

Department of Computer Science and Engineering
National Sun Yat-sen University
Second Semester of 2025 PhD Qualifying Exam

Subject : Operating Systems

1. Processes and CPU Scheduling (20%):

- (1) Explain the four sections in the memory layout of a process. (4%)
- (2) What are zombie processes and orphan processes? (4%)
- (3) What are the four missions of RPC (remote procedure call)? (4%)
- (4) Give four situations in which CPU-scheduling decisions may take place. (4%)
- (5) What is a memory stall? How to solve it using hardware? (4%)

2. Synchronization and Deadlocks (20%):

- (1) Explain three requirements for any solution to the critical-section problem. (6%)
- (2) What is the difference between the first readers-writers problem and the second readers-writers problem? (4%)
- (3) What is the difference between deadlock prevention and deadlock avoidance? (4%)
- (4) Explain the following items: a) abstract data type, b) mutex, c) memory barriers. (6%)

3. Memory and Paging (20%):

- (1) What are the purposes of base and limit registers? (4%)
- (2) Explain the first-fit, best-fit, and worst-fit solutions to the dynamical storage-allocation problem. (6%)
- (3) Give five steps to show how TLB (translation look-aside buffer) works. (5%)
- (4) Give five benefits of using virtual memory. (5%)

4. Mass Storage (20%):

- (1) Compared to HDD (hard disk drive) devices, what are the three advantages of NVM (nonvolatile memory) devices? (3%)
- (2) What is the problem in SCAN scheduling? (6%)
- (3) Explain the following items: a) raw disk, b) NAND flash memory, c) reflective optical disc. (6%)
- (4) What are the five steps in a sector-sparing transaction? (5%)

5. I/O and Files (20%):

- (1) Explain the following I/O items: a) port, b) bus, c) Daisy chain. (6%)
- (2) What are four common device-control registers? What are their purposes? (4%)
- (3) Explain the seven common attributes of a file. (7%)
- (4) Explain three access methods for files. (3%)