

Ph.D. Qualifying Exam: Operating Systems
Department of Computer Science and Engineering,
National Sun Yat-sen University

1. Basic of OS (15%):

- (1) What is an operating system? (3%)
- (2) Please draw the von Neumann architecture. (3%)
- (3) What is spooling? (3%)
- (4) What is the objective of storage pyramid? (6%)

2. Process Scheduling (15%):

- (1) Please explain the five criteria to evaluate process scheduling algorithms. (10%)
- (2) What is the major problem of the priority scheduling? How to solve it? (3%)
- (3) How does symmetric multiprocessing work? (2%)

3. Memory Management (15%):

- (1) What is the difference between external and internal fragmentation? (4%)
- (2) What are the three methods to translate addresses in a real-time system? (6%)
- (3) What is a reentrant code? (2%)
- (4) What is the difference between frames and pages? (3%)

4. Synchronization & Deadlocks (15%):

- (1) Please give two examples of atomic transactions. (2%)
- (2) When will the priority inversion problem occur? (3%)
- (3) Please explain the two popular solutions to recovery from deadlock. (4%)
- (4) In deadlock avoidance, how is a state is safe? (2%)
- (5) What are the four necessary conditions to cause a deadlock? (4%)

5. Protection & Security (15%):

- (1) Give two possible solutions to deal with the UNIX setuid-on problem. (4%)
- (2) How does the role-based access control (RABC) work? (3%)
- (3) What is a Trojan horse? (2%)
- (4) What is phishing? (2%)
- (5) How does a worm infect computers? (4%)

6. Virtual Memory (15%):

- (1) Explain thrashing from the viewpoints of processes and the working-set model. (4%)
- (2) How does memory-mapped I/O work? (3%)
- (3) Please explain how copy-on-write operates when using fork(). (4%)
- (4) Let the memory-access time be 200 nanoseconds and the average page fault time be 80,000 nanoseconds. If you want EAT no larger than 260 nanoseconds, what is the expected page fault rate? Please list your calculation. (4%)

7. Disks & File system (10%):

- (1) Please explain the two parts of the random-access time of a disk. (4%)
- (2) What is the purpose of swap space? (2%)
- (3) Please give two methods to implement directory. (4%)