

ITCS 4145/5145 Parallel Programming (Cluster Computing)

Test 1

5:00 pm - 6:15 pm, Monday September 24th, 2007

Name:

Part I is closed book. Do not refer to any materials for this part. Part II is open book. You may refer to any materials for this part (but not others in the class). Return Part I to get Part II.

Total /40
Part I /20
Part II /20

Part I

Do not refer to any materials for this part

Qu. 1 Answer each of the following briefly:

(a) Explain what is meant by the term “parallel programming” *without* using the terms “parallel”, “programming”, or “program”). 2

(b) Suppose a program has a part at the beginning that is sequential in nature (must be executed by only one processor) and takes 3 ms. Also there is a part at the end of the program that is sequential and takes 4 ms. Between these two parts can be divided into 5 equal parts that can be executed simultaneously and each of these parts takes 16 ms. What is maximum speed-up according to Amdahl's law? 2

(c) What is the difference between an asynchronous blocking send routine and an asynchronous non-blocking send routine? 2

(d) Could a Reduce operation be used with the subtract operation? Explain. 2
(No points for saying yes or no without an explanation.)

(e) What is a “communicator” in MPI? 2

(f) What does the command:

```
mpiexec -machinefile machines -n 6 ./hello world
```

do?

(be careful. -n and -np are equivalent.) 2

(g) What does the MPI routine MPI_Wtime() do?

(h) Explain Adaptive Quadrature as applied to numerical integration

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(i) The Barnes Hut algorithm when applied to a gravitational N -body problem creates an *octtree*. What is an octtree and why is it created?

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Part II

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Qu. 2 Write a complete MPI program that computes $x * \pi$ where π is computed using the series:

$$\pi = 1 - 1/3 + 1/5 - 1/7 + 1/9 \dots$$

using a pipeline approach, and different values of x are supplied to the first stage of the pipeline. Make whatever reasonable assumptions that are necessary but state them

Provide comments in your code to help the grader! If I do not understand the code, I will assume it is incorrect.