Sample questions from old Exams

1. Assume that two processes A and B are running on a Linux system. The nice values of A and B are −5 and +5, respectively. Using the CFS scheduler as a guide, describe how the respective values of vruntime vary between the two processes given each of the following scenarios:
   - Both A and B are CPU-bound.
   - A is I/O-bound, and B is CPU-bound.

2. Are the following two terms the same: concurrency & parallelism? If yes, say that they are the same. If not, explain the difference between them.

3. Consider the following code segment:

```
pid_t pid;
pid = fork ( );
if (pid == 0) {
fork ( );
thread_create ( );
}
fork ( );
```

   How many unique processes are created? How many unique threads are created? No explanation is necessary. Assume that the above code is part of a program that compiles & executes correctly.

4. Consider the following shell. Here, instead of first calling `fork( )` , and then `exec( )` to launch a new process, you do something different: the code first calls `exec( )` and then calls `fork( )`, like the following:

```
shell (..) {
.. ..
exec (cmd, args);
fork( );
.. ..
}
```

Does this work correctly? What is the impact of this change to the shell, if any? Explain.

5. If the execution costs of all processes are smaller than the value of the time quantum, q, Round Robin becomes First Come First Serve. This is a condition in which RR behaves identically to FCFS. Under what condition(s) can round robin perform poorly compared to first come first serve? Explain.

6. Name a scheduling algorithm that relies on predicting the next CPU burst based on an average of previous CPU bursts.

7. To compare scheduling algorithms, we use certain metrics. Consider the following metric: total completion time. This tells us when all the processes are finished. What do you think about this metric? Is it very useful? Is it totally useless? Is it partially useful? Provide proper explanation. Assume that the scheduling algorithms run on a system with a single CPU.

8. At which company was the first operating system with graphical user interface invented? No explanation is needed.

9. Unix is a monolithic kernel in that many system services (for example file system, network subsystem, memory management) run in the same kernel address space. An alternative approach to structuring an operating system is the microkernel approach in which different system functions run in different user level processes, i.e. the file system that supports file read/write is implemented in process A, the network subsystem that supports network access is implemented in another process B, and user programs that access the file system of the network subsystem run in yet another processes, say P1 and P2. Using your knowledge of processes, discuss the pros and cons of the microkernel approach versus the monolithic kernel approach.
