Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/MCA/SEM-3/MCA-301/2009-10

2009

OPERATING SYSTEM & SYSTEM SOFTWARE

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.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

i) Mutual exclusion problem occurs between

a) two disjoint processes that don't interact

b) processes that share resources

c) processes that don't share resources

d) none of these.

ii) The address generated by CPU is known as

a) logical address b) physical address

c) relational address d) virtual address.

iii) CPU performance is measured by

a) Throughput b) MHz

c) Mbps d) none of these.

iv) Dirty bit is used to show the

a) page with corrupted data

b) the wrong page in the memory

c) page that is modified after being loaded into cache memory

d) page that is less frequently accessed.

v) A system has 3 processes sharing 4 resources. If each process needs a maximum of two units, then

a) Deadlock may occur

b) Deadlock never occur

c) Deadlock has to occur

d) None of these.

vi) Which amongst the following statements is true for virtual memory ?

a) It allows for multiple users to use the system

b) It enhances scope for multi-programming

c) It extends the address space

d) It reduces external fragmentation as well as internal fragmentation.

vii) Semaphores work for

a) single threaded processes only

b) multi-threaded processes only

c) both (a) & (b)

d) none of these.

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viii) If there are 32 segments, each of size 1K, then the logical address should have

a) 13 bits b) 14 bits

c) 15 bits d) 16 bits.

ix) Once a program is compiled, it can be loaded for execution

a) only from the compiler generated starting address

b) anywhere in the main memory

c) user needs to specify where the compiled code is to be loaded

d) it is loaded starting form address 0 in the main memory.

x) A CPU scheduling algorithm determines an order for the execution of its scheduled processes. Given n processes to be scheduled on one processor, how many possible different schedules are there ? Give a formula in terms of n.

a) $n(n-1)$ b) n^2

c) $n!$ d) $n/2$.

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GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Differentiate between process and thread.

3. Differentiate between internal fragmentation and external fragmentation.

4. Consder the following reference string :

   1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6

   How many page faults will occur for

   i) FIFO

   ii) LRU replacement algorithms ?

   Assume three, four and five frames (All frames are initally empty). $2\frac{1}{2} + 2\frac{1}{2}$

5. a) What is an operating system ? What are the functions of the operating system ?

   b) When do we say a system is "multi-programming" ?

   $1 + 2 + 2$

6. a) What is "response time" ?

   b) With the help of a state transition diagram, explain various states of a process.

   c) What is a zombie process and how may it manifest itself ? $1 + 2 + 2$

GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Describe Dining Philosopher's problem with its solution.

b) Consider the following set of processes, with the length of the CPU-burst time given in milliseconds :

Process	*Burst Time*	*Priority*
P_1	10	3
P_2	1	1
P_3	2	3
P_4	1	4
P_5	5	2

The processes are assumed to have arrived in the order, P_1, P_2, P_3, P_4, P_5 all at time 0.

i) Draw four Gantt charts illustrating the execution of these processes using SJF scheduling (preemptive and non-preemptive) and Priority scheduling (preemptive and non-preemptive)

ii) Calculate the average waiting time for each of the aforesaid algorithms. 4 + 7 + 4

8. a) What is Deadlock ? Compare and constrast Deadlock Prevention and Deadlock Avoidance.

b) What is thrashing ?

c) Consider a system with five processes P_0 to P_4 and three resource types A, B, C. Resource type A has 7 instances, B has 2 and C has 6 instances. Suppose at 't_0' time we have the following state :

Process	Allocation	Request	Available
	A B C	A B C	A B C
P_0	0 1 0	0 0 0	0 0 0
P_1	2 0 0	2 0 2	
P_2	3 0 3	0 0 0	
P_3	2 1 1	1 0 0	
P_4	0 0 2	0 0 2	

Answer the following questions using Banker's Algorithm :

i) What is the content of matrix need ?

ii) Is the given system in deadlock state ?

iii) Suppose P_2 makes an additional request (0, 0, 1). What will be the effect of this request to the system ? (2 + 4) + 1 + (2 + 3 + 3)

9. a) i) Explain the difference between busy waiting and blocking.

ii) Define throughput and turn around time.

iii) Explain starvation. When and how may starvation occur ?

b) Suppose a new process in a system arrives at an average of six processes per minute and each such process requires an average of 8 seconds of service time. Estimate the fraction of time the CPU is busy in a system with a single processor. (2 + 2 + 4) + 7

10. a) Consider a system with 80% hit ratio, 50 nano-seconds time to search the associative registers, 750 nano-seconds time to access memory. Find the time to access a page :

    i) When the page number is in associative memory

    ii) When the time to access a page when not in associative memory

    Find the effective memory access time.

    b) What is swapping ? Why does one need to swap areas of memory ?

    c) Disk with geometrics exceeding the following maximums could not be handled by early DOS systems :

    Cylinders 1024

    Heads 16

    Sectors per track 63

    What is the maximum size disk could these systems use ? (3 + 3 + 3) + (1 + 2) + 3

11. Write short notes on any *three* of the following : 3 × 5

    a) Starvation and aging

    b) Boot block

    c) Device controllers

    d) Process control block

    e) Buffering

    f) Loader.

12. a) What is the role of compiler ? Diagrammatically represent its different phases.

    b) What are the advantages and disadvantages of assembly language program ?

    c) Explain UNIX structure in detail. (2 + 6) + 3 + 4