

EXAM (11/13/2000)
COP 6617 Distributed System Design
Open books and notes

Name _____ SSN _____

1. (20 pts) Calculate (a) node degree, (b) diameter, (c) the number of links for an $n \times n$ *extended mesh* (see page 207).

2. (20 pts) *Binomial coefficient* $\binom{n}{k}$ can be calculated in a tabular format (Pascal's triangle) based on $\binom{n}{k} = \binom{n-1}{k} + \binom{n-1}{k-1}$. Provide a DCDL implementation of $\binom{n}{k}$ and use one process for each binomial coefficient. Note that $\binom{n}{n} = \binom{n}{0} = 1$. Demonstrate the correctness of your solution using $\binom{4}{2}$.

3. (20 pts) Provide linear and vector clocks for all the events in the system given in Problem 2 of Chapter 3 (page 101). Assume that LC' s for P_1 , P_2 , P_3 are initialized to 1, 2, and 0, respectively. d' s for P_1 , P_2 , P_3 are 2, 1, and 2, respectively.

4. (20 pts) In Figure 6.2 (page 179), find the shortest distance from P_1 to P_i , where $i = 2, 3, 4, 5$ using (a) Dijkstra's algorithm and (b) Bellman and Ford's algorithm.

5. (20 pts) Recently (in July issue of IEEE TC), Chiu proposed an *odd-even turn model*, which is an extension to Glass and Ni's turn model. The odd-even turn model tries to prevent the formation of the *rightmost column segment of a cycle*. Two rules for turn are given in:

- Rule 1: Any packet is *not* allowed to take an EN (east-north) turn at any nodes located in an even column, and it is *not* allowed to take an NW turn at any nodes located in an odd column.
- Rule 2: Any packet is *not* allowed to take an ES turn at any nodes located in an even column, and it is *not* allowed to take a SW turn at any nodes located in an odd column.

(a) Use your own word to explain that the odd-even turn model is deadlock-free.

(b) Show *all the shortest paths* (permissible under the extended odd-even turn model) for

(a) $s_1 : (0, 0)$ and $d_1 : (2, 2)$ and (b) $s_2 : (0, 0)$ and $d_2 : (3, 2)$