OPERATING SYSTEMS
(INFO 3102)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.

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

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

    (i)   Operating system can be considered as something which comprises of -
           (a) Processes   (b) Input-output device drivers
           (c) Software routines   (d) All of these

    (ii)   ISR is associated with
           (a) Vectored Interrupt   (b) Non-vectored Interrupt
           (c) Semaphore   (d) Polling

    (iii)   Which of the statement(s) is/are false?
           I.   Aging can solve the problem of Starvation
           II. Increasing the number of pages always improves hit ratio
           III. With degree of multiprogramming CPU utilization also always increases
           (a) II   (b) III
           (c) II and III   (d) None of the above

    (iv)   Which of these is also known as long term scheduler?
           (a) Swapping Scheduler   (b) Job Scheduler
           (c) CPU scheduler   (d) None of these

    (v)   Let there are 0-199 cylinders and the r/w arm is located at cylinder 87. Now, if the requests are to be fetched from 100, 125, 106, 54, 30, 107 and 180ᵗʰ cylinder in a row, then which of the following algorithm will result into maximum number of cylinder-skipping?
           (a) FCFS   (b) SSTF   (c) SCAN   (d) C-SCAN

    (vi)   Three processes P1, P2 and P3 has burst time of 5 ms, 2 ms and 4 ms respectively and arrival time are 0ᵗʰ, 2ⁿᵈ and 3ʳᵈms.Which of the following will be the order of completion of the processes if they are scheduled using SRTF algorithm?
           (a) P1, P2, P3   (b) P1, P3, P2   (c) P2, P3, P1   (d) P2, P1, P3

    (vii)   Which of the following is not present in PCB?
           (a) Process Status   (b) Pointer
           (c) Program Counter   (d) Ready Queue

    (viii) If main memory access time is 350 ns and TLB access time is 40 ns, what will be the overall access time if TLB hit ratio is 85%?
           (a) 120.5 ns   (b) 442.5 ns   (c) 86.5 ns   (d) 92.5 ns

    (ix)   To solve Readers-Writers problem using semaphore how many and what type of semaphore(s) is/are required?
           (a) 2; both binary semaphores   (b) 3; one binary and others counting
           (c) 3; one counting and other binary   (d) 2; one binary and the other counting

    (x)   Which of the following statement(s) is/are not true?
           I.   If safe sequence exists, then it implies there is no deadlock.
           II. If the system supports pre-emption, there will be no deadlock.
           III. Banker's Safety Algorithm implements deadlock avoidance.
           (a) All of these   (b) I and II   (c) II   (d) None of these

Group- B

2. (a)   "An application program is better executed after dividing in user level threads." – Justify this statement.   [(CO3) (Evaluate/HOCQ)]

    (b)   Which is more advantageous among direct and indirect message passing? Justify your answer.   [(CO2) (Analyse/IOCQ)]

    (c)   What is virtual machine? What is PCB?   [(CO2)Remember/LOCQ)]

                                                4 + 4 + (2 + 2) = 12

3. (a)   Justify on which design component you will emphasize while designing operating system for Embedded System, Handheld System and Personal Computers.   [(CO1) (Evaluate/HOCQ)]

    (b)   Differentiate between Process and Thread.   [(CO3) (Understand/LOCQ)]

    (c)   State how context switching is important and at the same time overhead to a system.   [(CO2)(Analyse/IOCQ)]

                                                  6 + 3 + 3 = 12

Group - C

4. (a)   "The Quantum size in Round Robin Scheduling should be chosen very carefully, otherwise the performance of the system will get affected" – Justify this statement.   [(CO3) (Evaluate/HOCQ)]

    (b)   Consider the following four processes with arrival times (in milliseconds) and their length of CPU bursts (in milliseconds) as shown below:

Process	P1	P2	P3	P4
Arrival time	0	1	3	4
CPU burst time	3	1	Z	4

These processes are run on a single processor using pre-emptive SRTF scheduling algorithm. If the average waiting time of the processes is 1.5 millisecond, then what will be the value of Z?   [(CO2) (Apply/IOCQ)]

(c)   What are the different types of Semaphore? Where we can use them?
[(CO3)(Remember/LOCQ)]
3 + 5 + (2 + 2) = 12

5.   (a)   Which one seems better among deadlock avoidance and deadlock prevention to you? Explain with reasons.   [(CO3) (Evaluate/HOCQ)]

(b)   Redesign the Dining Philosopher's problem using semaphore is such a way so that no deadlock will occur. Explain your solution.   [(CO3) (Evaluate/HOCQ)]

(c)   Which CPU Scheduling algorithm can cause starvation and why not the others behave the same way? What could be the solution to this problem?
[(CO2)(Analyze/IOCQ)]
3 + 5 + (1 + 2 + 1) = 12

Group - D

6.   Consider a user program of logical address of size 5 pages and page size is 4bytes. The physical address contains 200 frames. The user program consists of 16 instructions a, b, c, . . . o, p. Each instruction takes 1 byte. Assume at that time the free frames are 3, 26, 52, 20, 55, 16, 18, 21, 170, and 99.
Find the following?
(i)   Draw the logical and physical maps and page tables?
(ii) Allocate each page in the corresponding frame?
(iii) Find the physical addresses for the instructions m, d, p, f?
(iv) Calculate the fragmentation if exist?   [(CO4) (Apply/IOCQ)]

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7.   (a)   Explain the working principle of segmentation with paging with proper block diagram.   [(CO4) (Understand/LOCQ)]

(b)   Suppose that we have free segments with sizes: 6, 17, 25, 4, and 9. Place programs with size 18kB, 11kb and 7kb in the free segments using first-fit, best-fit and worst fit?   [(CO4) (Apply/IOCQ)]

6 + 6 = 12

Group - E

8.   (a)   What is one time password? How does it work? [(CO6) (Remember/LOCQ)]

(b)   What is the best way to manage free space of a disk? Justify your answer.
[(CO4) (Evaluate/HOCQ)]

(c)   Explain how virtual file system works with proper diagram.
[(CO4)(Remember/LOCQ)]
4 + 4 + 4 = 12

9. (a) Explain the advantages and disadvantage of Polling and Interrupt Driven Systems. [(CO5) (Analyze/IOCQ)]

   (b) How a worm is different from virus?[(CO6) (Understand/LOCQ)]

   (c) What are the different data transfer modes of DMA? Explain how they work.
   [(CO5)(Remember/LOCQ)]
   3 + 3 + (4 + 2) = 12

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Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	34.37%	38.54%	26.04%

Course Outcome (CO):
After the completion of the course students will be able to
1. Analyze and differentiate between different types of operating systems (namely, batch, multi programmed, time-sharing, real-time, distributed, parallel processing system) based on their application domains and evolution.
2. Demonstrate and describe system operations, internal structure of computer system and operating system.
3. Design multiprocessing and multithreading environments based on inter-process/thread communication and synchronization.
4. Compare the different level of memory (Primary memory, cache, virtual memory, secondary storage) and how they are correlated to improve the performance of the system.
5. Demonstrate the operations of IO devices and how they are governed by the operating system.
6. Discuss the activity and impact of threat, virus, worm and how the system could be protected from them.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question

Department & Section	Submission Link
IT	https://classroom.google.com/c/NDA1MjQ1NDM0NTIz/a/NDYzNjcyODY0MDEz/details