BE Part III 6th Semester Final Examination, 2007
Operating System Principle
CST-602

Full Marks: 100   Time: 3 hours

Two marks from each half are reserved for clarity of answers.

First Half
Answer Question No. 1 and any two from the rest

1. a) What is an rnode?   [2]
   b) What is the difference between the *fork* and *exec* system call in UNIX? [2]
   c) Describe the different components of dispatch latency?   [2]
   d) What is an inode?   [2]
   e) Describe one advantage and one disadvantage of SRR over RR scheduling. [2]
   f) "In Linux, a process is never preempted when it is running in kernel mode
   except when a real time process arrives on the system" – comment. [2]
   g) Describe the role of reference count when a file is opened by multiple
   processes.   [2]
   h) What is a superblock?   [2]

2. a) Prove that SJF scheduling is optimal.   [3]
   b) What is approximate SJF scheduling? Why is it called "approximate"? [3+2]
   c) Prove that in Lottery scheduling the client's throughput is proportional to its
   ticket allocation.   [4]
   d) Describe in details how *recrediting* operation in Linux ensures rapid response
   time for interactive processes.   [4]

3. a) Describe the different in-memory file system structures and their utility in a file
   system implementation.   [4]
   b) Write one advantage and one disadvantage for each of the following disk
   allocation methods: i) contiguous allocation ii) linked allocation iii) indexed
   allocation.   [3]
   c) Given that the head starts at 50, and the request queue for the blocks is
   90,180,40,125,15,130,70 and 75. Calculate the total head movements for the
   following disk scheduling methods i) C-LOOK, ii) SSTF and iii) SCAN [6]
   d) Why SSTF disk scheduling is not optimal?   [2]
   e) How is C-LOOK different from LOOK disk scheduling algorithm? [1]

4. a) Why RAID level 0 is not a true RAID level? [1]
   b) What is the "write penalty" associated with RAID level 2? [2]
   c) Describe RAID level 4 and RAID level 6. [4]
   d) Describe the advantage of using RAID level 5 over RAID level 4. [2]
   e) Describe clearly how disk allocation is done in UNIX? [4]
   f) Compute the maximum size of a file in the scheme mentioned in (e), given the block size as 4096 bytes and pointer size as 4 bytes. [3]

5. a) Why is the generation number included while computing the file handle in NFS? [2]
   b) Describe the steps for asynchronous write in NFS (include both client and server side). [3]
   c) Describe the algorithm for writing data in Google File System (GFS) [4]
   d) Describe the algorithm for reading data from GFS. [4]
   e) Describe the role of Heartbeat messages in GFS. [3]

Second Half
Answer any three questions

6 a) Is it possible to have a deadlock involving only one single process? [3]

b) Consider a system consisting of 4 resources of the same type, being shared by 3 processes, each of which needs at most 2 resources. Show that the system is deadlock free. [9]

c) What is logical and physical address space? [4]

7 a) Consider the following memory map:

Memory Address	Occupant
0-500	O/S
501-800	P_8
801-859	Free
860-1400	P_2
1401-1600	Free
1601-2000	P_3
2001-2300	Free

i) Reconstruct the map, if all the free areas are pushed towards O/S. What is this called? [3]
ii) To get (i) what additional support is required from the O/S? [3]
iii) Why is the method describe at (i) costly? [3]

b) How does fragmentation pose problem? [3]

c) How is sharing accomplished in a pure segmentation system? [4]

8 a) Why is paper size typically a power of 2?
How can a logical address be translated into page number and offset? [2+3]

b) Mention the disadvantages common to both simple paging and demand paging schemes. In what ways is demand paging advantageous compared to simple paging? [6]

c) If memory reference string (interms of page number for a particular process) with 4 frames in main memory is as follows:
5, 1, 0, 2, 1, 9, 5, 2, 3, 3, 0, then compare the FIFO and LRU page replacement strategies. [5]

9 a) What is a critical section? [3]

b) What are the conditions, which must be ensured to provide a solution to critical section problems? [5]

c) Describe any one algorithm for the software solution of two process critical section problem? [8]

10 a) Suppose there are two sequences M and N, M containing a sequence of structured data and N is empty. Write a concurrent algorithm, which will copy sequence M and N. What are the constraints imposed on concurrent algorithm which will maintain sequence of M and N? [8]

b) A barbershop consists of a waiting room with n chairs and the barber goes to sleep. If a customer enters the barbershop and all the chairs are occupied, the customer leaves the shop. If the barber is busy but chairs available, then the customers sits in one of the free chairs. If the barber is asleep, the customer wakes up the barber. Write a program to coordinate the barber and the customers. [8]

11 a) What would have happened, if the operations on semaphore were not indivisible? [4]

b) What condition may lead to indefinite postponement of a process? [2]

c) What are the necessary conditions for a deadlock to occur? [7]

d) Distinguish between dead lock and starvation. [3]