Parallel Computing
Homework Assignment 2
[Total of 30 points]

1. Can two threads, corresponding to different processes, write to the same physical memory address? Justify.

2. Can two threads corresponding to the same process write to the same physical memory address? Justify.

3. A sequential application with a 50% part that must be executed sequentially, is required to be accelerated four-fold. How many CPUs are required for this task?

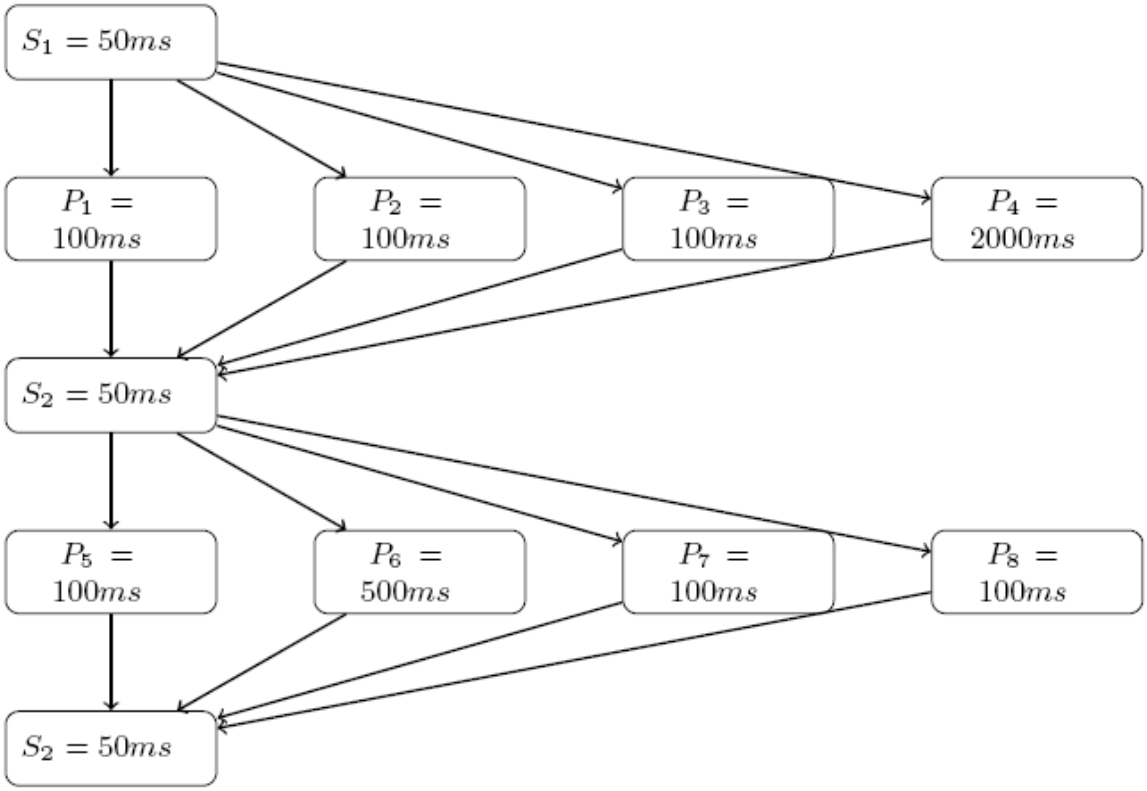
4. If two parallel threads try to update two different variables, can this cause coherence overhead? Justify.

5. Suppose we have four independent tasks A, B, C, and D. Give the amount of time needed for each task that makes executing the tasks on four cores give the same speedup, over sequential execution, as running the tasks on two cores.

6. State two reasons as to why load imbalance is bad.

7. If two threads have the same amount of computation, does this mean that we have perfect load balancing if we execute these two threads on two similar cores? Justify.

8. Assume we have the following task graph. A task can be thought of as function/procedure. Every task is labeled with its run time on a core. An arrow from a task to another means that the first task generates data needed by the second one. Assume all data are of the same size.



a. How will you parallelize that program (i.e. what is the smallest number of cores needed to execute in parallel to get the best performance)? Justify your choice.

b. What will be the speedup if we have 2 cores? 4 cores? 8 cores?

c. What is the span for the above graph? What is the work?