4.1 Provide two programming examples in which multithreading does not provide better performance than a single-threaded solution?

1) program that can only be executed sequentially

1. Shell program

4.3 Under what circumstances does a multithreaded solution using multiple kernel threads provide better performance than a single-threaded solution on a single-processor system?

when kernel threads frequently become blocked

4.4 Which of the following components of program state are shared across threads in a multithreaded process?

A) Register values

B) Heap memory

C) Global variables

D) Stack memory

1. C

4.8 Consider a multiprocessor system and a multithreaded program written using the many-to-many threading model. Let the number of user-level threads in the program be more than the number of processors in the system. Discuss the performance implications of the following scenarios.

A) The number of kernel threads allocated to the program is less than

the number of processors.

When the number of kernel threads is less than the number of processors, some processors will be in an idle state.

1. The number of kernel threads allocated to the program is equal

to the number of processors.

When the number of kernel threads allocated by the program matches the number of processors, it is possible that all processors will be used simultaneously, unless there are conflicts and exceptions.

1. The number of kernel threads allocated to the program is greater than the number of processors but less than the number of user-level threads.

In most cases, all processors will receive full utilization, leading to increased processor efficiency.