

1. (15%) Suppose that a scheduling algorithm (at the level of short-term CPU scheduling) favors those processes that have used the least processor time in the recent past.
  - (a) Will this scheduling algorithm favor CPU-bound processes or I/O-bound processes? Why?
  - (b) Please discuss if the starvation situation will permanently occur in this scheduling algorithm?
  
2. (20%) Are the following statements true or false? For each statement, you will get 4 points for correct answer, zero point for blank, or -2 point for incorrect answer.
  - (a) If a system is in unsafe state, then deadlock exists.
  - (b) Shared memory is one of models for interprocess communications among cooperating processes.
  - (c) Domain Name Service (DNS) can be used to acquire MAC addresses.
  - (d) The BGP protocol is an intra-AS routing protocol.
  - (e) ARP requests are broadcast packets.
  
3. (15%) How does DMA increase system concurrency? How does it complicate the hardware and system design?
  
4. (20%) A software engineer team found out that, a distributed system developed by them has the problem of deadlock. They had tried their best to fix the bug and failed because the source code is too complicated to be fixed. New fatal bugs emerged every time when they had introduced a new fix. Therefore, they want to add a new mechanism to the system to solve the problem of deadlock without changing the code too much.

Please provide a possible solution for the software engineer team.

5. (20%) Answer the following question regarding memory management:
  - What is “Belady’s anomaly?”
  - Explain the relationship between “working sets” and “page fault rates.”
  - Explain the concept of “inverted page tables.”
  - Explain “copy-on-write” for fast process creation.
  
6. (10%) Explain the following term regarding virtualization and virtual machines
  - Paravirtualization
  - Trap-and-emulate (hint: privileged instructions)