



Continuous Assessment Test-1 – May 2023

Programme	B.Tech (CSE and its Specialization)	Semester	Fall Inter 2022-23
Course	Operating System	Code	BCSE303L
Faculty	Dr.ABDUL QUADIR MD Dr.BHANU CHANDER BALUSA Dr.RISHIKESHAN C A Dr.SANDEEP KUMAR SATAPATHY Dr.PRADEEP K Dr.VALARMATHI Dr.INDRA PRIYADHARSHINI Dr.MONICA K M Dr.SANGEETHA N Dr.ANANDAN P Dr.YOGESH C Dr.LEKI CHOM THUNGN Dr.TAPABRATA ROY	Slot(s) 1 2 3 4 5 6 7	E2+TE2 CH2022232500759 CH2022232500982 CH2022232500983 CH2022232500993 CH2022232500992 CH2022232500988 CH2022232500755 CH2022232500756 CH2022232500757 CH2022232500758 CH2022232500760 CH2022232501076 CH2022232501075
Time	1½ Hours	Max. Marks	50

Answer ALL Questions

1. Mr. Anuj is attending an interview for a developer role at XYZ Pvt. Ltd. During the interview his manager asked him to list out the components and functionalities of the Operating system. Your task is to help Mr. Anuj to achieve the above scenario while taking into consideration the goal of a good operating system? [10]
2. a. Consider the following C program to be executed on CPU. With neat diagram explain how the following code is prepared for execution in terms of text, data, stack and heap segments when stored in memory. [5 Marks]
- ```
#include<stdio.h>
int c;
int main()
{
 int a=10;
 int b=20;
 print(a,b);
 return 0;
}
void print(int x, int y)
{
 c=x+y;
 printf("%d",c);}
```
- b. In general, the processor does not acknowledge the interrupts generated, till the completion of current instruction. Assume that the processor acknowledges the generated interrupt by preventing the execution of current on-going instruction. Write the various difficulties encountered by the operating system if the above step is implemented by the processor. [5 Marks]

3. a. Consider the following C program and explain in detail the creation of child processes and [10] how many times the "Hello" statement will be printed and which process will be responsible for printing each of them. [5 Marks]
- ```
#include<stdio.h>
#include<unistd.h>
int main()
{
    if (fork() && fork())
    {
        fork();
    }
    printf("Hello\n");
    return 0;
}
```
- b. Find the output for the two programs given below. Compare in brief why there is a similarity or difference in the outputs. [5 Marks]
- ```
#include <stdio.h>
#include<unistd.h>
int main()
{
 int i, a = 10;
 for(i = 0; i < 2; i++)
 {
 a += 5;
 printf("%d\n", a);
 }
 return 0;
}
#include <stdio.h>
#include<unistd.h>
int main()
{
 int a = 10;
 fork();
 a += 5;
 printf("%d\n", a);
 return 0;
}
```
4. Assume four students [S1, S2, S3, S4] would like to refer operating system book in the VIT [10] library. Unfortunately, only one copy is available for reference. Assuming S1 will read the book for 10m, S2 for 12m, S3 for 6m, and S4 for 9m. Also consider that all four students arrive at the library at the same time. Analyze the following scenarios with appropriate CPU scheduling algorithm and determine the average Turn Around Time (TAT) and average Waiting Time(WT) of the students in library if,
- The students are allowed to read the book based on their time requirement. The book will be allotted (until completion) to a student only if the demanded reading time of the student is lesser than the others.
  - The students are allowed to read the book one after the other for 5m in each of their turn.
5. a. Consider the following snapshot of a system in which five resources R1, R2, R3, R4 and R5 [10] are available. Using the below snapshot convert the matrix representation to a resource

allocation graph and find whether the system contains a deadlock or not. [5 Marks]

|                | Allocation     |                |                |                |                | Request        |                |                |                |                | Available      |                |                |                |                |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
|                | R <sub>1</sub> | R <sub>2</sub> | R <sub>3</sub> | R <sub>4</sub> | R <sub>5</sub> | R <sub>1</sub> | R <sub>2</sub> | R <sub>3</sub> | R <sub>4</sub> | R <sub>5</sub> | R <sub>1</sub> | R <sub>2</sub> | R <sub>3</sub> | R <sub>4</sub> | R <sub>5</sub> |
| P <sub>1</sub> | 0              | 0              | 0              | 1              | 0              | 1              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              |
| P <sub>2</sub> | 1              | 0              | 0              | 0              | 0              | 0              | 1              | 1              | 0              | 1              |                |                |                |                |                |
| P <sub>3</sub> | 0              | 0              | 1              | 0              | 0              | 0              | 0              | 0              | 0              | 1              |                |                |                |                |                |
| P <sub>4</sub> | 0              | 1              | 0              | 0              | 0              | 0              | 0              | 0              | 0              | 0              |                |                |                |                |                |
| P <sub>5</sub> | 0              | 0              | 0              | 0              | 1              | 0              | 0              | 0              | 1              | 0              |                |                |                |                |                |

- b. Consider the following snapshot of a system in which five resources A, B, C, D and E are available. Using the below snapshot convert the matrix representation to a resource allocation graph and find whether the system contains a deadlock or not [5 Marks]

|                | Allocation |   |   |   |   | Request |   |   |   |   | Available |   |   |   |   |
|----------------|------------|---|---|---|---|---------|---|---|---|---|-----------|---|---|---|---|
|                | A          | B | C | D | E | A       | B | C | D | E | A         | B | C | D | E |
| P <sub>0</sub> | 1          | 0 | 1 | 1 | 0 | 0       | 1 | 0 | 0 | 1 | 2         | 1 | 1 | 2 | 1 |
| P <sub>1</sub> | 1          | 1 | 0 | 0 | 0 | 0       | 0 | 1 | 0 | 1 |           |   |   |   |   |
| P <sub>2</sub> | 0          | 0 | 0 | 1 | 0 | 0       | 0 | 0 | 0 | 1 |           |   |   |   |   |
| P <sub>3</sub> | 0          | 0 | 0 | 0 | 0 | 1       | 0 | 1 | 0 | 1 |           |   |   |   |   |

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**Continuous Assessment Test 1(CAT 1) –January 2023**

|              |                                                                                      |              |                                                                                                                       |
|--------------|--------------------------------------------------------------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------|
| Programme    | : B.Tech (CSE)                                                                       | Semester     | : Winter Semester 2022-23                                                                                             |
| Course Code  | : BCSE303L                                                                           | Class Nbr(s) | : CH2022235000811,<br>CH2022235000812,<br>CH2022235000816,<br>CH2022235000815,<br>CH2022235000819,<br>CH2022235000813 |
| Course Title | :<br><br>Operating Systems                                                           |              |                                                                                                                       |
| Faculty(s)   | : R.K.Singh, Shyamal.L, , Thomas Abraham, Pradeep.K , IndraPriyadarshini, M.Sivagami | Slot         | : F1+TF1                                                                                                              |
| Time         | : 90 Minutes                                                                         | Max. Marks   | : 50                                                                                                                  |

**Answer all the Questions**

**Note: Assume that the necessary header files are included wherever required.**

| Q. No. | Question Text                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Marks |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1.     | <p>Considering the below C code execution, explain in detail how protection is achieved through abstraction in a microkernel operating system. Justify your answer with a neat diagram.</p> <pre>int main() {     int i,n;     scanf("%d\n",&amp;n);     for (i=0; i&lt;n; i++)         printf("%d\n", i);     return 0; }</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 10    |
| 2.     | <p>Develop a C program which creates two child processes from the parent process. Child1 should display the perfect square numbers from 1 to 10000 and child2 should display the perfect square numbers from 10000 to 20000. Discuss the nature of the output generated by your program for this scenario with proper justification. (8 marks)</p> <p><b>Note:</b></p> <p><b>Perfect Square Number:</b> A perfect square is a positive integer that is obtained by multiplying an integer by itself. In simple words, perfect squares are numbers that are the products of integers by themselves. Generally, we can express a perfect square as <math>x^2</math>, where x is an integer and the value of <math>x^2</math> is a perfect square.</p> <p>Ex: List of perfect square numbers from 1 to 25 are 1,4,9,16,25.</p> | 10    |

|            | <p>Discuss the execution status of the below program with justification. (2 marks)</p> <pre>int main() {     while(1) // 1 represents the condition is true and 0 represents the condition is false     in C      {fork();}     return 0; }</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                   |              |                   |    |   |        |    |   |   |    |   |   |    |   |         |    |        |         |    |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|--------------|-------------------|----|---|--------|----|---|---|----|---|---|----|---|---------|----|--------|---------|----|
| 3.         | Declare an integer array that has 1000 elements and calculate the sum of all 1000 elements. To complete this task, write a C program with two threads such that each thread find the sum of half of the array elements and return the result to the main(). main() should display the sum of total values returned by these two threads.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 10                |              |                   |    |   |        |    |   |   |    |   |   |    |   |         |    |        |         |    |
| 4.         | You are part of Operating Systems Development team in a company who develop android OS and ios for mobile phones. Identify kernel structures used in these operating systems, elaborate the structure in detail. Differentiate user experience and functionalities of these two operating systems                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 10                |              |                   |    |   |        |    |   |   |    |   |   |    |   |         |    |        |         |    |
| 5.         | <p>Consider a clinic with a set of patients for getting the treatment from an Eye specialist. Patients along with the arrival time and expected consultation time are mentioned in the following table.</p> <table border="1"> <thead> <tr> <th>Patient_id</th> <th>Arrival time</th> <th>Consultation time</th> </tr> </thead> <tbody> <tr> <td>p1</td> <td>5</td> <td>6<br/>5</td> </tr> <tr> <td>P2</td> <td>6</td> <td>8</td> </tr> <tr> <td>P3</td> <td>7</td> <td>7</td> </tr> <tr> <td>P4</td> <td>0</td> <td>3<br/>2.</td> </tr> <tr> <td>P5</td> <td>4<br/>3</td> <td>2<br/>10</td> </tr> </tbody> </table> <p>i) Give a pictorial representation of the sequence of patients being consulted by the Doctor for the below both strategies.</p> <ol style="list-style-type: none"> <li>Arrival time to the clinic.</li> <li>Shortest consultation time (considering with arrival time).</li> </ol> <p>Compare the performance of both strategies in terms of Waiting Time and Turnaround Time.</p> <p>(ii) Identify the best strategy used in (a) and (b) and justify.<br/>   (iii) Calculate the CPU utilization for both scheduling</p> | Patient_id        | Arrival time | Consultation time | p1 | 5 | 6<br>5 | P2 | 6 | 8 | P3 | 7 | 7 | P4 | 0 | 3<br>2. | P5 | 4<br>3 | 2<br>10 | 10 |
| Patient_id | Arrival time                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Consultation time |              |                   |    |   |        |    |   |   |    |   |   |    |   |         |    |        |         |    |
| p1         | 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 6<br>5            |              |                   |    |   |        |    |   |   |    |   |   |    |   |         |    |        |         |    |
| P2         | 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 8                 |              |                   |    |   |        |    |   |   |    |   |   |    |   |         |    |        |         |    |
| P3         | 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 7                 |              |                   |    |   |        |    |   |   |    |   |   |    |   |         |    |        |         |    |
| P4         | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3<br>2.           |              |                   |    |   |        |    |   |   |    |   |   |    |   |         |    |        |         |    |
| P5         | 4<br>3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2<br>10           |              |                   |    |   |        |    |   |   |    |   |   |    |   |         |    |        |         |    |



Reg. No.:

Name :



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**Continuous Assessment Test-I – September 2023**

|           |   |                                                              |            |   |                                                         |
|-----------|---|--------------------------------------------------------------|------------|---|---------------------------------------------------------|
| Programme | : | B.Tech(CSE)                                                  | Semester   | : | Fall 23-24                                              |
| Course    | : | Operating Systems                                            | Code       | : | BCSE303L                                                |
| Faculty   | : | Dr. Pravin Renold A, Dr. J. C. Kavitha, Dr. A. Menaka Pushpa | ClassNbr   | : | CH2023240100892,<br>CH2023240100893,<br>CH2023240101113 |
| Time      | : | 90 Minutes                                                   | Slot       | : | C2+TC2                                                  |
|           |   |                                                              | Max. Marks | : | 50                                                      |

**Answer all Questions**

Mar

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |    |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1. | <p>Imagine you're leading a team tasked with developing a cutting-edge operating system to power a fleet of autonomous delivery drones. These drones are designed to navigate complex urban environments, make real-time decisions, and seamlessly communicate with each other and central control systems. To ensure the success of this project, you need an operating system that guarantees high reliability, flexibility to adapt to changing conditions, and efficient resource management.</p> <p>(i) Which kernel model would you choose for this purpose, and why do you believe it's the most suitable option? Draw the OS design diagram. (7 Marks)</p> <p>(ii) How does the operating system facilitate the interaction between user programs and system services to ensure real-time decision-making for the delivery drones and efficient data and resource allocation? (3 Marks)</p> | 10 |
| 2. | <p>Write a C program to create a parent-child process hierarchy using the fork() system call. The first-level child has to find the vowels in the given input string and print their locations in the string. This child process creates a next-level child using fork(). The second level child prints the frequency of occurrence of the searched pattern in the given file name. The task assigned for the parent process is using the system call it print the system date and time. The parent process should allow its child to finish its task first which gives the</p>                                                                                                                                                                                                                                                                                                                     |    |

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |    |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|    | following process execution order, inner child process – outer child process – parent process.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |    |
| 3. | <p>In the multiprocessing systems, process P1 arrived at the ready queue at 1.05 a.m. with an overall execution time of 20 m. P1 has a higher priority than the currently running process. P1 pre-empts the currently running process. Consider the context switching time to save the currently running process's PCB and load the new process's PCB is 3 m. After 8 minutes, the execution of the P1 is stopped by the interrupt. The PCB of P1 is saved using context switching before transferring the CPU control to ISR. The execution time of the corresponding ISR is 240 sec. P1 resided at the ready queue for 3 m after ISR completion. Then P1 gets back the CPU control. After 5 m of P1 execution, 2 m I/O activity is triggered. The waiting time of P1 in the waiting queue and ready queue are as follows; 2 m and 6 m. Here, m represents minutes. For the given system scenario;</p> <p>(i) Draw the process P1 state transition diagram with time. (7 Marks)</p> <p>(ii) Calculate the end time and overall execution time of process P1. (3 Marks)</p>                                                                                                                                                                                                                                                                                                                                                  | 10 |
| 4. | <p>You have been assigned the task of evaluating and comparing the performance of three distinct scheduling algorithms within the context of managing audience interactions at a musical concert hosted in an indoor stadium for the following three scenarios:</p> <ul style="list-style-type: none"> <li>a. The concert's audience is comprised of individuals who possess tickets with varying rupee values. Assume that all the audience arrived at the same time and a higher ticket value corresponds to a greater preference for interacting with the singer.</li> <li>b. Drawing upon the required interaction times, individuals within the audience are allocated high-priority slots for engaging in discussions with the singer. Once an audience member is allotted a slot, they retain that slot until they conclude their discussion with the singer.</li> <li>c. Each audience member is provided a fixed time slot that is calculated based on the average of the interaction times to interact with the singer.</li> </ul> <p>Determine the following considering the given data and scenarios:</p> <p>(i) Identify the algorithms utilized in each scenario. (2 Marks)</p> <p>(ii) Generate Gantt charts to visually represent the execution order of the algorithms. (3 Marks)</p> <p>(iii) Determine the optimal algorithm based on the average waiting time and average turnaround time. (5 Marks)</p> | 10 |

| Audience | Entry Time in 24 Hrs clock | Interaction Time (s) | Ticket Value (Rupees) |
|----------|----------------------------|----------------------|-----------------------|
| 1        | 4 am                       | 6                    | 4000                  |
| 2        | 5 am                       | 3                    | 3000                  |
| 3        | 6 am                       | 5                    | 1000                  |
| 4        | 8 am                       | 2                    | 5000                  |
| 5        | 10 am                      | 4                    | 2000                  |

5.

In a hospital environment, different departments such as Casualty, Cardiology, Gynaecology, Pediatrics, and Oncology require resources such as medical equipment, staff, and rooms for various procedures. The resource staff has 10 instances, equipment has 8 instances and rooms have 5 instances in total. An algorithm could be applied to manage these resources efficiently. For example, the cardiology department needs staff, specific equipment, and rooms. The hospital can ensure that procedures are scheduled in such a way that the resources are allocated safely and don't exhaust the available resources and cause conflicts.

| Department | Allocation |           |       | Maximum |           |       |
|------------|------------|-----------|-------|---------|-----------|-------|
|            | Staff      | Equipment | Rooms | Staff   | Equipment | Rooms |
| Casualty   | 1          | 0         | 0     | 8       | 4         | 3     |
| Cardiology | 2          | 2         | 0     | 6       | 2         | 0     |
| Gynecology | 2          | 1         | 1     | 3       | 3         | 3     |
| Pediatrics | 1          | 1         | 1     | 4       | 4         | 3     |
| Oncology   | 2          | 1         | 0     | 5       | 2         | 2     |

Can these requirements be satisfied? Justify your answer by specifying the order in which the allocation can be done. Consider the following independent requests for additional resources in the current state.

- a) The cardiology department requests for 3 staff.
- b) Oncology department requests for 2 rooms.

Can these requests be granted immediately?



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Continuous Assessment Test 1 – September 2023

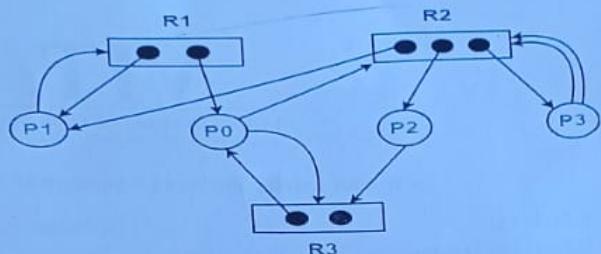
|              |                                                                                |              |                                    |
|--------------|--------------------------------------------------------------------------------|--------------|------------------------------------|
| Programme    | : B.Tech. CSE<br>B.Tech. CSE (AI&ML)<br>B.Tech. CSE (CPS)<br>B.Tech. CSE (AIR) | Semester     | Fall 2023-24                       |
| Course Code  | : BCSE303L                                                                     | Class Nbr(s) | CH2023240100694<br>CH2023240100695 |
| Course Title | : Operating Systems                                                            |              |                                    |
| Faculty(s)   | : Dr. K. Vallidevi<br>Dr. Afruza Begam                                         | Slot         | F1+TF1                             |
|              | : 90 Minutes                                                                   | Max. Marks   | 50                                 |

Answer all the Questions

| Q. No. | Sub-division | Question Text                                                                                                                                                                                                                                                                                                                                                                                                                               | Marks |
|--------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1.     | A            | What do you mean by the term "multitasking" in operating system? How do these concepts contribute to efficient resource utilization and improved user experience in modern operating systems?                                                                                                                                                                                                                                               | 4     |
|        | B            | Explain the transition procedure from user mode to kernel mode. Write down the System call sequences to copy the contents of one file to another file.                                                                                                                                                                                                                                                                                      | 6     |
| 2.     | A            | Consider a process P1 that forks P2, P2 forks P3, and P3 forks P4. P1 and P2 continue to execute while P3 terminates. Now, when P4 terminates, which process must wait for and reap P4? Explain the scenario with the pseudocode and a neat diagram.                                                                                                                                                                                        | 5     |
|        | B            | Consider a scenario where two tasks T2 and T3 request for the CPU burst while the task T1 is being executed by the CPU. It is assumed that the task T2 has the highest priority, followed by T3 and then T1. Explain the mechanism of execution of all the three tasks in case of pre-emptive process scheduling with the help of a Gantt chart. Also mention the processes completion sequence at the end of the execution of three tasks. | 5     |

3.

A Find the system is deadlock or not? If not find the safe sequence?



7

B

Consider a system with N process with a single resource R with 10 instances. If each process requires 2 instance of R to complete its execution. What is the maximum value of N to ensure dead lock free operation?

4.

Imagine that you have multi-core processor with 3 cores, and you need to schedule a set of processes on these cores. Each process has a specific execution time and a priority. The goal is to use a Round Robin (RR) scheduling algorithm with a time quantum of 4 units and ensure that each process gets a fair share of CPU time while maximizing overall throughput.

10

The details of the processes are:

| Process ID | Execution Time | Arrival Time | Priority |
|------------|----------------|--------------|----------|
| P1         | 10             | 1            | 2        |
| P2         | 6              | 2            | 1        |
| P3         | 8              | 3            | 3        |
| P4         | 5              | 4            | 2        |
| P5         | 7              | 5            | 1        |

Implement the Round Robin Scheduling algorithm with a time quantum of 4 units and show the scheduling on the 3 cores. Process with the higher number will get the higher priority. The CUP scheduler maintains a single common ready queue. Calculate the average turn-around time, completion time and waiting time of the processes.

5.

Consider a computer system with two user-level processes, Process A and Process B, both running on the same operating system.

10

Process A tries to access a sensitive file located in the system's protected directory. Process B, on the other hand, is responsible for authenticating users and managing user accounts.

- Explain the concept of process isolation and how it applies to this scenario.
- Identify potential security risks that might arise if Process A and Process B were not properly isolated.
- Describe a technique or mechanism that could be used to enforce process isolation and prevent unauthorized access to sensitive files.



**Continuous Assessment Test- I, November 2022**

|           |                                  |            |                   |
|-----------|----------------------------------|------------|-------------------|
| Programme | M.Tech - CSE and specializations | Semester   | : FALL 2022-23    |
| Course    | Operating Systems                | Code       | : MCSE504L        |
| Faculty   | Prof. B . Rajesh Kanna           | Class Nbr  | : CH2022231700015 |
| Time      | 1½ Hours                         | Slot(s)    | : E2+TE2          |
|           |                                  | Max. Marks | : 50              |

**Answer ALL the Questions**

1. 1) The day-to-day duties of a proactive student at VIT involves visiting the library for 15 minutes (L), referring to scientific literature for research-based learning for 30 minutes (R), designing code for lab studies for 45 minutes (C), active participation in the student seminar series for 12 minutes (S), and spending time on social media for 35 minutes (M). Consider the below cases and find out the task completion sequence as well as the wait time for each task.

[15]

- a) When a student imitates a uni-programming strategy in order to complete all tasks in the preferred task sequence, M, R, L, C, and S. (3 Marks)  
b) When a student mimics a multiprogramming approach by changing tasks every 5 minutes of their preferred task sequence, C, M, L, S and R. (7 Marks)  
c) When a student emulates the multitasking approach of two processors, both processors are assumed to be in uniprogramming mode. The preferred task sequence for processor 1 is C,M,L,R, and S, and for processor 2 is S,R,L,M and C. (5 Marks)

2. int value = 5;

[5]

```
int main()
{
 pid_t pid;
 pid = fork();
 if (pid == 0)
 {
 value += 15;
 printf("Statement 1 : value = %d",value);
 }
 if (pid > 0)
 {
 wait(NULL);
 printf("Statement 2 : value = %d",value);
 }
 value += 10;
 printf("Statement 3 : value = %d",value);
}
```

Display the outputs produced by the Statements 1,2,3 and Justify ?

3. A three-level feedback queue scheduler based on a single processor is setup with round robin scheduling methods with time slice quantum 8 and 16 for queues 1 and 2, followed by the FCFS

[15]

algorithm for queue 3. Also, 50 milliseconds (msec) is setup to prevent starvation for moving any process that waits too long in the lower priority queue to the higher priority queue (Queue 1).

a) Describe in detail the flow procedures involved in scheduling a specific process of your choice for the given context. (5 Marks)

b) You are given the task of scheduling three jobs of length 30, 20, and 10 msec for the aforementioned setup with no context switch time, all jobs' arrival at the same time, and each task's instructions having only CPU bound operation. Find out the turn-around time of all three processes. (10 Marks)

4. The following processes "A" and "B" have a shared memory variable "X" which is initialised as the numeral 5. [15]

| Process A                      | Process B                      |
|--------------------------------|--------------------------------|
| int Y;<br>Y = X * 2;<br>X = Y; | int Z;<br>Y = X + 1;<br>X = Z; |

Once execution begins, instructions from any process can be executed in any order. However, within each process, the statements are executed sequentially.

a) After both processes have been executed, how many different values of X are possible? (5 marks)

b) Assume the programmes have been modified to use a shared binary semaphore, S, which is set to 1 before either process starts. Then, how many different values of X are possible after both processes finish executing ? Justify (5 Marks)

| Process A                                                | Process B                                                |
|----------------------------------------------------------|----------------------------------------------------------|
| int Y;<br>wait(S);<br>Y = X * 2;<br>X = Y;<br>signal(S); | int Z;<br>wait(S);<br>Y = X + 1;<br>X = Z;<br>signal(S); |

c) Suppose the programmes are modified as follows to use a shared binary semaphore T as set to 0 before either process begins execution. Then, how many different values of X are possible after both processes finish executing? ( 5 Marks)

| Process A                                    | Process B                                  |
|----------------------------------------------|--------------------------------------------|
| int Y;<br>Y = X * 2;<br>X = Y;<br>signal(T); | int Z;<br>wait(T);<br>Y = X + 1;<br>X = Z; |

<><><><><><>

Reg. No.:

Name :

**VIT<sup>®</sup>**

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

**Continuous Assessment Test-I – September 2023**

|           |                                |            |                                       |
|-----------|--------------------------------|------------|---------------------------------------|
| Programme | : B.Tech(CSE)                  | Semester   | : Fall 23-24                          |
| Course    | : Operating Systems            | Code       | : BCSE303L                            |
|           |                                | ClassNbr   | : CH2023240100890,<br>CH2023240101112 |
| Faculty   | : Dr. L. Shyamala, Dr. Braveen | Slot       | : C1+TC1                              |
| Time      | : 90 Minutes                   | Max. Marks | : 50                                  |

**Answer all Questions****Mark**

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |    |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1. | (i) To implement a kernel, different types of structures are used. Identify the structure type of kernel that facilitates a dynamically loadable module that can be added to a running system without rebooting the system or rebuilding the kernel. (3 Mark)<br><br>(ii) Considering the below C code execution, explain in detail how protection is achieved through abstraction in a microkernel operating system. Justify your answer with a neat diagram. (7 Mark)<br><pre>main() {     int i,n;     scanf("%d\n",&amp;n);     for (i=0; i&lt;n; i++)         printf("%d\n", i); }</pre>                                                | 10 |
| 2. | (i) Consider a child process "A" which completed the execution using exit() system call but still has an entry in the process table. The parent process is sleeping or unaware of the child's exit. What will happen to the child process? In this state, if the kill() is executed by the parent will it work on the child? Justify your answer for this situation with a proper diagram. (4 Mark)<br><br>(ii) The OS is responsible for executing a process. Explain how OS handles the execution of the process in detail and also discuss the related system call associated with the process management with a proper diagram. (6 Mark) | 10 |
| 3. | Assume that there are 4 customers C1, C2, C3, and C4 arrive 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.<br>Compute the average waiting time and average turnaround time using the appropriate algorithm with respect to the following scenario:<br>(i) Allow the customers based on their token numbers. (5 Mark)<br>(ii) Allow the customers based on the shortest request time.(5 Mark)                                                                                 | 10 |

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |    |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |    |
| 4. | <p>i) Consider four processes P, Q, R, and S scheduled on a CPU as per round robin algorithm with a time quantum of 4 units. The processes arrive in the order P, Q, R, S, all at time t = 0. There is exactly one context switch from S to Q, exactly one context switch from R to Q, and exactly two context switches from Q to R. There is no context switch from S to P. Switching to a ready process after the termination of another process is also considered a context switch. Which one of the following CPU burst time (in time units) of these processes is NOT possible for the above-mentioned scenario? Justify your answer. (6 mark)</p> <p>(a) P=4, Q=10, R=6, S=2   (b) P=2, Q=9, R=5, S=1   (c) P=3, Q=7, R=7, S=3.</p>                              | 10 |
| 5. | <p>ii) A scheduling algorithm assigns priority proportional to the waiting time of a process. Every process starts with priority zero (the lowest priority). The scheduler re-evaluates the process priorities every T time unit and decides the next process to schedule. Which one of the following is TRUE if the processes have no I/O operations and all arrive at time zero? Justify your answer with an example. (4 mark)</p> <p>(a) This algorithm is equivalent to FCFS algorithm<br/>         (b) This algorithm equivalent to Round Robin algorithm<br/>         (c) This algorithm equivalent to SJF algorithm</p>                                                                                                                                          |    |
| 6. | <p>o Write a C program using the fork() system call that finds whether the given number is Armstrong or not in the child process (Child1). The parent must display "Welcome" message before the child starts its function. The input number should be accepted from the command line. Create another child from child1 to display "Thank you" message after completing the process. The parent should display "Bye" message after all child processes are completed. Display error messages, if</p> <p>(a) The user input is not a valid integer number.<br/>         (b) The operating system is not able to create the child.</p> <p>Note: Armstrong number is a number that is equal to the sum of cubes of its digits. For example 0, 1, 153, 370, 371 and 407.</p> | 10 |