1) there are two processes in the system: proc1 and proc2.In proc1 , there is only one thread named thr11.In proc2, there are two threads named thr21 and thr22. For thr21, are the given values the same as or different from those of the other threads?

|  |  |  |  |
| --- | --- | --- | --- |
|  | **thr11 (proc1)** | **thr21 (proc2)** | **thr22 (proc2)** |
| **Files** | Different | Same | Same |
| **Registers** | Different | Different | Different |
| **Data** | Different | Same | Same |
| **Stack** | Different | Different | Different |
| **Code** | Different | Same | Same |
| **Program Counter** | Different | Different | Different |

2) what is the difference between concurrency and parallelism?

 **Concurrency** is about **managing multiple tasks** effectively at the same time.

 **Parallelism** is about **executing multiple tasks** simultaneously.

 Concurrency is a concept related to **task switching** and efficient scheduling, whereas parallelism involves **true simultaneous execution** of tasks using multiple hardware resources.

3) what is the benefit of multi-threading compared to multi-processing?

| **Feature/Aspect** | **Multithreading** | **Multiprocessing** |
| --- | --- | --- |
| **Memory Sharing** | Shared memory space | Independent memory space |
| **Resource Overhead** | Low | High |
| **Context Switching** | Faster, lightweight | Slower, heavyweight |
| **Communication** | Easier (shared memory) | Requires IPC mechanisms |
| **Use Case** | I/O-bound tasks, real-time applications | CPU-bound tasks, compute-heavy workloads |
| **Memory Consumption** | Lower | Higher |