

RAMAKRISHNA MISSION VIDYAMANDIRA

Belur Math, Howrah – 711 202

P.G. ADMISSION TEST – 2023

COMPUTER SCIENCE

Date : 18-08-2023

Full Marks : 50

Time: 12-00 noon – 2-00 p.m.

Instructions for the candidates

Answer all the questions given below. *Calculator is not allowed.*

Answer all the questions :

[10×5]

1. Write the following sentences in FOL and then convert them into Normal forms.
 - a) Every Professor writes at least one book.
 - b) Every dog owner is an animal lover. (2.5+2.5)
2. For each of the following activities give a PEAS (Performance-Environment-Actuator-Sensor) description of the task environment:
 - a) AI based teaching to humans.
 - b) Practicing tennis against a wall. (2.5+2.5)
3.
 - a) Suppose n computers are connected in a network through mesh topology. Find the values of n, for which the graph representing that network should be an Euler graph.
 - b) There are five coplanar lines. Four distinct points are there on each of these lines. Find the maximum number of triangles with vertices at those points. (2+3)
4. An ordinary deck of 52 playing cards is randomly divided into 4 piles of 13 cards each. Compute the probability that each pile has exactly 1 ace. (5)
5. Suppose we want to transmit the message 1011001001001011 and protect it from errors using the CRC8 polynomial $x^8 + x^2 + x^1 + 1$.
 - a) Use polynomial division to determine the message that should be transmitted.
 - b) Suppose the leftmost bit of the message is inverted due to noise on the transmission link. How does the receiver know that an error has occurred? (2.5+2.5)
6. In a block of addresses, the IP address of one host is 182.44.82.16/26.
 - a) What is the first address (network address) and the last address in this block?
 - b) Find the number of addresses in this block. [(2+2)+1]
7. Show that, $\sum_{i=1}^n i^k = \theta(n^{k+1})$ (5)
8. The main memory of a computer has $2cm$ blocks while the cache has $2c$ blocks. If the cache uses the set associative mapping scheme with 2 blocks per set, then block k of the main memory maps to the which set of cache memory. (5)
9. In a k-way set associative cache, the cache is divided into v sets, each of which consists of k lines. The lines of a set placed in sequence one after another. The lines in set s are sequenced before the lines in set (s+1). The main memory blocks are numbered 0 onwards. Which cache lines would be mapped to the memory block numbered 'j'? (5)
10. Create a Red Black Tree by inserting the values (show all rotations): 4, 7, 12, 15, 3, 5, 14, 18, 16, 17. (5)

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