**Printed Page:-** **Subject Code:- AMCA0102**

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**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA**

**(An Autonomous Institute Affiliated to AKTU, Lucknow)**

**MCA**

**SEM: I - THEORY EXAMINATION (2022 - 2023)**

**Subject: Operating System**

**Time: 3 Hours** **Max. Marks: 100**

**General Instructions:**

**IMP:** *Verify that you have received the question paper with the correct course, code, branch etc.*

**1.** *This Question paper comprises of* **three Sections -A, B, & C.** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

**2.** *Maximum marks for each question are indicated on right -hand side of each question.*

**3.** *Illustrate your answers with neat sketches wherever necessary.*

**4.** *Assume suitable data if necessary.*

**5.** *Preferably, write the answers in sequential order.*

**6.** *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

**SECTION A** **20**

**1. Attempt all parts:-**

1-a. The operating system works between (CO1) 1

(a) User and Computer

(b) Network and User

(c) One user to another user

(d) All of the these

1-b. Which of the following is Disadvantages of Multiprocessor Systems? (CO1) 1

(a) Multiprocessor systems is quite expensive

(b) All the processors in the multiprocessor system share the memory. So a much larger pool of memory is required as compared to single processor systems.

(c) more complex and complicated operating system is required in multiprocessor systems.

(d) All of the above

1-c. Mutex can also be reffered to as a _____ (CO2) 1

(a) Binary Semaphore

(b) Counting semaphore

(c) Monitor

(d) None of the above

1-d. Information about a process is maintained in a _____ (CO2) 1

(a) process control block

(b) file control block

(c) program control block

(d) translation lookaside buffer

1-e. From the time of submission of a process to the time of completion, The interval is termed as (CO3) 1

(a) waiting time

(b) turnaround time

(c) response time

(d) throughput

1-f. What is the objective of multiprogramming? (CO3) 1

(a) Have a process running at all time

(b) Have multiple programs waiting in a queue ready to run

(c) To increase CPU utilization

(d) None of the mentioned

1-g. In a virtual memory environment (CO4) 1

(a) segmentation and page tables are stored in the cache and do not add any substantial overhead

(b) slow down the computer system considerable

(c) segmentation and page tables are stored in the RAM

(d) none of the above

1-h. The operating system and the other processes are protected from being modified by an already running process because : (CO4) 1

(a) they are in different memory spaces

(b) they are in different logical addresses

(c) they have a protection algorithm

(d) every address generated by the CPU is being checked against the relocation and limit registers

.

1-i. In the which algorithm, the disk arm starts at one end of the disk and moves toward the other end, servicing requests till the other end of the disk. At the other end, the direction is reversed and servicing continues. (CO5) 1

(a) LOOK

(b) SCAN

(c) C-SCAN

(d) C-LOOK

1-j. Rotational latency is ? (CO5) 1

(a) Half of the rotation

(b) One Fourth of the rotation

(c) Full rotation

(d) Time taken to reach the starting of the desired sector

**2. Attempt all parts:-**

2.a. Define Operating system and its various functions in brief. (CO1) 2

2.b. What do you mean by process synchronization? Explain the race condition in brief. (CO2) 2

2.c. What do you mean by Deadlock? Explain Deadlock handling methods.(CO3) 2

2.d. What do you mean by paging? Why do we use multilevel paging. (CO4) 2

2.e. Compare the linked and indexed disk allocation strategies? (CO5) 2

**SECTION B** **30**

**3. Answer any <u>five</u> of the following:-**

3-a. Discuss the following terms: 6
1. Multiprogramming
2. Multitasking
3. Multithreading (CO1)

3-b. Compare the monolithic and micro-kernel with the help of suitable diagram . (CO1) 6

3-c. Explain the Reader-Writer problem. Write the code for synchronization of reader and writer processes (CO2) 6

| | | |
|---|---|---|
| 3-d. | A Shared variable x initialized to zero is operated by four processes W, X, Y and Z. Process W and X increment x by one while process Y and Z decrement x by two. Each process before reading perform wait() on a semaphore 'S' and signal() on 'S' after store. If 'S' is initialized to two find what is the minimum possible value of x after all processes complete their executions. What are the various applications of Semaphore? (CO2) | 6 |
| 3.e. | Explain the process state transition diagram with the help of suitable diagram. What do you mean by preemption and non-preemption? (CO3) | 6 |
| 3.f. | Consider the reference string 7, 0,1,2,0,3,0,4,2,3,0,3,2,1,2,0,1. With a physical memory of 3 page frames determine the number of page faults in FIFO, LRU and Optimal page replacement algorithms (CO4) | 6 |
| 3.g. | Consider a process requesting to read from the following tracks: 98, 183, 37, 122, 14, 124, 65, 67. Assuming the head is initially at track number 98. Draw track chart for FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK. Determine total head movement in each case.(CO5) | 6 |

**SECTION C** **50**

**4. Answer any <u>one</u> of the following:-**

| | | |
|---|---|---|
| 4-a. | List the essential differences between the following types of operating systems.<br>(i) Real Time Operating System<br>(ii) Distributed Operating System (CO1) | 10 |
| 4-b. | What characteristics is common to traps, interrupts, supervisor calls and sub-routine calls. What do you mean by system call? Explain its type in detail. What is the purpose of using fork() system call in Linux? (CO1) | 10 |

**5. Answer any <u>one</u> of the following:-**

| | | |
|---|---|---|
| 5-a. | Explain Dining Philosopher's problem in detail. Provide deadlock free solution to Dining Philosopher's problem using semaphore(CO2) | 10 |
| 5-b. | What are the requirements of a critical section solution. Explain the Peterson's algorithm for the process synchronization of two processes. (CO2) | 10 |

**6. Answer any <u>one</u> of the following:-**

6-a. Consider the following snap-shot of jobs to be executed using round robin algorithm with a time slice 1 ms. Find average turnaround time, average waiting time and average response time. What is the condition when round robin scheduling becomes First Come First Served scheduling. (CO3) 10

| Job | Arrival Time(ms) | Burst Time(ms) |
|---|---|---|
| J1 | 0 | 4 |
| J2 | 2 | 5 |
| J3 | 5 | 6 |
| J4 | 6 | 2 |

6-b. Consider the following snap-shot of processes and compute average turn-around time and waiting time of processes for FCFS, SJF and SRTN algorithms 10

| Process | Arrival time(ms) | Burst Time(ms) |
|---|---|---|
| P1 | 0.0 | 6 |
| P2 | 0.5 | 4 |
| P3 | 1.0 | 2 |

**7. Answer any <u>one</u> of the following:-**

7-a. A computer system has a page size of 2000 bytes. The page table of a process A is as follows: 10

| In/out | Frame no |
|---|---|
| in | 20 |
| out | 22 |
| in | 200 |
| in | 150 |
| out | 30 |
| out | 50 |
| in | 120 |
| in | 101 |

Which of the following virtual addresses would generate a page fault? For those that do not generate a page fault to what physical address would they translate? (CO4)

(a) 10451 (b) 5421 (c) 14123 (d) 9156

7-b. Consider the following snap-shot of a system 10

| Process | Allocated | | | | Max | | | | Available | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R1 | R2 | R3 | R4 | R1 | R2 | R3 | R4 | R1 | R2 | R3 | R4 |
| P1 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 2 | 2 | 1 | 0 | 0 |
| P2 | 2 | 0 | 0 | 0 | 2 | 7 | 5 | 0 | | | | |
| P3 | 0 | 0 | 3 | 4 | 6 | 6 | 5 | 6 | | | | |
| P4 | 2 | 3 | 5 | 4 | 4 | 3 | 5 | 4 | | | | |
| P5 | 0 | 3 | 3 | 2 | 0 | 6 | 5 | 2 | | | | |

(i) Compute NEED Matrix

(ii) is the system in safe state?

(iii) is the system deadlocked? justify the answer

(iv) Can a request (0,1,0,0) from P3 be safely granted immediately? justify the answer. Show the system state after grant of request?(CO4)

**8. Answer any <u>one</u> of the following:-**

8-a. Explain i-node scheme of UNIX in detail?. What do you mean by disk block addresses, single indirection, double indirection and triple indirection (CO5) 10

8-b. Explain the disk architecture with the help of diagram. What are the various components of disk access time? What do you mean by 'Cycle-stealing' in DMA transfer (CO5) 10