ITCS 4145/5145 Introduction Parallel Programming
Final exam
Tuesday May 7th, 2002, 7 pm - 10 pm

FOUR pages
Attempt all questions in the spaces provided.   Name: ....
Use additional paper if necessary.
Do not refer to any materials except that provided with this exam paper.

Mark/40

Qu. 1   Answer each of the following <u>briefly</u>:

(a)   Name two ways to create executable code for a shared memory multiprocessor.   2

(b)   If three processes reach their critical sections together, what is the total time the processes spend waiting to enter their critical sections given each critical section takes t_c seconds?   2

(c)   Under what circumstances would process 2 not obtain the value new in data_copy after the execution of the following: 2

```
     Process P1                    Process 2
        .                             .
     data = new;                      .
     flag = TRUE;                     .
        .                             .
        .                          while (flag != TRUE) { };
        .                          data_copy = data;
        .                             .
```

(d)   What is meant by the term strict consistency and why is it not usually enforced in a distributed shared memory system?   4

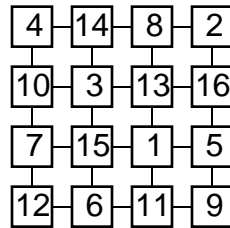(e)   Briefly outline how a multiple reader/single writer policy can be implemented in a distributed shared memory system.   4

(f)   What is meant by the term cost-optimal parallel algorithm?   2

(g)   Show the steps to sort the following numbers using Shearsort: 6

$$
\begin{array}{|c|c|c|c|}
\hline
4 & 14 & 8 & 2 \\
\hline
10 & 3 & 13 & 16 \\
\hline
7 & 15 & 1 & 5 \\
\hline
12 & 6 & 11 & 9 \\
\hline
\end{array}
$$

(h)   What is a Bitonic sequence and what specific feature of this sequence is used in Bitonic Mergesort?   4

(i)   What is meant by the term block matrix multiplication and why is it used in parallel matrix multiplication?
                                                                                                    4

Qu. 2   Write a parallel program (PVM or MPI) to perform matrix-vector multiplication using a systolic array approach. Assume a 4×4 matrix and a 4×1 vector. Use four processes.   10