MIDTERM EXAM (Feb. 25, 2003)
COP 6617   Distributed System Design
Open books and notes

Name ————————————————- SSN ———————————————-

1. (20 pts)

   For a given $n \times n \times n$ 3-D mesh, find out (a) the number of links, (b) diameter, and (c) bisection width. Consider separate cases when n is even and when n odd for (c). Demonstrate the solutions on a $3 \times 3 \times 3$ 3-D mesh.

2. (20 pts)

Given a 6-node directed graph with the directed edge set $\{(1,2), (1,3), (1,4), (2,5), (3,6), (4,6), (5,6)\}$. Express this DAG using (a) parbegin/parend, (b) fork/join, and (c) parbegin/parend together with semaphore.

3. (20 pts)

In the example on page 81 (Figure 3.8), suppose the initial clock values for processes A, B, and C are 2, 1, 3, respectively. In addition, the d values for A, B, and C are 1, 3, 2, respectively. Assign a vector clock for each event. Events in B can be labeled as b_1, b_2, and so on.

4. (20 pts)

Show the resource allocation time for each of the three processes in the table below

process id	priority	retry interval	request time	length
P_1	2	2	1	3
P_2	1	1	1.5	2
P_3	3	2	2.5	1

when

(a) the wait-die scheme is used, and

(b) the wound-wait scheme is used.

5. (20 pts)

Implement three iterative processes A, B, C. In each round of iteration, process A applys $a := f(a)$ once to reduce variable a (which has an initial value of n). When a reaches 0, A resets a to the initial value n and starts over again. Processes B and C are involved in a barrier synchronization. B and C perform $b := g(b)$ and $c := h(c)$ once each round, respectively. However, C does only one round of iteration for every two rounds of iteration in B. In addition, B starts a new round only when each time a in A reaches 0. (Assume it takes a longer time for A to reduce a to 0 than for B and C to complete one round). Use DCDL to describe interactions among A, B, and C. Show all details of communication and synchronization using asynchronous send and receive commands.