BENNETT UNIVERSITY
THE TIMES GROUP

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Department/ School: SCSET BTECH CSE

**END-TERM EXAMINATION, ODD SEMESTER DECEMBER 2023**

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|---|---|---|---|
| **COURSE CODE** | CSET240 | **MAX. DURATION** | 2 HRS |
| **COURSE NAME** | Probability and Statistics | | |
| **PROGRAM** | B. Tech | **TOTAL MARKS** | 45 |

| Mapping of Questions to Course and Program Outcomes | | | | | | | |
|---|---|---|---|---|---|---|---|
| Q.No. | A1 | A2 | A3 | B1 | B2 | B3 | B4 |
| CO | 1 | 3 | 1 | 1 | 2 | 3 | 2 |
| PO | 1-2 | 1-2 | 4-5 | 1-2 | 1-2 | 4-5 | 4-5 |
| BTL*[1] | 1 | 1 | 2 | 3 | 2 | 4 | 4 |

**GENERAL INSTRUCTIONS: -**

1. Do not write anything on the question paper except **name, enrolment number** and **department/school.**
2. Carrying mobile phones, smartwatches and any other non-permissible materials in the examination hall is an act of **UFM.**

**COURSE INSTRUCTIONS:**

a) **The question paper comprises of two sections, A and B.**

b) **All the questions are compulsory.**

c) **Scientific Calculator is allowed.**

**SECTION A**

**Max Marks: 20**

A1) Prove that for any events $A$ and $B$, the probability of the union of $A$ and $B$, denoted as $P(A \cup B)$, can be expressed as: **(5 Marks)**

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

A2) A person was in Singapore and was afraid that he has caught a tropical disease. He, therefore, went to the doctor and got himself tested. The test came back positive. The accuracy of the test is 96%. However, being a rare disease, only one out of 5,000 people is affected by the disease. Calculate the probability that the person has the disease given that he tested positive. Assume false positive to be 4%. **(7 Marks)**

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**A3)** Prove that the sum of two independent Bernoulli random variables is or is not Bernoulli. **(8 Marks)**

## SECTION B

**Max Marks: 25**

**B1)** Bennett University conducts its exam on a scale of 0 to 1. Suppose 60% is needed to pass the exam. The marks of all students are modeled as: **(6 Marks)**

$$f(x) = \begin{cases} 4x & \text{for } 0 \le x \le 1/2 \\ 4 - 4x & \text{for } 1/2 \le x \le 1 \\ 0 & \text{otherwise} \end{cases}$$

**a)** Compute the probability that a random student passed the exam.
**b)** What score is the 80th percentile of the distribution?

**B2)** Derive the mean of Normal Distribution. **(8 Marks)**

**B3)** Once people arrive in Thailand, they want to enjoy the sun and beaches on two popular islands in the south: Samui Island and Phangan Island.
From survey data:

**a)** When on the mainland, *70%* of tourists plan to go to Samui Island, *20%* to Phangan Island, and only *10%* remain on shore the next day.
**b)** When on Samui Island, *40%* continue to stay on Samui, *50%* plan to go to Phangan Island, and only *10%* return to mainland the next day.
**c)** When on Phangan Island, *30%* prolong their stay here, *30%* divert to Samui Island, and *40%* go back to mainland the next day.

Starting from the mainland, what is the probability (in percentage) that the travellers will be on the mainland at the end of a 2-day trip? **(5 Marks)**

**B4)** From generation to generation, the mean age when smokers first start to smoke varies. However, the standard deviation of that age remains constant of around *2.1* years. A survey of *40* smokers of this generation was done to see if the mean starting age is at least *19*. The sample mean was *18.1* with a sample standard deviation of *1.3*. Do the data support the claim at the *5%* level? **(6 Marks)**

-ALL THE BEST-