Code : 326104

MCA 1st Semester Exam., 2024

MODERN OPERATING SYSTEM

Time : 3 hours   Full Marks : 70

Instructions :

(i) *The marks are indicated in the right-hand margin.*

(ii) *There are* **SEVEN** *questions in this paper.*

(iii) *Attempt* **FIVE** *questions in all.*

(iv) *Question Nos.* **1** *and* **2** *are compulsory.*

SECTION—A

1. Choose the correct answer :   2×10=20

   (a) The entry of all the PCBs of the current processes is in

       (i) process register

       (ii) program counter

       (iii) process table

       (iv) process unit

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(b) A semaphore is a shared integer variable

   (i) that cannot drop below zero

   (ii) that cannot be more than zero

   (iii) that cannot drop below one

   (iv) that cannot be more than one

(c) If the size of logical address space is 2 to the power of m, and a page size is 2 to the power of n addressing units, then the high order ____ bits of a logical address designate the page number, and the ____ low order bits designate the page offset.

   (i) m, n

   (ii) n, m

   (iii) $m - n, m$

   (iv) $m - n, n$

(d) For larger page tables, they are kept in main memory and a ____ points to the page table.

   (i) page table base register

   (ii) page table base pointer

   (iii) page table register pointer

   (iv) page table base

(e) Effective access time is directly proportional to

   (i) page-fault rate

   (ii) hit ratio

   (iii) memory access time

   (iv) None of the mentioned

(f) A process is thrashing, if

   (i) it is spending more time paging than executing

   (ii) it is spending less time paging than executing

   (iii) page fault occurs

   (iv) swapping cannot take place

(g) A process refers to 5 pages, A, B, C, D, E in the order : A, B, C, D, A, B, E, A, B, C, D, E. If the page replacement algorithm is FIFO, the number of page frames is increased to 4, then the number of page transfers

   (i) decreases

   (ii) increases

   (iii) remains the same

   (iv) None of the mentioned

(h) In priority scheduling algorithm, when a process arrives at the ready queue, its priority is compared with the priority of

   (i) all processes

   (ii) currently running process

   (iii) parent process

   (iv) init process

(i) A FIFO replacement algorithm associates with each page the

   (i) time it was brought into memory

   (ii) size of the page in memory

   (iii) page after and before it

   (iv) All of the mentioned

(j) A computer system has 6 tape drives, with n processes competing for them. Each process may need 3 tape drives. The maximum value of n for which the system is guaranteed to be deadlock-free is

   (i) 2

   (ii) 3

   (iii) 4

   (iv) 1

SECTION—B

Answer any *four* out of *five* questions :   5×4=20

2. (a) What are multi-user operating systems, and how do they differ from single-user operating systems?

   (b) What is the cause of thrashing? How does the system detect thrashing? Once it detects thrashing, what can the system do to eliminate this problem?

   (c) Describe compaction strategies used to mitigate external fragmentation in memory management. Discuss their advantages, limitations and potential overhead.

   (d) Suppose a computer system uses a two-level page table scheme for virtual memory management. The virtual address space is 32 bits, and each page table entry is 4 bytes. The page size is 4 KB, and each page table covers 1 MB of virtual memory. Calculate the size of the outer and inner page tables.

(e) Explain the concept of disk scheduling in operating systems. Discuss the importance of disk scheduling algorithms in improving disk I/O performance.

SECTION—C

Answer any three out of five questions : 10×3=30

3. Explain the concept of deadlock in distributed mutual exclusion algorithms. Discuss the conditions that lead to deadlock and propose methods to prevent or detect deadlock in distributed systems.

4. Describe the challenges of ensuring security and privacy in distributed systems. Discuss the design principles and techniques for securing communication, data storage, and access control in distributed environments.

5. Consider a disk with 500 tracks, and the disk arm is currently at track 250. There are pending I/O requests at tracks 100, 400, 200, 350, and 450. Apply the C-SCAN (Circular SCAN) disk scheduling algorithm. Calculate the total distance travelled by the disk arm to service all these requests.

6. Describe various IPC mechanisms used in operating systems, including shared memory, message passing, pipes and sockets. Discuss the trade-offs between these mechanisms in terms of performance, complexity and synchronization overhead.

7. Given a system with four processes and their respective burst times P_1 (6 ms), P_2 (8 ms), P_3 (4 ms), and P_4 (10 ms). Apply SJF scheduling to these processes. Calculate the average waiting time.

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