# 2023

## COMPUTER SCIENCE — HONOURS

### Paper : CC-7

### (Operating Systems)

### Full Marks : 50

*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* questions from the rest.

1. Answer *any five* questions :    2×5

    (a) What is a 'semaphore'?

    (b) Why is it difficult to implement the LRU (Least Recently Used) page replacement algorithm?

    (c) Why is spooling necessary?

    (d) Mention any two differences between multi-programming and multi-tasking.

    (e) What is the difference between 'client-server' and 'peer-to-peer' architecture?

    (f) What role does 'context switch' play?

    (g) Differentiate between long-term scheduler and short-term scheduler.

    (h) How does a real-time operating system differ from a traditional one?

2. (a) What role does 'aging' play in dynamic priority scheduling?

    (b) Discuss the important scheduling criteria used to analyse the performance of an algorithm.

    (c) Consider the following set of processes along with their arrival time and the length of CPU burst-time given in msec :

    | Process | Burst - time | Arrival time |
    |---------|--------------|--------------|
    | $P_1$   | 6            | 0            |
    | $P_2$   | 1            | 1            |
    | $P_3$   | 5            | 2            |
    | $P_4$   | 4            | 4            |
    | $P_5$   | 3            | 6            |

    Implement the following scheduling algorithms on the above scenario, draw the corresponding Gantt chart and calculate the average waiting time in each case : (i) SJF, (ii) SRTF.    2+3+(2½+2½)

**Please Turn Over**

(2)

3. (a) Why is the 'race around' condition problematic in case of Interprocess Communication (IPC)?

   (b) Explain how the 'strict alternation' algorithm violates the necessary 'progress' condition of the critical section problems.

   (c) What is 'priority inversion problem'?

                  3+4+3

4. (a) Consider a system with 5 processes $P_0$ to $P_4$, and three resource types A, B, C. Suppose that at a particular instance the system has been recorded as follows :

| Process ID | Allocation A B C | MAX A B C | Available A B C |
|---|---|---|---|
| $P_0$ | 0 1 0 | 7 5 3 | 3 3 2 |
| $P_1$ | 2 0 0 | 3 2 2 | |
| $P_2$ | 3 0 2 | 9 0 2 | |
| $P_3$ | 2 1 1 | 2 2 2 | |
| $P_4$ | 0 0 2 | 4 3 3 | |

Find the safe sequence and check whether the following permission is achieved or not using Banker's algorithm. The process $P_1$ requests one additional instance of resource type A and two instances of resource type C.

   (b) Why is deadlock prevention considered as a poorer approach, when compared to deadlock avoidance?

                  (4+3)+3

5. (a) What is effective memory access time? If memory reference takes 150 ns, how long does a paged memory reference take? If we add TLBs and 75% hit is successful, what is the effective memory reference time? (Assume that finding page table entry in the TLBs take zero time, if the entry is there).

   (b) Differentiate external and internal fragmentation. When do they occur? (2+3)+(3+2)

6. (a) What do you mean by a page fault rate?

   (b) Consider the following page 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, assuming three page frames, for the following page replacement algorithms : (i) FIFO, (ii) LRU? 2+(4+4)

7. (a) Explain the different accessing methods of a file.

   (b) Define seek time and latency time.

   (c) When does dangling pointer occur? What is the solution to it? 3+2+(3+2)

8. (a) Why is disk scheduling necessary?

   (b) What is the Master Boot Record (MBR)? Explain its purpose.

   (c) Given the order of track requests below, use SSTF to service the requests and calculate the total seek time.

     Order of requests : 82, 170, 43, 140, 24, 16, 190

     Current position of R/W head : 50.

                  2+(2+1)+5