

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2015

COMPUTER SCIENCE & ENGINEERING

(INFORMATION SECURITY/COMPUTER SCIENCE & ENGINEERING/NETWORK
ENGINEERING)

01CS6101 MATHEMATICAL FOUNDATIONS OF COMPUTING SYSTEMS ✓

Max. Marks : 60

Duration: 3 Hrs

(Answer Any Two Questions From Each PART. All Questions Carry Equal Marks)

PART-A

1(a) Show that if $n = ab$, where a and b are positive integers, then $a \leq \sqrt{n}$ or $b \leq \sqrt{n}$ by contraposition. (3)

(b) Solve the recurrence relation $a_r - 2a_{r-1} = (r+1)2^r$ using characteristic root method (3)

(c) Explain Branching -time logic. (3)

2(a) Prove by exhausting cases that $2n^3 + 3n^2 + n$ is an even integer (3)

(b) Let $H_1 = 1$, $H_2 = 1 + 1/2$, $H_n = 1 + 1/2 + \dots + 1/n$ Prove that $\sum_{i=1}^n H_i = (n+1)H_n - n$ for all +ve integers $n \geq 1$ (3)

(c) What is meant by adequate set of connectives? Explain. (3)

3(a) Show that $\sqrt{2}$ is irrational by giving a proof by contradiction (3)

(b) Solve the Fibonacci series $a_n = a_{n-1} + a_{n-2}$; $a_0 = 1, a_1 = 1$, using Generating Functions. (3)

(c) Briefly discuss Linear -time temporal Logic. (3)

(2 x 9 = 18 marks)

PART-B

4(a) Five friends run a race everyday for 4 months (excluding Feb). If no race ends in a tie, Show that there are at least 2 races with identical outcomes. (3)

(b) In how many ways can (i) 12 balloons be distributed at a birthday party among 10 children (ii) Find the number of ways the balloons can be distributed if we ensure that every child gets at least one balloon.

(3)

(c) Discuss various methods of enumeration.

(3)

5(a) List out the important properties of Pascal's Triangle.

(3)

(b) Determine the coefficient of x^9y^3 in the expansion of $(x+y)^{12}$, $(x+2y)^{12}$ and $(2x-3y)^{12}$ using binomial theorem.

(3)

(c) Explain Binomial distribution. A fair coin is tossed 50 times. What is the probability that heads will appear exactly 25 times?

(3)

6(a) There are 8 guests in a Party. Each guest brings a gift and receives another gift in return. No one is allowed to receive the gift they bought. How many ways are there to distribute the gifts? <http://www.ktuonline.com>

(3)

(b) Find the mean & variance of a Poisson distribution.

(3)

(c) Suppose an Item is manufactured by three machines X, Y, Z. All the three machines have equal capacity and are operated at the same rate. It is known that percentages of defective items produced by X, Y, Z are 2, 7, 12 % respectively. All the items produced by X, Y, Z are put into one bin. From this bin one item is drawn at random and is found to be defective. What is the probability that this item was produced by Y?

(3)

(2 x 9 = 18 marks)

PART-C

7(a) Prove that "If a graph (connected or disconnected) has exactly two vertices of odd degree, there must be a path joining these two vertices". (4)

(b) Discuss Elliptic Curve Arithmetic. (4)

(c) Prove that the subgroup of a Cyclic Group is Cyclic. (4)

8(a) Give examples of (i) Directed Graph (ii) Undirected Graph (iii) Simple Graph (iv) Weighted Graph (4)

(b) What are decision Trees? Explain. (4)

(c) Discuss reciprocity. (4)

9(a) If in a Ring 'R' with Unity $(xy)^2 = x^2y^2$ for all $x, y \in R$ then R is Commutative. (4)

(b) Prove that the necessary & sufficient condition that a non-empty subset 'H' of a Group 'G' be a Subgroup is $a \in H, b \in H \Rightarrow ab^{-1} \in H$. (4)

(c) State & Prove Euler's Theorem (4)

(2 x 12 = 24 marks)

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