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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

First Semester M.Tech Degree Regular and Supplementary Examination December 2023 (2022 Scheme)

Discipline: COMPUTER SCIENCE AND ENGINEERING

Course Code & Name: 221TCS002 FOUNDATIONS OF COMPUTER SCIENCE

Normal Distribution tables are permitted during the examination

Max. Marks: 60 Duration: 2.5 Hours

PART A

Answer all questions. Each question carries 5 marks Marks

1 Use mathematical induction to prove that 5 divides n^5-n whenever n is a non-negative integer. (5)

2 Is the set of real numbers countable? prove your answer. (5)

3 Solve the recurrence relation $a_n - 3a_{n-1} = 5.(7^n)$, $n \geq 1$, $a_0=2$ (5)

4 In a certain factory turning razor blades, there is a small chance of 1/500 for any blade to be defective. The blades are in packets of 10. Use Poisson's distribution to calculate the approximate number of packets containing (5)

(i) No defective blades

(ii) One defective blade

(iii) Two defective blades respectively in a consignment of 10000 packets.

5 In a set of 'm' randomly selected people, what is the probability that at least two people share the same birthday? (5)

PART B

Answer any 5 questions. Each question carries 7 marks

6 20 students are participating in an after-school program offering classes in Yoga Bridge course and Painting. Each student must take at least one of these 3 classes but may take 2 or all the 3 classes. Ten students take yoga, 13 students take bridge and 9 take Painting. Nine students take at least 2 classes. How many students are taking all the 3 courses? (7)

7 (a) Define Pigeon hole principle (3+4)

(b) What is the minimum number of students required in a maths class to be sure that at least 6 will receive the same grade if there are 5 possible grades such as A,B,C,D,E.

8 The harmonic numbers H_K , $K = 1,2,3$ ...are defined as (7)
$H_K = 1+1/2+1/3+\ldots\ldots+1/K$. Use mathematical induction to show that
$H_{2^N} \geq 1 + N/2$.

9 Determine the number of positive integers 'n' where $1 \leq n \leq 100$ and 'n' is not (7)
divisible by 2,3, or 5.

10 Ram and Sita are planning to apply for a job. The probability that Ram will apply (7)
for a job is ¼, Probability that Ram will apply for a job given Sita applies for the job is ½. The probability that Sita applies for a job given that Ram applies is 1/3. Determine the probability that Ram does not apply for the job given that Sita does not apply for the job.

11 Prove that the inverse of the product of two elements of a group G is equal to the (7)
product of the inverse taken in reverse order.

12 Suppose that a person deposits 20000 Rs in a savings account at a bank yielding (7)
11% per year with interest compounded annually. How much will be in the account after 40 years? (Strictly solve the problem using the concept of recurrence relation)

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