**Instructions:**

* Read the question completely before answering it.
* Write starting and finishing time in above section

**Time: 40 minutes.** **Max Marks: 20**

1. **The single benefit of a thread pool is to control the number of threads. [1]**
   1. **True**
   2. **False**
2. **A \_\_\_\_\_ uses an existing thread — rather than creating a new one — to complete a task.[1]**
   1. **Lightweight process**
   2. **Asynchronous procedure call**
   3. **Thread pool**
   4. **None of the above**
3. **A thread is composed of a thread ID, program counter, register set, and heap.[1]**
   1. **True**
   2. **False**
4. **When a child process is created, which of the following is a possibility in terms of the execution or address space of the child process?[1]**
   1. **The child is a duplicate of the parent.**
   2. **The child process has a new program loaded into it**
   3. **The child process runs concurrently with the parent.**
   4. **All of the above**
5. **Consider the following code segment:How many unique processes and threads are created?[3]**

|  |  |
| --- | --- |
| **pid t pid;**  **pid = fork();**  **if (pid == 0) { /\* child process /\***  **fork();**  **thread create( . . .);**  **}fork();** | **5 unique processes (p1, p2, p3, p4, p5) will be created. If the parent process is also considered, then 6 unique processes (p, p1, p2, p3, p4, p1, p5) will be created.**  **2 unique threads will be created.**  **Detail answer:**  **The statement pid = fork(); before the if statement creates one process. The parent process say p creates this process. Let it be p1.**  **The statement fork(); in the if statement creates one process. The parent process p creates this process. Let it be p2.**  **After the if statement, parent process p, process p1 and process p2 will execute fork(); creating three new processes.**  **One process is created by parent process p.**  **One process is created by process p1.**  **One process is created by process p2.**  **Hence, 5 unique processes (p1, p2, p3, p4, p5) will be created. If the parent process is also considered, then 6 unique processes (p, p1, p2, p3, p4, p1, p5) will be created.**  **Thread creation is done in if block. Only child process p1 is executed in the if block. Therefore, process p1 will be created one thread.**  **In the if block one process p2 is created using fork(). Therefore, process p2 will also create a thread.**  **Hence, 2 unique threads will be created.** |

1. **Determine if the following problems exhibit task or data parallelism:[3]**
   1. **The multithreaded sorting program: Data**
   2. **The multithreaded statistical program: Data**
   3. **The multithreaded web server: Task**
2. **What is a thread-join operation? [5]**

**A thread-join operation allows a thread to wait for another thread to finish. It puts the**

**calling thread to sleep and wakes when the target thread exits.**

1. **True or False: When designing a multithreaded application, you must use synchronization primitives to make sure that the threads do not overwrite each other’s registers. Explain. [5]**

**FALSE. The thread scheduler is responsible for making sure that each thread has its own set of register values (stored in the TLB). A TLB is never shared between threads.**