Parallel Computing Practice Exam

Instructions: Answer all questions to the best of your ability. This exam is designed for debugging and practice; focus on understanding the concepts.

Section 1: Multiple Choice (2 points each)

1. Which of the following is NOT a primary advantage of parallel computing?

a) Increased speed for computationally intensive tasks

b) Reduced memory usage

c) Ability to solve larger problems

d) Enhanced fault tolerance

Answer: _____

2. What is Amdahl's Law used to estimate?

a) The maximum speedup achievable through parallelization

b) The optimal number of processors for a given task

c) The communication overhead in a parallel system

d) The memory bandwidth required for parallel processing

Answer: _____

3. A race condition occurs when:

a) Two processes share the same memory location concurrently

b) A process is waiting indefinitely for a resource held by another process

c) A process terminates unexpectedly

d) A deadlock situation occurs

Answer: _____

4. Which of the following is a common method for achieving synchronization in parallel programs?

a) Mutexes

b) Semaphores

c) Monitors

d) All of the above

Answer: _____

Section 2: Short Answer (3 points each)

5. Briefly explain the difference between shared memory and distributed memory parallel systems.

Answer: _____
_____
_____

6. Describe the concept of a "deadlock" in the context of parallel programming. Give a simple example.

Answer: _____
_____
_____

Section 3: Problem Solving (5 points each)

7. A program has a sequential portion that takes 10 seconds to execute and a parallelizable portion that takes 60 seconds to execute sequentially. If we use 4 processors to execute the parallelizable portion, what is the total execution time of the program, assuming perfect parallelization?

Answer: _____
_____
_____

8. Consider a parallel program that performs matrix multiplication. Identify at least two potential sources of overhead and explain how they can affect performance.

Answer: _____
_____
_____

Section 4: True/False (2 points each)

9. True or False: Using more processors always leads to a proportional increase in the speed of a parallel program.

Answer: _____

10. True or False: Load balancing is crucial for efficient parallel program execution.

Answer: _____

Answer Key (For Debugging Purposes):

1. b
2. a
3. a
4. d
5. Shared memory systems have a single address space accessible by all processors, while distributed memory systems have multiple address spaces, requiring explicit communication between processors.
6. A deadlock occurs when two or more processes are blocked indefinitely, waiting for each other to release resources. Example: Process A holds resource X and needs resource Y; Process B holds resource Y and needs resource X. Neither can proceed.
7. 25 seconds (10 seconds + 60 seconds / 4)
8. Communication overhead (passing data between processors) and load imbalance (uneven distribution of work) are two sources of overhead. These can increase execution time significantly, negating the benefits of parallelization.
9. False
10. True

This exam provides a balanced assessment of understanding for the subject, covering various concepts and question types. Remember to adjust difficulty and content according to your specific curriculum.