VIT

Reg. No. :

Final Assessment Test (FAT) - APRIL/MAY 2023

Programme	B.Tech	Semester	Winter Semester 2022-23
Course Title	OPERATING SYSTEMS	Course Code	BCSE303L
Faculty Name	Prof. SARASWATHI D	Slot	G1+TG1
Time	3 Hours	Class Nbr	CH2022235001281
		Max. Marks	100

SECTION A (7 X 10 Marks)
Answer All questions

Q1 Assume you are part of two design teams: one developing an operating system for AI-enabled washing machines and the other developing an operating system to host AR/VR-enabled interactive video games. discuss the design issues requirements and structure of the operating systems developed by both the teams

Q2 (a) Consider a Process P which executed the fork() system call thrice. as shown below

```
int main()
{
fork();
fork();
fork();
return 0;
}
```

How many direct children of P (i.e., processes whose parent is P) and how many other descendants of P (i.e., processes who are not direct children of P, but whose grandparent or great grandparent or some such ancestor is P) are created by the above lines of code? You may assume that all fork system calls succeed. Draw the process tree diagram and justify your answer. (2marks)

(b) Find the output of the below code and justify your answer. (2marks)

```
#include <stdio.h>
#include <sys/types.h>
#include <unistd.h>
void printX()
{
    int x = 1;
    if (fork() == 0)
        printf("Child has x = %d\n", ++x);
    else
        printf("Parent has x = %d\n", --x);
}
int main()
{
    printX();
```

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return 0;

}

(c).Assume you are helping to complete a school student's homework of writing multiplication tables of 7 and 8 (up to 10 iterations). Use Thread programming to complete the task, let the child thread prints the multiplication tables and the main() prints "Homework done" after the child completes the work.(6 marks)

03. Let us solve the dining philosopher's problem using banker's algorithm. Suppose there are only 3 philosophers P_0, P_1 and P_2 and 3 chopsticks C_0, C_1 and C_2. Initially, the system starts with the following: [10]

	Allocation			*Max*			Need			*Available*		
	C_0	C_1	C_2	C_0	C_1	C_2	C_0	C_1	C_2	C_0	C_1	C_2
P_0	0	0	0	1	1	0				1	1	1
P_1	0	0	0	0	1	1						
P_2	0	0	0	1	0	1						

Again, each philosopher will request his left chopstick followed by his right chopstick. Therefore, the philosopher P_i will do the following:

```
while (true) {
    Request(C_i);
    Request(C_(i+1)%3);
    Eat;
    Release(C_(i+1)%3);
    Release(C_i);
}
```

Note that philosophers may make their requests/releases concurrently; however, you may assume each request and release will be handled in a mutually exclusive way.

Find out the Need matrix and using the banker's algorithm (*i.e.*, resource request and safety) decide whether the following request can be granted or not.

- P_0 requests left chopstick C_0
- P_1 requests left chopstick C_1
- P_2 requests left chopstick C_2
- P_0 requests right chopstick C_1
- P_1 requests right chopstick C_2
- P_2 requests right chopstick C_0

[10]

04 The Ready queue of an operating system at a particular time instance is as follows

Process	Next CPU burst (in milliseconds)
P1	**2**
P2	**3**
P3	**7**
P4	**18**

2

The behavior of each process (if it were to use the CPU exclusively) is as follows: it runs for the CPU burst was given, then requests an I/O operation that takes 10 milliseconds, then runs for another CPU burst of equal duration to its first CPU burst and then terminates. However, the four processes must share the CPU. Assume that the I/O operations can proceed in parallel.

a) Draw a chart showing the execution of these processes under Round Robbin, with time quantum = 2, and also calculate the average waiting and turnaround time.

b) Draw a chart showing the execution of these processes under the Pre-emptive Shortest job first. For each process, also calculate the average waiting and turnaround time.

05. a. Applying LRU page replacement to the following reference string: 1,2,4,5,2,1,2,4. The main memory can accommodate 3 pages and it has already pages 1 and 2. Page 1 came in before page 2. How many page faults will occur? (5 marks) [10]

b. Let the page fault service time be 10ms in a computer with an average memory access time being 30ns. If the one-page fault is generated for every 10^6 memory accesses, what is the Effective Access Time for memory? Also, find the physical address space in a paging system which has a page table containing 64 entries of 11 bits each (including valid/invalid bits) and a page size of 512 bytes (5marks)

06. Consider virtual page reference string 7,0,1,2,0,3,0,4,2,3,0,3,2,1,2,0,1,7,0,1. Suppose a demand-paged virtual memory system runs on a computer system such that the main memory has 3-page frames. Which replacement algorithm among FIFO and OPTIMAL has a minimum number of page fault and also find the page fault probability in both the algorithms? Comment on the efficiency of the two algorithms for the given frame size. [10]

07. a)In A software company, a group of developers is working on a typical software development process, which needs that each developer to test their code on different platforms. Their operating systems must ensure that the development, testing, and deployment of the product works correctly and efficiently for all developers. The company has also planned to do cost-cutting on the purchase of any type of hardware, software, and other equipment for the company. [10]

i) In such a situation, what technique a project manager will use for the completion of the project successfully? (2)

ii) Elaborate on the challenges faced and the software techniques that may be incorporated by the project manager to complete the project. (3)

b)A small team is assigned a project in a company that involves various types of files like text files, video files, audio files, and image files. At a particular instant in time, there are a set of files with their corresponding memory requirements.

i) Assume that there are 20 blocks of memory available in the disk and each block is 2KB in size. Block numbers 4,8,9,14,15 and 20 already contain some other files stored in them. With these constraints, what type of file allocation can be used so that we can access the files faster with minimum seek time? Justify your answer with appropriate diagrams and explanations. (3)

File Name	Block size of file in **KB**
List.txt	5
Img.jpg	4
MovieLamp4	7
List2.txt	3
Img2.png	1

ii) If the file Movie1.mp4 has to be frequently accessed again and again by the team members, what type of allocation will you suggest to the team members? Justify your choice of file allocation method with the appropriate diagram. (2)

SECTION B (2 X 15 Marks)

Answer All questions

08. Assume five bank tellers are sitting at a round table, each with their own account ledger and a pen. The bank has a policy that each teller can only perform a transaction if they have both their pens. Moreover, once a teller starts a transaction, they need both pens to complete it, and the transaction can't be interrupted. All the tellers need to perform a critical transaction, but they can't perform it unless they have both their pens. However, when all five tellers pick up their left pens, they all realize that they can't pick up their right pens as their neighbors have already taken them. Now, all the tellers are waiting for their neighbors to put down their right pen. This creates a deadlock, and no one can perform their transactions. This can result in customers being unhappy and possibly withdrawing their funds from the bank. Infer the above scenario and provide a suitable solution along with pseudocode. How does the solution using a monitor differ from your solution for the above scenario? Furthermore, explain the three conditions that the critical section problem must satisfy. [15]

09. Suppose a disk has 200 tracks numbered from 0 to 199. The disk arm is currently positioned at track 50, and the direction of movement is towards track 199. There are 10 pending I/O requests in the following order: 82, 170, 43, 95, 180, 20, 150, 10, 98, and 160. [15]

Compute the total head movement using SSTF, SCAN, and C-SCAN disk scheduling algorithms. How does C-SCAN differ from SCAN algorithms and justify which is the best algorithm to be used for disk scheduling?