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7. Distinguish between the following: (15)

- (i) Process and thread
- (ii) Preemptive and non-preemptive scheduling
- (iii) Seek time and rotational latency
- (iv) Paging and demand paging
- (v) Physical memory and virtual memory

(700)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7310 J

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Name of the Paper : Operating Systems

Name of the Course : B.A. Prog./ B.Sc.
(Phy. Sc. & MS)

Semester : IV

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll. No. on the top immediately on receipt of this question paper.
2. **Section A** is compulsory.
3. Attempt any **FOUR** questions from **Section B**.
4. Parts of a question should be attempted together.

P.T.O.

Section A

1. (a) A system uses a logical address composed of 8 bits for the page number and 12 bits for the offset. Calculate the total size of the logical address space. (3)
- (b) Write the steps involved in handling a page fault in an operating system. (3)
- (c) List three operations that can be performed on a file. (3)
- (d) How can we handle the problem of starvation in Priority Scheduling algorithm? (3)
- (e) Explain the concept of Dual-Mode Operation in an operating system and its importance. (3)
- (f) Write three advantages of multi-threaded systems. (3)
- (g) What is a System Call? Name any two system calls used in file handling. (3)

Segment	Base	Length
0	120	600
1	2300	14
2	60	105

- (b) Describe the states of a process using a suitable diagram. (5)
- (c) Consider a system with 3 processes (P1, P2, P3) and 2 resource types (R1 with 1 instance, R2 with 2 instances). The current allocation and requests are as follows: (6)

P1 holds R1 and requests R2,

P2 holds one instance of R2 and requests R1,

P3 holds another instance of R2.

Draw the Resource Allocation Graph and determine whether a deadlock exists or not. Justify your answer.

5. (a) A disk scheduling system has the following queue of pending requests (in the order they arrive): [98, 183, 37, 122, 14, 124, 65, 67]. The disk head starts at position 53. Answer the following: (10)

(i) Calculate the total head movement using the First-Come, First-Served (FCFS) algorithm.

(ii) Calculate the total head movement using the Shortest Seek Time First (SSTF) algorithm.

(iii) Which algorithm results in less head movement, and why?

- (b) Explain the concept of caching in an operating system. Discuss the concept of cache coherency and its importance in multiprocessor systems.

(5)

6. (a) Explain the purpose of the base register. Using the segment table provided below, calculate the physical address for the logical address (1, 10).

(4)

- (h) Define Deadlock. Mention any two necessary conditions required for a deadlock to occur. (3)
- (i) Discuss why progress and bounded waiting are essential requirements in solving the Critical Section Problem. (3)
- (j) Explain the concept of a Process Control Block (PCB) and name any three essential elements it comprises. (3)

Section B

2. (a) The system uses the non-preemptive Shortest Job First scheduling algorithm. Consider the following processes: (7)

Process	Arrival Time	Burst Time
P1	0	8
P2	1	4
P3	2	2
P4	3	1

- (i) Draw the Gantt chart showing the execution order.
 - (ii) Calculate waiting time and turnaround time for each process.
 - (iii) Calculate average waiting and average turnaround time
- (b) Explain the role of long-term, short-term, and medium-term schedulers. (6)
- (c) How does multiprogramming improve system performance? (2)
3. (a) Consider a memory system with available partitions of sizes: 180 KB, 300 KB, 120 KB, 500 KB, 220 KB. Three processes request memory in the following order: P1: 215 KB, P2: 125 KB, P3: 400 KB: (8)
- (i) For each of the contiguous memory allocation strategies (First-Fit, Best-Fit, and Worst-Fit), identify the partition each process would be allocated to.

- (ii) Rank the algorithms in terms of how efficiently they use memory. Briefly justify your ranking.
- (b) Explain how the translation of logical addresses to physical addresses occurs in paging technique. (4)
- (c) Distinguish between internal fragmentation and external fragmentation. (3)
4. (a) Explain the concept of demand paging in an operating system. What are the advantages of using demand paging? Consider the following page reference string: (10)
- 7, 2, 3, 1, 2, 5, 3, 4, 6, 7
- Assuming demand paging with three frames, how many page faults would occur if optimal replacement algorithm is used?
- (b) Compare single-level, two-level, and tree-structured directories. (5)