

Ph.D. Qualifying Exam: Operating Systems
Department of Computer Science and Engineering,
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1. Process management (15%):

- (1) What are the four principal events which cause processes to be created? (4%)
- (2) What are the four common conditions to cause process termination? (4%)
- (3) Please draw the state transition diagram of a process. (7%)

2. Process scheduling (10%):

Consider five processes P1~P5 coming to serve at time 0. Processes P1, P2, P3, P4, and P5 have burst time of 10, 1, 2, 1, and 5 and are assigned with priority of 3, 1, 3, 4, and 2, respectively. Given four scheduling methods: First-come first-served (FCFS), round robin (RR with quantum = 1), shortest job first (SJF), and non-preemptive priority (where a smaller priority number indicates a higher priority), answer the following questions.

- (1) Draw the Gantt chart to show the execution of all processes by each method. (4%)
- (2) In each method, which process has the maximum turnaround time? (4%)
- (3) Which method has the minimum overall waiting time? Notice that you will get no point without showing your calculation. (2%)

3. I/O mechanisms (15%):

- (1) What is the major job of a device adapter? (2%)
- (2) How can BIOS do for Plug'n Play? (2%)
- (3) What does uniform naming mean in I/O software? (2%)
- (4) What are the differences between synchronous and asynchronous I/O? (4%)
- (5) Please draw the layer architecture of the I/O software system. (5%)

4. Deadlock (10%):

- (1) What is the corresponding approach to deal with each deadlock condition in the deadlock prevention solution? (4%)
- (2) Please explain how the two-phase locking method works? (6%)

5. Memory management (15%):

- (1) When will the dirty bit and the reference bit of a page be set? (4%)
- (2) Suppose that the memory-access time is 200 nano-seconds and the average page fault time is 80,000 nano-seconds. If you want the effective access time for demand paging no larger than 240 nano-seconds, what is the expected page fault rate? (5%)
- (3) What is copy-on-write? (2%)
- (4) What are the working set and trashing? (4%)

6. Segmentation (10%):

- (1) What is the purpose of segmentation? (2%)
- (2) What is the checker-boarding phenomenon in pure segmentation? (2%)
- (3) Please illustrate the conversion of a (selector, offset) pair to a linear address in Intel Pentium. (6%)

7. File system (15%):

- (1) Please explain how incremental, physical, and logical dump work. (9%)
- (2) What is the purpose of an i-node? (2%)
- (3) What is the MBR of a disk and its purpose? (2%)
- (4) What is a random access file? (2%)

8. Security (10%):

- (1) What is the major difference between a virus and a worm? (4%)
- (2) What are the six design principles for security? (6%)