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1. (20%)In the context of operating systems, one approach to prevent deadlocks between concurrent processes is to impose a total ordering of all resource types, and each process must request resources in an increasing order of enumeration. (1) What is a "total ordering"? (Please give formal definitions)(2)Why the total ordering approach can prevent deadlocks? (Please give a proof.)

2. (20%)Find the finite-state automata equivalent to the nondeterministic finite-state automata defined as follows, where the input set of symbols = {a, b, c}, the set of states = $\{S_0,S_1,S_2\}$, and the initial state = $\{S_0\}$.

Input /states	a	b	c
S_0	$\{S_1\}$	Empty set	Empty set
S_1	$\{S_0\}$	$\{S_2\}$	$\{S_0, S_2\}$
S_2	$\{S_0,S_1,S_2\}$	$\{S_0\}$	$\{S_0\}$

3. (15%)Let c_n denote the number of strings over {0,1,2} of length n that contain an even number of 1's. (1)Write a recurrence relation and initial condition that define the sequence c_1, c_2,….(2) Solve the recurrence relation to obtain an explicit formula for c_n.

4. (10%)Consider the tic-tac-toe game. Assume that the first player marks an X at the center square. The other player is supposed to mark an O at some square. Draw a two-level game tree, with the root having an X in the center square. Omit symmetric positions. Evaluate all the vertices use the evaluation function: ef(P) = NX – NO; where NX (respectively, NO) is the number of rows, columns, or diagonals containing an X (respectively, O) might complete, if square P is chosen. Which is the best position for O to move?

(背面仍有題目,請繼續作答)

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5. Answer the following questions briefly:

(1)(5%)Give examples of distinct binary trees B_1 and B_2, each with two vertices, with the preorder vertex listing of B_1 equal to the preoder listing of B_2 and the postorder vertex listing of B_1 equal to the postorder listing of B_2.

(2)(5%)Show that any simple, connected graph with 31 edges and 12 vertices is not planar.

(3)(5%) Prove that a tree is a bipartite graph.

(4)(5%)Let G be a connected graph. The distance between vertices x and y in G, $dist(x,y)$ is the length of a shortest path from x to y. The *diameter* of G is: $d(G) = \max \{dist(x,y) \mid x \text{ and } y \text{ are vertices in } G.\}$

What is the diameter of an n-cube? In the context of parallel computing, what is the meaning of this value?

(5)(5%)Let A be the adjacency matrix of a graph G with n vertices. Let $B = A^1 + A^2 + \ldots + A^{n-1}$. If some off-diagonal entry in the matrix B is zero, what does this imply?

(6)(5%)A marathon beginner decides to try to complete the local marathon. The beginner (runner) will stop if the marathon is completed or after three attempts. The probability of completing the marathon in one attempt is 1/3. Analyze the following argument that, assuming independence. What is the probability that the beginner is able to complete the marathon?

(7)(5%) Suppose that there are three persons who each randomly choose a box among 12 consecutive boxes. What is the probability that the three boxes are consecutive?