Roll Number: _____ Name: _____ Group: _____

Thapar Institute of Engineering & Technology
Department of Electronics and Communication Engineering

B. E. (ECE VI Semester): EST
28th May, 2022 Saturday
Time– 8:00-10:00AM, MM: 35

Course Code: UCS303
Course Name: Operating Systems
Name of Faculty: Dr. Shubhra Jain

Note: **Attempt *all* questions.**

Q.1 A disk has 200 tracks (numbered 0 through 199). At a given time, it was servicing the request of reading data from track 120, and at the previous request, service was for track 90. The pending requests (in order of their arrival) are for track numbers. 30 70 115 130 110 80 20 25.
(i) How many times will the head change its direction for the disk scheduling policies C-SCAN, LOOK and SSTF (Shortest Seek Time First)?

(ii) Identify the total head movement (in number of cylinders) incurred while servicing these requests using C-SCAN, LOOK and SSTF. [7 Marks]

Q.2 (i) What are the disadvantages of fixed partitioning? How dynamic partitioning overcome these issues? Briefly discuss. [5 Marks]

(ii) What are the causes of thrashing? [2 Marks]

Q.3 (i) Consider a single level paging scheme. The virtual address space is 4 GB and page size is 128 KB. What is the maximum page table entry size possible such that the entire page table fits well in one page? [4 Marks]

(ii) A computer system, using inverted page table where logical address space is 16MB and physical address space 8GB, and page size are 4KB. Memory is byte-addressable and page entry size is 8 bytes. What is the page table size? [3 Marks]

Q. 4 (i) Consider six memory partitions of size 200 KB, 400 KB, 600 KB, 500 KB, 300 KB, and 250 KB, where KB refers to kilobyte. These partitions need to be allotted to four processes of sizes 357 KB, 210 KB, 468 KB and 491 KB in that order. If the best fit algorithm is used, which partitions are NOT allotted to any process?

[2 Marks]

(ii) Consider the following segment table-

Segment No.	Base	Length
0	1219	700
1	2300	14
2	90	100
3	1327	580
4	1952	96

Which of the following logical address will produce trap addressing error?

i. 0, 430
ii. 1, 11
iii. 2, 100
iv. 3, 425
v. 4, 95

[5 Marks]

Q.5 (i) Discuss that file allocation scheme, which suffers from both internal and external fragmentation.

[4 Marks]

(ii) Consider a disk pack with 16 surfaces, 128 tracks per surface and 256 sectors per track. 512 bytes of data are stored in a bit serial manner in a sector. Calculate -

a. Capacity of the disk pack
b. Number of bits required to specify a particular sector in the disk? [3 Marks]

Roll Number:_____

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Thapar Institute of Engineering & Technology
Department of Computer Science and Engineering
END SEMESTER EXAMINATION

B. E. **(2nd Yr. Mechatronics / Electrical & Computer)**
28th May, 2022
Saturday, Time– 8:00 To 10:00 AM
Time: 2 Hours, Max Marks: 35, Weightage: 25

Course Code: UCS303
Course Name: Operating Systems
Name of Faculty: **Dr. Vinay Arora**

Assume any missing data; and show all intermediate computations properly.

Q.1 Rohan got selected for the technical interview round of Amazon, where interviewer Mr. X asked him for his favourite topic in the subject operating systems. Rohan replied to this saying "Memory management". After this Mr. X given a scenario to Rohan, which was related to memory management: In a system of 8GB RAM, virtual address space of 4GB was there for the processes (maximum processes that system can accommodate). Where, the said system allows a maximum of 1K (=1024) processes to run concurrently. Also, the Paging-based memory management system was in place. 4KB was the size of physical frames and logical pages. In the system, each page table entry requires an additional 11 bits (beyond the frame number) to store allied information related to flags (assumption). After quoting the scenario, Mr. X questioned Rohan for his comments on the **requirement of the maximum memory space needed to store the page tables of all processes in the system**; where the Operating Systems uses hierarchical paging. Now, imagine yourself in place of Rohan and give a suitable attempt to pass the technical round of Amazon. [While computing, consider the memory required for both outer and inner page tables.] (7)

Q.2 For a disk with 200 tracks on it, the table below gives a snapshot of the input/output request(s) made at different instances of time ('**ms**' is millisecond): (7)

Serial No.	Track No.	Time of arrival
1	12	65th ms
2	85	80th ms
3	40	110th ms
4	100	100th ms
5	75	175th ms

At the current clock time, which is **160th ms**, assume the current head position at track number **65**, and direction of last movement is towards higher number of tracks. Compute the total number of track movements when **Shortest Seek Time First** and **LOOK** disk-arm scheduling algorithms have been deployed [give suitable diagram].

Q.3 a. What do we exactly mean by the term "allocation" for a particular file? With a suitable diagram, explain three file allocation methods available in an operating system. (4)

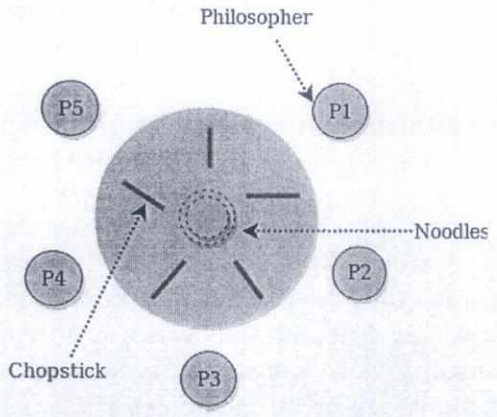
b. With a suitable diagram differentiate between RAID 1+0 and RAID 0+1. (3)

Q.4 a. List three types of breaches through which security in a computer system can be compromised. (3)

b. With a suitable diagram, explain the access matrix, various access rights and mode switching in it. (3)

c. In an access matrix, what does the symbol (*) star symbolize? (1)

Q.5 a. For the Dining Philosopher Problem [taking 05 philosophers here], following code snippet is one among the semaphore based proposed solution (for the i^{th} Philosopher). Here, chopstick [] is an array of Semaphore and has been initialized to 1 (i.e. chopstick [5] = {1,1,1,1,1}) (4)



Philosopher i^{th}

```
do {
    wait (chopstick [i] );
    wait (chopstick [ (i + 1) % 5] );
        // eat
    signal (chopstick [i] );
    signal (chopstick [ (i + 1) % 5] );
        // think
} while (TRUE);
```

Although the given code was proposed as a solution, but this code is still having a problem. Point out the problem with this code and give a robust solution by amending this snippet.

b. Explain the following terms: (3)
   i. Concurrency
   ii. Race Condition