Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech (CSE)/SEM-1/MCS-103/2009-10

2009

SYSTEM PROGRAMMING & OPERATING SYSTEMS

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer Question No. 1 and any *four* from the rest. 5 × 14 = 70

1. Answer any *seven* questions : 7 × 2 = 14

   i) What is meant by a short-term scheduler ?

   ii) The execution of critical sections must be mutually exclusive. Explain.

   iii) What do you mean by conditional macro ?

   iv) What is a Semaphore ?

   v) "Operating system acts as a resource manager". Justify it.

   vi) What do you mean by cycle stealing of DMA ?

vii) State the relation between CPU utilization and degree of multiprogramming.

viii) "Page I/O is distinct from program I/O." Justify it.

2. a) Explain the resource manager and virtual machine view of an operating system.

b) What are the major objectives of any scheduling algorithm ? Differentiate between preemptive and non-preemptive scheduling methods.

c) Compare the performances of FCFS and SJF scheduling.

d) What is multi-level queue scheduling ? 4 + 4 + 4 + 2

3. a) State and explain the properties that a solution to a critical section problem must possess.

b) State and explain the Peterson's solution to the critical section problem.

c) Develop a solution to the Bounded Buffer Producer-Consumer problem using semaphores as synchronization primitive. 4 + 4 + 6

4. a) Presence of a cycle in a Resource Request Allocation Graph (RRAG) is an essential but not sufficient condition for the occurrence of a deadlock — Justify.

b) A system has four processes P_1, P_2, P_3, P_4 and four resource classes R_1, R_2, R_3, R_4. The maximum need, allocated resources and requested resources for each process is given below :

	R_1	R_2	R_3	R_3
P_1	2	1	2	1
P_2	2	4	3	2
P_3	5	4	2	2
P_4	0	3	4	1

Max. Need

	R_1	R_2	R_3	R_3
P_1	1	1	1	1
P_2	2	0	1	0
P_3	2	0	2	2
P_4	0	2	1	1

Allocated Resources

	R_1	R_2	R_3	R_3
P_1	0	0	0	0
P_2	0	1	1	0
P_3	0	0	0	0
P_4	0	0	0	0

Requested Resources

The system has 6, 4, 8 and 5 instances of resources R_1, R_2, R_3 and R_4 respectively. Find out whether the request made by P_2 is a safe request and hence can be granted. Show all the steps.

C) Discuss the working principle of a two-pass assembler. 4 + 6 + 4

5. a) State the sequence of events when a page fault occurs.

b) Compute the number of page faults using LRU and OPTIMAL page replacement algorithm, when memory reference string is

< 5 4 3 2 1 4 3 2 2 3 4 5 1 1 2 >

c) Define thrashing ? How can it be solved ?

d) Consider the logical address of an instruction of a process as 2447_d. It will be run on a 16-bit microprocessor. The memory manager uses a two-level paging scheme with page size of 128 k. The process uses 4 page tables for execution. Find out the page table no., page no. of the corresponding instruction. If the frame number of that instruction is 15, then what will be the physical address of the instruction ? If the system uses demand paging with a hit ratio 0·9, then what will be the effective memory access time of the system ? Assume that the time overhead of page fault handling = 20 ns and memory access time = 30 ns.

3 + (2 + 2) + (1 + 2) + (2 + 2)

6. a) "Thrashing under global page replacement is severe." Justify it.

b) State the working principle of a device controller.

c) Compare the performance of C_SCAN and SCAN disk scheduling in a system with disk drive having 500 cylinders, numbered as 0 to 499, disk drive is currently serving a request at cylinder 14, disk drive has served previous request at 12, the queue of pending request (in FIFO order) in 9, 147, 91, 177, 95, 150, 102, 175, 13.

d) What do you mean by exception handling ? How does kernel manage it ?

e) Write a short note on hashed inverted page table.

3 + 2 + 3 + (1 + 2) + 3

7. a) State the 50% rule for memory allocation. What are the differences between coalescing and compaction ?

b) How does hole size to process size ratio depend on fragmentation ? Explain it.

c) "Optimal page replacement provides better result with respect to other methods." Justify it.

d) Consider the sequence of job *A* (30 k), *B* (165 k), *C* (250 k), *D* (78 k), *E* (184 k) that will be allocated on a 1 MB free memory space. The allocation will be done by the concept buddy system. After the allocation of all five jobs, calculate the external and internal fragmentation.

e) What do you mean by software interrupt ? How does it differ from hardware interrupt ?

(1 + 2) + 3 + 3 + 2 + (1 + 2)