSWER ALL QUESTIONS**

**QUESTION 1 [20 Marks]**

- a) Suppose that employees of a certain IT firm are such that 70% of them knows Python, 60% knows Fortran and 50% know both languages. Let  $P(A)$  be the probability of those who know Python,  $P(B)$  be the probability of those who know Fortran. Determine the values of the following.
- i)  $P(\bar{A})$  [3]
  - ii)  $P(A \cap B)$  [3]
  - iii)  $P(A \cup B)$  [3]
  - iv)  $P(A \cup \bar{B})$  [3]
  - v)  $P(A \cup \bar{A})$  [3]
- b) During some construction, a network blackout occurs on Monday with probability 0.8 and on Tuesday with probability 0.3. Suppose there is a probability 0.35 of experiencing network blackouts on both Monday and Tuesday. What is the probability of having a blackout on Monday or Tuesday? [5]
- c) There is a 0.04 probability for a hard drive to crash. Therefore, it has two backups, each having a 0.17 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? [5]

**QUESTION 2 [20 Marks]**

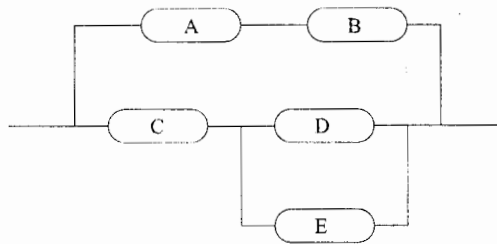
- a) Lifetime of a certain hardware is a continuous random variable with density

$$f(x) = \begin{cases} v - \frac{x}{50} & \text{for } 0 < x < 10 \text{ years} \\ 0 & \text{for all other } x. \end{cases}$$

- i) Find  $v$ . [5]
  - ii) What is the probability of a failure within the first 5 years? [8]
  - iii) What is the expectation of the lifetime? [5]
- b) The time it takes a printer to print a job is an Exponential random variable with the expectation of 12 seconds. You send a job to the printer at 10:00 am, and it appears to be third in line. What is the probability that your job will be ready before 10:01? [7]

**QUESTION 3 [20 Marks]**

- a) Ninety percent of flights depart on time. Eighty percent of flights arrive on time. Seventy-five percent of flights depart on time and arrive on time. You are meeting a flight that departed on time. What is the probability that it will arrive on time? [7]
- b) 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. [8]
- c) Calculate reliability of the system in the figure below if each component is operable with probability 0.68 independently of the other components. [10]



**QUESTION 4 [20 Marks]**

- a) For some electronic component, the time until failure has Gamma distribution with parameters  $\alpha = 2$  and  $\lambda = 3$  ( $years^{-1}$ ).
- i) Compute the probability that the component fails within the first 6 months. [10]
- ii) Compute the probability that the component failure exceeds 6 months. [5]
- b) Every day, the number of network blackouts has a distribution (probability mass function).

$x$	$P(x)$
0	0.7
1	0.2
2	0.1

A small internet trading company estimates that each network blackout results in a  $E500.00$  loss. Compute expectation of this company's daily loss due to blackouts. [10]