M. E. (SOFTWARE ENGINEERING) EXAMINATION, 2011
(1st Semester)
OPERATING SYSTEMS AND KERNEL PROGRAMMING

Time : Three hours | Full Marks : 100

Answer any five questions.

1. a) What advantage is there in having different time-quantum sizes on different levels of a multilevel feedback queue scheduling? (3)

b) Many CPU scheduling algorithms are parameterized.(for example, the RR scheduling algorithm requires a parameter to indicate the time slice). One set of algorithm may include another (for example, the FCFS algorithm is the RR algorithm with an infinite time slice). What relationship holds between the following pairs of algorithm in terms of their own scheduling parameters –

Priority & SJF
Priority & FCFS
FCFS & multilevel feed back queues.
RR & SJF (12)

c) Consider n processes sharing the CPU in a round-robin fashion. Assuming that one process to another process switch takes s seconds, what must be the time quantum size q such that the overhead resulting from process switching is minimized but, at the same time each process is guaranteed to get its turn at the CPU at least every t seconds. (5)

2. a) Distinguish between deadlock prevention and deadlock avoidance. (4)

b) "A system may go from a safe state to an unsafe state" – Justify your answer. (4)

c) Is it possible to have a deadlock involving only one process? Explain your answer. (2)

d) Consider a system consisting of m resources of the same type, being shared by n processes. Resources can be requested and released by processes only one at a time. Show that the system is deadlock-free if the followings two consideration holds –

i) The maximum need of each process is between 1 and m resources
ii) The sum of all maximum needs is less than (m + n). (6)

e) Explain the necessary conditions to be deadlock. (4)

3. a) Explain the requirements that must be satisfied in a solution of a critical section problem. (4)

b) Classically define a semaphore with its operations. (3)

c) Distinguish between deadlock and starvation. (3)

d) A barber shop consists of a waiting room with n chairs and the barber room containing the barber chair. If there are no customers to be served, the barber goes to sleep. If a customer enters the barber shop and all chairs are occupied, then the customer leaves the shop. If the barber is busy but chairs are available, then the customer sits in one of the free chairs. If the barber is asleep, the customer wakes up the barber. Write procedures to synchronize the barber and the customers. (10)

4. a) How we can ensure that a circular wait situation will never occur among processes to access resources? Proof it. (4)

b) A computer system has 6 tape drives, with n processes competing for them. Each process may need two tape drives. What is the minimum value of n to be deadlock free system -- Explain clearly. (4)

c) Consider the following snapshot of the system :-

	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P0	0	1	0	7	5	3	3	3	2
P1	2	0	0	3	2	2			
P2	3	0	2	9	0	2			
P3	2	1	1	2	2	2			
P4	0	0	2	4	3	3			

Is it possible to grant the following requests

(i) Process P1 requests (1,0,2)

(ii) Process P4 requests (3,3,0)

(iii) Process P0 requests (0,2,0) (4+4+4)

5. a) In a 4-level paging system, the TLB is having hit ratio 98% and access time is 20ns. The memory access time is 100ns, then what will be the effective memory access time? (3)

b) Given memory partitions of 100k, 500k, 200k, 300k and 600k (in order).

(i) How would each of the first-fit, best-fit and worst-fit algorithms place processes 212k, 417k, 112k and 426k (in order) ?

(ii) Which algorithm makes most efficient use of memory and why ? (6+2)

c) Explain why compaction always can not be done to overcome external fragmentation ? (3)

d) What are the causes of thrashing ? (2)

e) Including the initial parent process, how many processes do the following program creates? (4)

```
void main( )
  {
      fork( );
      fork( );
      fork( );
      fork( );
      system("ls -l /");
  }
```

6. a) One of the parameter of a virtual memory system is its page size. Give one advantage and one disadvantage of choosing a large page size rather than a small one. (2)

b) What do you mean by pure demand paging ? Suppose you have devised a new page-replacement algorithm that you think must be optimal. In some contorted test cases, Belady's anomaly occurs. Is the new algorithm optimal? –Explain your answer. (2+4)

c) Does the paging system can eliminate both internal and external fragmentation? Justify your answer. (4)

d) Suppose that pages in a virtual address space are referenced in the following order: 1,2,1,3,2,1,4,3,1,1,2,4,1,5,6,2,1. There are three empty frames available. Assume that paging decisions are made on demand, i.e., when page fault occurs. Show the content of the frames after each memory reference, assuming the LRU replacement policy is used. How many page faults occur? (8)

7. Write short notes on any two of the following : (10+10)
   a) Optimal page-replacement algorithm.
   b) Pipe.
   c) Inverted page-table.