moving towards track 99 and the disk request queue contains read/write requests for the sectors on tracks 184, 55, 103, 96 and 197 respectively. What is the total number of head movements needed to satisfy the requests in the queue using :

(i) FCFS

(ii) LOOK (3+2)

(b) What is the critical section problem? What are the three requirements for a solution to the critical section problem? (2+3)

13/12/17 (M)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 6505 **HC**

Unique Paper Code : 32341302

Name of the Paper : Operating Systems

Name of the Course : **B.Sc. (H) Computer Science**

Semester : III

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Q. **1** is compulsory.
3. Attempt any **4** questions out of the questions from Q. **2** to Q. **6.**
4. Parts of a question must be answered together.

1. (a) Give one word answers for the following : (0.5×6)

(i) the mode in which operating system executes

(ii) A software generated interrupt

(iii) the path name that begins at the root and follows a path down to the specified file

(iv) excessive number of page faults that results in degradation of the system performance

(v) this type of file allocation allows only sequential access of the file

(vi) a way of interprocess communication

(b) Consider the following code segment :

```
int a = 10, p = fork();
if (p == 0)
    a++;
else {
    wait(NULL);
    a--;
}
cout << a << endl;
```

(i) What will be the output of the code segment? (1)

(ii) What are the possible outputs if wait() statement is removed and why? (2)

(c) What is Processor Affinity? (1)

(b) Consider the following page reference string

0 3 1 4 7 6 2 7 6 2 7 1 4 7 3 2 1 2 1

How many page faults would occur with FCFS and optimal page replacement algorithms assuming three frames? All frames are initially empty. (6)

5. (a) Consider a logical address space of 128 pages with 2-KB frame size mapped onto a physical memory of 512 KB.

(i) How many bits are there in the logical and physical addresses? (2)

(ii) How what is the breakup of offset and page number in the logical address? (2)

(iii) What is the maximum number of entries in the conventional page table and in the inverted page table? (2)

(b) What is a Process Control Block? Explain any of its four components. (4)

6. (a) Suppose a disk drive has 200 cylinders numbered from 0 to 199. The request for 62 is being serviced and is

3. (a) A system has 3 processes P1, P2 and P3, and 3 resources R1, R2 and R3. There are 2 instances each of R1 and R2, and one instance of R3. Given the edge set E = {R1 → P1, R2 → P2, P1 → R3, R1 → P2, P3 → R1, R2 → P3, R3 → P3}.

(i) Draw the resource allocation graph. (3)

(ii) Is the system in a deadlock? If the answer is yes, then mention the processes in the deadlock else identify the sequence in which the processes can execute. (2)

(b) What is file-open count? When does its value become zero? (2)

(c) Explain any three challenges in programming for multicore systems. (3)

4. (a) Consider a file system on a disk that has both logical and physical block sizes of 1-KB. If we are currently at logical block 15 and want to access logical block 6, how many physical blocks must be read from the disk for the following access methods and why?

(i) sequential

(ii) direct (4)

(d) Differentiate between the following : (3×2)

(i) Free space management using grouping and counting

(ii) Data parallelism and Task parallelism in threads

(iii) Long term scheduler and Short term scheduler

(e) What is the difference between the following two cases? (2)

Case 1: renaming a file

Case 2: copying a file and deleting the original file

(f) Consider the following segment table :

Segment	Base	Length
0	200	600
1	1200	20
2	40	150

What are the physical addresses for the following logical addresses?

(i) 1,30 (ii) 2,100 (2)

(g) If the total number of frames in main memory is 60 and there are 4 processes in the system with the demand as

30, 10, 100 and 60 frames, respectively. What will be the number of frames allocated using the following allocation strategies?

(i) equal allocation (1)

(ii) proportional allocation (2)

(h) What is busy waiting in semaphores? How can it be removed? (3)

(i) What is the main advantage of the layered approach to system design? What are the disadvantages of using the layered approach? (1+2)

(j) Why command interpreter is usually placed separate from the kernel? (2)

(k) What are real time embedded systems? (2)

(l) How can timer be used to protect CPU? (2)

(m) Compare indexed and linked allocation schemes. (3)

2. (a) Consider the following set of processes, with the length of CPU burst time given in milliseconds :

Process	Arrival Time	Burst Time	Priority
P_1	0	5	2
P_2	2	3	1 (Highest)
P_3	5	6	3
P_4	6	2	4

(i) Draw Gantt chart for Shortest Job First algorithm and calculate turnaround time for every process.

(ii) Draw Gantt chart for Priority based (preemptive) algorithm and calculate waiting time for every process. (6)

(b) Suppose there is a system with 128KB of memory with no memory initially allocated. Given the following sequence of requests by the processes, show the memory layout at intermediate stages for best-fit allocation algorithm. (4)

Process Number	Nature of Request	Amount of memory requested (in KB)
P0	Allocation	20
P1	Allocation	15
P2	Allocation	10
P3	Allocation	25
P0	Deallocation	
P2	Deallocation	
P4	Allocation	8
P5	Allocation	10