

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. What are the three major activities of an operating system in regard to memory management? (18%)
2. Consider a demand-paging system with the following time-measured utilizations:
CPU utilization 20%
Paging disk 97.7%
Other I/O devices 5%
Which of the following will (probably) improve CPU utilization? Explain your answer. (24%)
 - (a) Install a faster CPU.
 - (b) Install a bigger paging disk.
 - (c) Increase the degree of multiprogramming.
 - (d) Decrease the degree of multiprogramming.
 - (e) Install more main memory.
 - (f) Install a faster hard disk or multiple controllers with multiple hard disks.
 - (g) Add prepaging to the page fetch algorithms.
 - (h) Increase the page size.
3. The operating system generally treats removable disks as shared file systems but assigns a tape drive to only one application at a time. Give three reasons that could explain this difference in treatment of disks and tapes. Describe additional features that would be required of the operating system to support shared file-system access to a tape jukebox. Would the applications sharing the tape jukebox need any special properties, or could they use the files as though the files were disk-resident? Explain your answer. (24%)
4. RAID (redundant arrays of inexpensive disks) is a storage technology that combines multiple disk drive components into a logical unit.
 - (a) What are the key purposes of using RAID? (8%)
 - (b) RAID 0 uses striping to force parallel access among many disks. Why does striping improve disk performance? For applications of either *online database services* or *sound editing*, will striping help better achieve their goals? (12%)
 - (c) RAID 1 mirrors data among several disks. Assuming that inexpensive disks have lower MTBF than expensive disks, how can redundancy using inexpensive disks result in a system with lower MTBF? Use the mathematical definition of MTBF to explain your answer. (4%)
 - (d) RAID 1 maintains several complete copies of a dataset while RAID 3 maintains error correction data only. Explain the tradeoff between RAID 1 and RAID 3. Would *online database services* benefit from RAID 3 over RAID 1? Please justify your answer. (10%)