50.005 Quiz OS 2 (15 mins) - **suggested solution**

Note: This quiz is closed-book and closed-notes, except for one double-sided A4 cheat sheet allowed. You also can't go online or look at anything electronic, including your laptop, smartphone, etc.

1. **[2m]** _____context switch_____ involves saving the PCB of a process and restoring the saved PCB of another process. It is a key *mechanism* that allows the kernel to switch the use of the CPU among different processes. Among all the ready processes, which process the kernel selects to next use the CPU at a scheduling point is a question of **[1m]** ___policy_____ (in contrast to mechanism).

2. A Unix system has four components: system programs, kernel, user applications, hardware.
a) **[2m]** Order these components in layers, from lowest to highest.
Hardware -> kernel -> system programs -> user applications

b) **[1m]** Consider the I/O subsystem and process management subsystem in the kernel layer (kernel space), and a system program that does file modification. Can a bug (malicious instructions) in the I/O subsystem corrupt the operations of the process management subsystem?
Yes. The kernel mode is privileged, meaning that it can do anything and everything, including corrupting itself. (No explanation needed for the grade)

c) **[1m]** Can a bug (malicious instructions) in the `write` system program corrupt the operations of the I/O subsystem in the kernel?
No. The system program is in user mode, the bug cannot reach the kernel address space and cause disturbance there. (No explanation needed for the grade)

3. Consider a single-CPU system with five processes, whose respective scheduling states are as shown in the table below. There are in total six I/O devices attached to the system.

Process	1	2	3	4	5
State	Ready	Ready	Running	Terminated	Waiting

A. **[2m]** After some time, Process 3 is interrupted by the timer and the kernel makes a new decision of which process should be given the CPU next. Which processes are candidates for being selected? List ALL possible candidates.
   1, 2, 3
B. **[1m]** How many processes at maximum can have the **running** state at a time?
   1, its a single core system

C. **[2m]** How many device queues are there in the system? What is the scheduling state of each process in such a queue? 6, one queue per device. Wait state.

Total marks: 11 marks

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