



## **MASENO UNIVERSITY**

**FIRST YEAR SECOND SEMESTER EXAMINATIONS FOR THE  
DEGREE BACHELOR OF SCIENCE IN INFORMATION  
TECHNOLOGY  
(CITY CAMPUS - EVENING)**

### **CIT 107: PROBABILITY AND STATISTICS**

Date: 7<sup>th</sup> April, 2014

Time: 5.30 – 7.30 p.m.

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#### **INSTRUCTIONS:**

- **SECTION A: Attempt Question 1 (COMPULSORY) 30 marks.**
- **SECTION B: Questions 2-5: answer ANY TWO questions of your choice.**

**SECTION A****{30 MARKS}**

- Q1. (a) Define
- (i) Trial [2 marks]
  - (ii) Sample space [2 marks]
- (b) Outline the main difference between probability and statistics [4 marks]
- (c) (A die has the numbers one to six marked on its sides. Assuming that it is a fair distribution
- (i) Draw the graph of the probability distribution function for the outcome from one throw of the die. [3 marks]
  - (ii) Calculate the probability that throwing two dice the sum of the dice is 5. [4 marks]

(d)

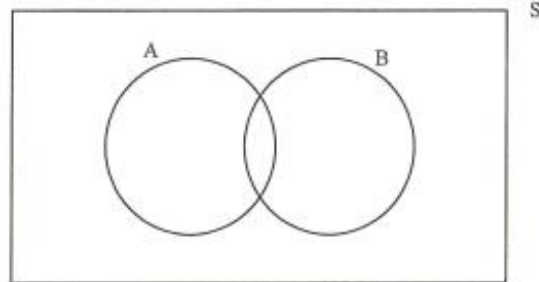


Figure 1.1.

Given figure 1.1.

- (i) Expand the probability  $P(A \cap B)$ . [2 marks]
  - (ii) Expand the probability  $P(A \cup B)$ . [2 marks]
  - (iii) Graphically represent  $P(A \cup B)$ . [3 marks]
- (e) Given that the School of Computing and Informatics has two departments, that is, Computer Science (CS) and Information Technology (IT). In CS department there are 318 female students and 382 male students. In IT department there are 200 female students and 150 male students. In the School meeting between the students and the dean, the dean picks a department at random and then picks a student at random in that department during question and answer time. Calculate

- (i) The probability that student chosen is a male. [4 marks]
- (ii) The conditional probability that the student picked is in IT department given that he is a male. [4 marks]

**SECTION B**

**{20 MARKS EACH}**

- Q2. (a) An integrated circuit design includes resistors of 100 *ohms*. After manufacture, 100 samples are tested and the following resistances found for the nominal 100 –  $\Omega$  resistor (the data is presented in ohms in table 2.1.).

Table 2.1

90	106	103	94	96	98	93	101	90	101
100	103	90	113	99	111	104	103	103	104
115	95	96	92	98	119	97	101	96	119
80	105	97	110	83	110	83	86	110	83
113	95	99	104	97	110	98	120	99	110
114	101	86	104	96	102	91	96	101	91
99	87	105	95	98	100	85	101	99	101
105	91	107	93	84	101	92	112	91	92
90	101	93	95	102	104	100	119	93	104
99	102	118	85	109	105	91	102	85	109

- (i) Express the data in a table of frequency distribution of resistances of a sample of resistors [10 marks]
  - (ii) Draw the histogram [4 marks]
  - (iii) Calculate the mean, variance and standard deviation [6 marks]
- Q3. (a) A bag contains four yellow beads and five orange beads. A bead is randomly chosen out of the bag without replacement. Three selections are made. All out comes are assumed equally likely.
- (i) Draw the probability tree [4 marks]
  - (ii) Find the probability that two orange beads were selected. [3 marks]
  - (iii) Find the probability that the beads selected were all yellow [3 marks]

(b) A bag contains four black balls and six red balls. A ball is repeatedly chosen at random from the bag, its colour noted and then replaced. Find the following probabilities:

(i) in the first two selections no black ball was picked. [2 marks]

(i) the first four picked balls were red [4 marks]

(ii) in a selection of five there were exactly 3 black balls [4 marks]

Q4. (a) Two components X and Y are connected to form a circuit. The probability that component X functions is  $P(X)$  while the probability that component Y functions is  $P(Y)$ . Find the overall probability of the system functioning if X and Y are connected in:

(i) Series [3 marks]

(ii) Parallel [3 marks]

(b) A communication network has a 1.2 % probability of power failure over 24-hr period. To guard against failure, a standby electrical power generator is connected in parallel with an automatic switching device should the mains fail. If the generator has a 3.1 % probability of failure, determine the probability that despite this precaution the communication will fail? [4 marks]

(c) In figure 3.1., each component in system S is assumed to be independent of the others and has its reliability indicated.

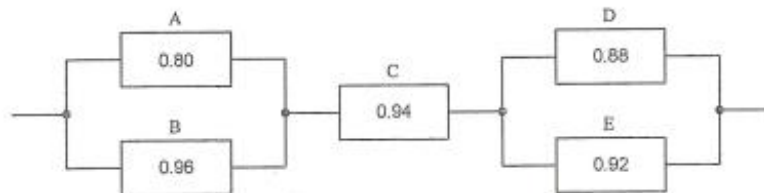


Figure 3.1. System S.

Calculate:

(i) the reliability of the system [8 marks]

(ii) the probability of the system failure [2 marks]

Q5. (a) Give a brief description of Normal distribution and outline its importance. [8 marks]

(b) A continuous probability density function for  $x$ , where  $x$  is  $N(\mu, \sigma)$  is given by

$$f(x) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(x-\mu)^2}{2\sigma^2}}.$$

(i) Briefly explain what happens when a substitution  $z = \frac{x-\mu}{\sigma}$  is made into equation 5.1. [4 marks]

(ii) Supposing it has been found that a sample of resistors have a mean of 10.02 and a standard deviation of 0.06, explain how the area lying inside an acceptable tolerance of  $10 \pm 1$  can be obtained using the expression for  $z$  in (i). [8 marks]