



Final Assessment Test (FAT) – November/December 2022

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|--------------|----------------------|-------------|-----------------------|
| Programme | M.Tech. (Integrated) | Semester | Fall Semester 2022-23 |
| Course Title | OPERATING SYSTEMS | Course Code | SWE3001 |
| Faculty Name | Prof. Renuka Devi S | Slot | C1+TC1 |
| | | Class Nbr | CH2022231000988 |
| Time | 3 Hours | Max. Marks | 100 |

Part A (10 X 10 Marks)

Answer All questions

- Consider that you are designing an efficient operating system for a Smart TV. Demonstrate the critical hardware components and their interactions using a block diagram, explaining the functions of the various components and the default functionalities which your operating system should handle. [10]
- X is a program that resides in memory. It has to get executed by an operating system Y. Discuss in the point of Y, what are the states and necessary steps X should undergo for executing in main memory. Illustrate with neat diagram.(5 marks) [10]
 - Write a program to create four processes (1 parent and 3 children) where they terminate in a sequence as follows: (5 marks)
 - Parent process terminates at last
 - First child terminates before parent and after second child.
 - Second child terminates after last and before first child.
 - Third child terminates first.
- Assume that there are 4 customers C1, C2, C3, and C4 arrives at 3 ms, 8 ms, 0 ms, 5 ms and are waiting in the queue at the help desk of a bank. Each customer takes 5ms, 3ms, 9ms and 4ms to complete their requests and have token numbers as 3, 1, 2, and 4 respectively. [10]
Compute the average waiting time and average turnaround time using the appropriate algorithm with respect to the following scenario:
 - Allow the customers based on the minimum time taken to complete their requests first. (3 Marks)
 - Allow the customers based on their token numbers. (3 Marks)
 - Allow the customers to access the help desk counters evenly for 2 ms. (4 Marks)
- A reputed restaurant employs three people A, B and C to make the dish, and they share 5 chopping boards(R0), 6 knives(R1) and 5 bowls(R2) for cooking. At Time T1, three chefs are doing some dish and their current state of possessing and maximum requirement of culinary items are shown in the table below. [10]

| Persons | Have | | | Maximum | | |
|---------|------|----|----|---------|----|----|
| | R0 | R1 | R2 | R0 | R1 | R2 |
| A | 2 | 0 | 2 | 5 | 1 | 2 |
| B | 0 | 3 | 1 | 1 | 5 | 1 |
| C | 1 | 1 | 2 | 1 | 3 | 3 |

- Will this allocation is safe to prepare the dish? Justify your answer. (5 Marks)
- Can a request by "A" for one more knife at T2 is possible? Justify your answer. (5 Marks)

5. Consider three concurrently running processes: P1 with a statement S1, P2 with a statement S2 and P3 with a statement S3. Suppose we require that S1 be executed only after S3 has completed and S2 be executed only after S1 has completed. Write pseudocode to implement this using semaphore and justify the execution of the code. [10]

6. Consider an Educational Institution consisting of 6 computer laboratories with the maximum capacity of 320, 610, 370, 200, 730 and 125 computers. Assume that five concurrent workshops are scheduled at the same time. The expected student strength of the five workshops are 115, 500, 358, 200 and 375. As a lab administrator, how will you allocate the laboratory? If suppose random allocation is made, how effective will the lab utilization be? [10]

7. Consider the following segment table: [10]

| Segment | Base | Length |
|---------|------|--------|
| 0 | 190 | 800 |
| 1 | 1750 | 126 |
| 2 | 60 | 120 |
| 3 | 2345 | 220 |
| 4 | 1876 | 30 |

Map the given physical addresses to the corresponding logical addresses?

- a. 1877
- b. 183
- c. 1910
- d. 2407
- e. 130

8. Consider the following page reference string: [10]
7, 2, 3, 1, 2, 5, 3, 4, 6, 7, 7, 1, 0, 5, 4, 6, 2, 3, 0, 1.

Assuming demand paging with three frames, how many page faults would occur for the following replacement algorithms?

- a. LRU replacement (5 Marks)
- b. FIFO replacement (5 Marks)

9. Suppose that a disk drive has 1,000 cylinders, numbered 0 to 999. The drive is currently serving a request at cylinder 431, and the previous request was at cylinder 361. The queue of pending requests, in FIFO order, is: [10]

413, 242, 459, 560, 108, 324, 70, 305, 993, 732

Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for each of the following disk-scheduling algorithms?

- a. FCFS (5 Marks)
- b. SCAN (5 marks)

10. Consider the directory structures as given below:

Structure 1: (3 Marks)

| File Name | Start | Length |
|-----------|-------|--------|
| W | 3 | 1 |
| X | 6 | 5 |
| Y | 12 | 3 |
| Z | 19 | 4 |

Structure 2: (3 Marks)

| File Name | Start | End |
|-----------|-------|-----|
| W | 3 | 12 |
| X | 22 | 45 |

Structure 3: (4 Marks)

| File Name | Index | Other Blocks |
|-----------|-------|-----------------------|
| X | 9 | 17,12,43,39,2 3,34 |

Perform the file allocation methods for the given structures.



Final Assessment Test (FAT) - APRIL/MAY 2023

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|--------------|------------------------------|-------------|-------------------------|
| Programme | B.Tech | Semester | Winter Semester 2022-23 |
| Course Title | OPERATING SYSTEMS | Course Code | BCSE303L |
| Faculty Name | Prof. Indra Priyadharshini S | Slot | F1+TF1 |
| | | Class Nbr | CH2022235000819 |
| Time | 3 Hours | Max. Marks | 100 |

Section-A (8 X 10 Marks)
Answer All questions

- SSS company is manufacturer of Smart medical diagnostic machine products. For this they want to design new customized operating system to incorporate SMART functionality specific to medical device, considering device memory is smaller compared to normal computer system. List the default functions to be supported by OS. Therefore suggest a good architecture which is suitable to build new OS and justify your answer [10]
- Maths teacher has given you two integers to determine the highest digit in each integer and further she would like to add those two digits. Develop a C program using threads to accomplish the given task concurrently for the two numbers and return the highest digit for the two numbers and display the sum of the returned two highest digits in main(). [10]
Example:
Two numbers are $a = 55687$ $b = 87934$.
Highest digit of $a = 8$ and $b = 9$.
So the sum will be $8+9 = 17$.
- Redesign the readers-writers problem such that, writer is having higher priority than reader. A reader should start its read after two writers have completed their writing. The third writer has to wait until 5 readers have completed their reading. Use appropriate variables and write the pseudo-code or program for the above scenario using semaphores and justify your algorithm meets the properties of synchronisation. [10]
- A process contains eight virtual pages on disk and is assigned a fixed allocation of three page frames in main memory. The following page trace occurs: 1, 0, 2, 2, 1, 7, 6, 7, 0, 1, 2, 0, 3, 0, 4. Remember that all frames are initially empty and the frame size is three. Calculate page hit ratio, page miss ratio and page faults for following algorithms. [10]
 - Optimal page replacement algorithm.(4 marks)
 - Second Chance page replacement algorithms and Comment on the efficiency of algorithms for the given frame size.(4 marks)
 - Identify the algorithm which gives the minimum number of page faults and justify the same. [2 Marks]
- Does Translation Lookaside Buffer (TLB) is used to reduce the time taken for logical to physical address translation?. Justify your answer with proper diagram.(5 Marks) [10]
 - A process P1 uses TLB for 60% of its execution remaining 40% through page table. Memory accesstime is 30 nano seconds and TLB access time is 20 nano seconds. Calculate the Effective Access Time of the process P1. (2 Marks)

c) Consider a logical address space of 128 pages of 1024 bytes mapped onto a physical memory of 256 frames. Calculate the number of bits required to represent logical and physical address. (3 Marks)

06. Assume that there exists 24 numbers of blocks available in the back store each of size 256 bytes. [10]
The list of files, the starting block from where it has to be allocated, with its size details are as follows:

| File Name | Start | Size in bytes |
|-----------|-------|---------------|
| X | 2 | 856 |
| Y | 7 | 512 |
| C | 11 | 1316 |
| B | 18 | 148 |
| L | 21 | 420 |

- Illustrate with diagram the allocation of the files into the blocks specified using contiguous file allocation strategy with file allocation table. [3Marks]
 - Illustrate with diagram the allocation of the files into the blocks using indexed file allocation strategy by considering the index block as 9 for file C.[4 Marks].
 - Discuss the advantage and disadvantage of above mentioned file allocation strategies.(3 marks)
07. Suppose that a disk drive has 2000 cylinders, numbered 0 to 1999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests, in order as given below [10]
96, 1375, 973, 1797, 848, 1520, 1050, 1650, 230, 110
Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests using the following disk scheduling algorithms (Consider service from left to right)?
a. SCAN b. LOOK algorithm.
08. a) As a virtualization expert, briefly elaborate different approaches to operating system virtualization. Discuss advantages and limitations. (5 marks) [10]
b) Online shopping website X would like to host web application on your customized Operating Systems. As an expert, analyse the security threats that are possible with respect to this application and provide the suggestions to enhance the security of the same. (5 marks)

Section-B (1 X 12 Marks)

Answer All questions

09. Assume that 6 students S1, S2, ..., S6 are willing to practise basketball and the target is to place a shoot. To complete a shoot, a student will get a maximum of three chance. First chance is based on the arrival of a student, second chance is allowed when no one is waiting for their first chance. Third chance will be given to process based on their longest waiting time for their third chance. First chance allowed for 8 time units for maximum, second chance for 16 time units. Every student enters the stadium on their own time and they take an amount of time to place a shoot. Following table shows the arrival time and required practice time of each student. [12]

| Student.No | Arrival Time Clock Time(A.M) | Practice Time Time units in Minutes |
|------------|---------------------------------|--|
| 1 | 6.00 | 3 |
| 2 | 6.10 | 25 |
| 3 | 6.30 | 30 |
| 4 | 6.40 | 10 |
| 5 | 6.45 | 35 |
| 6 | 6.50 | 40 |

Illustrate with required diagram, identify the time at which each student has completed their practice and the time they have taken to wait for their turn to play. (12 Marks)

Section -C (1 X 8 Marks)

Answer All questions

10. Four different groups of family want to go trip on same time. All four groups require different set of vehicles to accomadate all their family members. They approached ABC travel agency for their arrangements. The travel agency has the following number of three different types of luxurious cars. (8 Marks)

[8]

Car Type A=10; Car Type B=8; Car Type C=11;

The maximum requirements of different types of cars and the allotted cars for varius groups are as follows:

| | Max Cars Required | | | Alloted Cars | | |
|----|-------------------|---|---|--------------|---|---|
| | A | B | C | A | B | C |
| G1 | 8 | 6 | 8 | 4 | 2 | 3 |
| G2 | 4 | 3 | 6 | 1 | 1 | 3 |
| G3 | 7 | 7 | 4 | 2 | 3 | 2 |
| G4 | 6 | 4 | 5 | 1 | 1 | 1 |

The travel agency wanted to work out the schedule plan to find the possibility of allotting available vehicle based on their trip plan. Initially travel agency allotted some cars to various groups to plan their schedule. Provide a solution to the travel agency to find a schedule plan. Will that travel agency satisfied all 4 groups requirement? If not, how travel agency can solve this issue, Illustrate your solution in detail for this scenario.

