Operating Systems

Homework 1: Solutions

[30 points]

1.

- [2 points] We generate two processes. This is because each click tells the OS to start a new process.
- [2 points] As with the above bullet, since we created two processes, then each one must have its own entry. So, we will have two entries.

2. [4 points] Such an abstraction from the OS has several advantages:

- It makes the life of the programmer much easier. Because the programmer will not have to worry about what other processes may be doing.
- It makes the life of the compiler also easier because it will not have to worry about other processes either.

3. [6 points] There are several reasons, for example:

- For security reason: If two processes can access, say, the physical memory, they can see each other data.
- To ensure fairness: A process can hold a resource, for example, the printer, for a long time and denies access to other processes.
- For reliability reasons: a faulty process may then cause the whole system to crash.

4. [3 points] Yes, we still need it because the number of processes running in most machines is larger than the number of cores.

5.

- [4 points] Having more states for a process gives the OS mode detailed information about the status of each process, which enables the OS to make better scheduling decision.
- [2 points] On the downside, the scheduling algorithm will be more sophisticated, as it must deal with more states, which can be a bit slower.

6. [1 point] A process is blocked when it is executing and requests and I/O operation. So, if the process is in the ready state, then it is not executing and won't request anything.

7. [6 points, one point for each]
The CPU efficiency is the useful CPU time divided by the total CPU time. When $Q \geq T$, the basic cycle is for the process to run for T and undergo a process switch for S. Thus (a), (c), and (d) have an efficiency of $T /(S + T)$.

When $Q < T$, each run of T will require T /Q process switches, wasting a time ST /Q. The efficiency here is then $T/ (T + ST /Q)$ which reduces to $Q/(Q + S)$, which is the answer to (b).

For (e), we just substitute Q for S and find that the efficiency is 50%.

Finally, for (f), as $Q \rightarrow 0$ the efficiency goes to 0.