Q03
CPU Bound Tasks Hypothesis:

Threaded:
Assume there is only one processor and only one program can run at a time.
Processor can process only one thread at a time. Every time when processor switch to new thread, the TCB needs to be saved and loaded(new thread's) which adds over head. The overhead increases with increase in number of threads.

Process:
Same as the case with thread, but with process, the overhead will be more because the process control block needs more states to be saved and loaded when there is a switch. So, with process the time may increase more when compared to threads as overhead is more in process.

Sequential:
The time remains same, and will be less than threaded and forked as CPU need not to do any switching between Process/Threads.
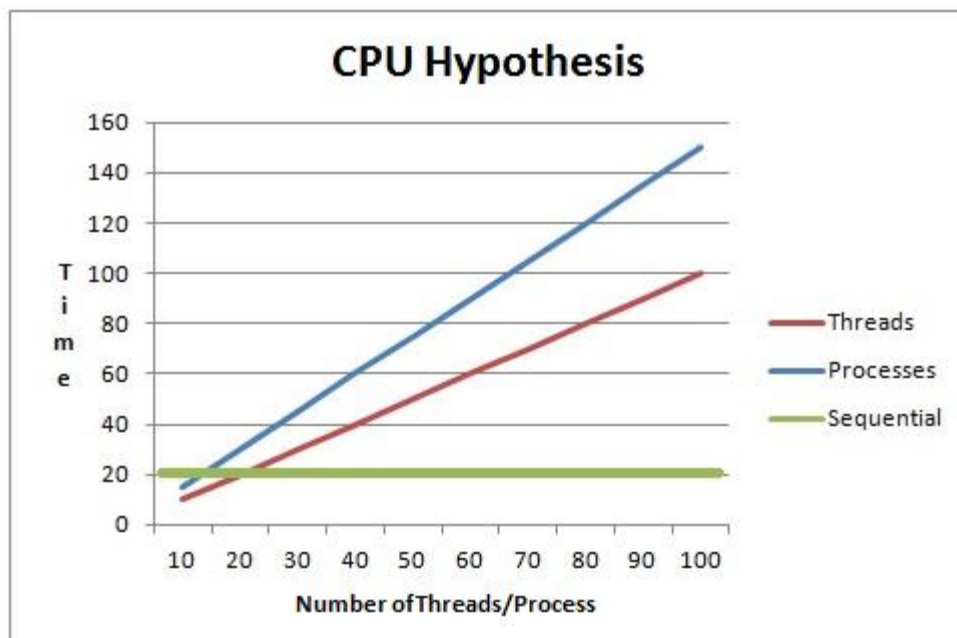
I/O Bound Hypothesis:
In I/O bound tasks, computer need to wait for I/O devices until they are ready.
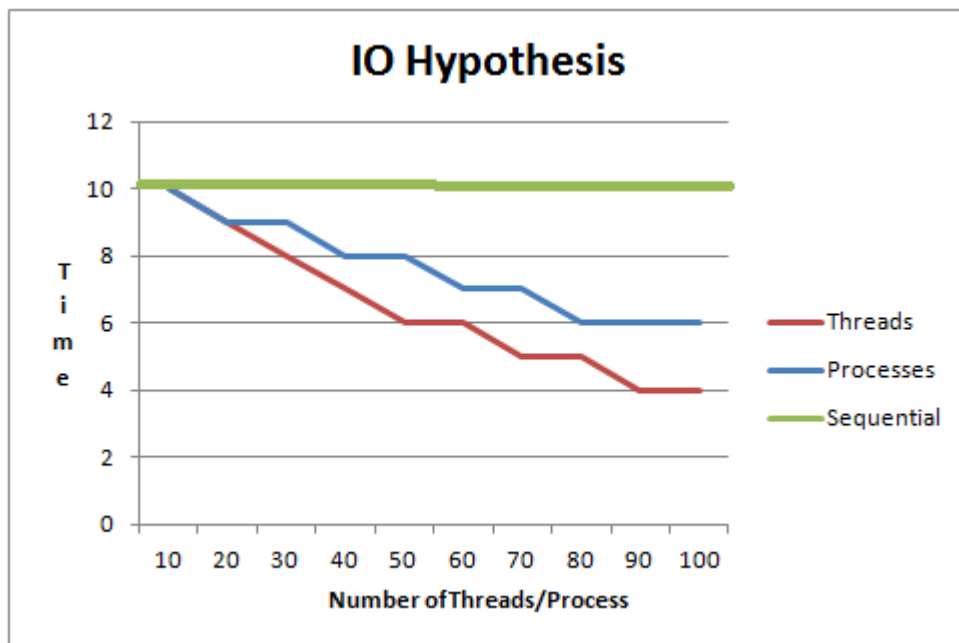
Sequential:
If sequential, the computer will wait for each I/O one by one and incur huge waiting time as it waits one after other.

Threaded:
If threaded, each thread may be waiting for an I/O task and the thread whose I/O gets ready will start to process resulting in less wait time.

Process:
Multi process will also has same advantage as that of threaded but the overhead associated with it may make it more slower than threaded.
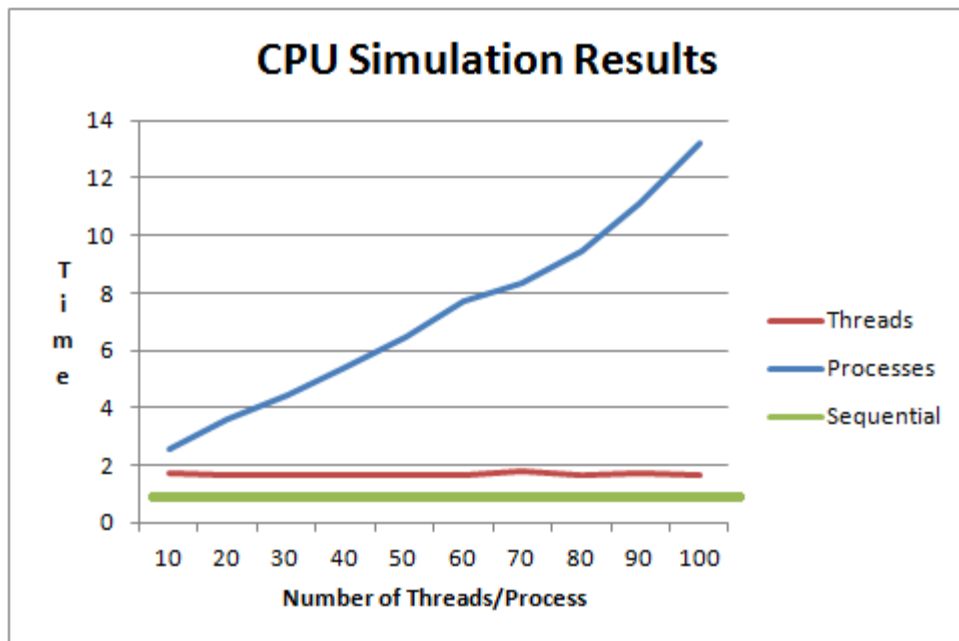
CPU Simulation Results:

Sequential processing costs less time when compared to forked and threaded as hypothesized.

Results from Multiprocessing also matched the hypothesis, proving that Switching between processes is costlier due to high overhead associated with it. It increases with increase in number of process.

Threads did not incur more time as number of threads increased. On researching, found that thread overhead is very small as very less memory copying is required and as data can be shared between threads.

CPU Simulation Results

Legend:
- Threads
- Processes
- Sequential

X-axis: Number of Threads/Process (10, 20, 30, 40, 50, 60, 70, 80, 90, 100)
Y-axis: Time (0, 2, 4, 6, 8, 10, 12, 14)

I/O Simulation Results:

The simulation results for Threaded and the Sequential matched the hypothesis proving the hypothesis.

But for MultiPorcess, the overhead associated with memory copying is high resulting in increasing time cost with increasing number of Process. If the overhead is much higher than the time the process need to wait for an I/O, then the increase in number of process will incur more time than required. I concluded that, multi process should be an option only if the Computation or Wait time will be much higher than the overhead associated with the process.