

Dept. of Computer Science and Engineering, National Sun Yat-sen Univ.
Second Semester of 2020 PhD Qualifying Exam

Subject : Operating Systems

1. [Process: 20%]

- (1) Please explain the five process states. (5%)
- (2) What is the priority inversion problem? How can we solve it? (5%)
- (3) Please explain the many-to-many multithreading model. Do you think that this model can support true concurrency? (5%)
- (4) What is a critical section? Explain the three basic requirements for any solution to the critical-section problem. (5%)

2. [Memory: 20%]

- (1) Suppose that the page-fault time and memory-access time are $80\mu s$ and $240ns$. What is the expected page-fault rate if we wish to get the effective access time smaller than $290ns$? List your calculation. (5%)
- (2) How can we speed up the creation of processes by using virtual memory? (5%)
- (3) Explain the first-fit, best-fit, and worst-fit strategies for memory allocation. (6%)
- (4) What are the purposes of base and limit registers? (4%)

3. [Disk and I/O: 20%]

- (1) What are the five popular schemes to define the logical structure of directories? (5%)
- (2) Please explain the two interrupt request lines for a CPU. (4%)
- (3) Consider a disk queue with requests for I/O to blocks on cylinders 103, 175, 45, 120, 21, 138, 75 and 87. Let the disk head currently stay at cylinder 60, and the maximum cylinder be 200. Give the results of SSTF and C-LOOK scheduling methods. (6%)
- (4) What is the raw I/O? (3%)
- (5) How does the parity bit work in RAID? (2%)

4. [Distributed and Special Systems: 20%]

- (1) What are location transparency and location independence? (4%)
- (2) Suppose that processes P1, P2, and P3 have timestamps 8, 10, and 15, respectively. P2 is holding the resource that P1 and P3 want to access. Please show the behavior of these processes in the wait-die and wound-wait schemes. (6%)
- (3) What are safety-critical and embedded systems? (4%)
- (4) What is the purpose of each of the three layers in a media file defined by MPEG? (6%)

5. [Protection & Security: 20%]

- (1) Please give four benefits of using language-based protection. (4%)
- (2) Please explain five common types of program threats. (5%)
- (3) Please explain five common types of security violations. (5%)
- (4) Given two primes p & q , how does RSA encrypt and decrypt with private key k_d ? (6%)