

**Master of Computer Applications**  
**MCAC 203: Operating Systems**  
**Unique Paper Code: 223421203**  
**Semester II**  
**May-June 2024**  
**Year of Admission: 2023**  
**(Including ER/Imp./Ex-Students)**

**Time: Three Hours**

**Max. Marks: 70**

Instructions:

1. All questions are compulsory.
2. Attempt all the parts of a question together.

1. Describe the similarities and differences of the following system calls. 2\*5
  - a) creat and open
  - b) mknod and mkdir
  - c) setpgrp and setpgid
  - d) wait and waitpid
  - e) exit and \_exit
2. Consider the following page reference string 9

1 2 3 4 2 1 2 3 6 2 1 5 6 2 1 2 3 7 6 3

Find out the number of page faults if there are 4-page frames, using the following page replacement algorithm

  - i) LRU
  - ii) FIFO
  - iii) Optimal.
- 3(a) Create two files (f1.txt and f2.txt) using system calls. Write a code snippet with the help of system calls to copy the content of f1.txt file to f2.txt file. 5
- 3(b) Consider a logical address space of 8 pages of 1024 words each, mapped on to a physical memory of 32 frames. How many bits are there in the logical address and in the physical address? 2
- 3(c) How many times does the following C program print "Hello" on execution of the following code? 2

```
main ()
{
    for (int i=0; i<8; i++) {
        if (i%2 == 0) break;
        fork ();
    }
    printf ("Hello\n");
}
```
4. What is producer and consumer problem? Write code snippet to solve producer and consumer problem using (mutex) conditional variables and semaphores. Assume get() and put() are used to get and put the data into shared-buffer. 1+4+4

5. Consider the following set of processes. What would be the average waiting time and average process turnaround time. If the following scheduling policies are used. Show the Gantt chart and all the calculations.

Assumption: all the processes arrive at the same time, time-slice  $t=2$  sec. for RR scheduling.

Ignore context switching time.

- First come first serve (FCFS)
- Shortest Job First (SJF)
- Round Robin (RR)

| Process        | Burst Time (sec.) | Arrival time (sec.) |
|----------------|-------------------|---------------------|
| P <sub>1</sub> | 24                | 0                   |
| P <sub>2</sub> | 3                 | 2                   |
| P <sub>3</sub> | 3                 | 1                   |
| P <sub>4</sub> | 7                 | 3                   |

- 6(a) The cylinder sequence of requests is 86, 98, 47, 183, 91, 37, 147, 122, 94, 65, 124, 67. The head is initially at position-cylinder 56. What is the total head movement for FCFS and SSTF disk scheduling algorithm? Suppose that the head of moving head disk with 200 tracks numbered 0 to 199.

- 6(b) Find out the safe sequence of the following data using Banker's Algorithm:

|       | Allocation | Max   |
|-------|------------|-------|
| A B C | A B C      | A B C |
| P0    | 0 1 0      | 7 5 3 |
| P1    | 3 0 2      | 3 2 2 |
| P2    | 3 0 2      | 9 0 2 |
| P3    | 2 1 1      | 2 2 2 |
| P4    | 0 0 2      | 4 3 3 |

Available -  
A B C  
4 2 1

7. What are binary and counting semaphores? Write structure for ordering where processes must be executed in  $p_4 \rightarrow p_2 \rightarrow p_3 \rightarrow p_1$  order. Also need to declare and initialize the semaphores.
8. Write a program that creates a child process. Parent process writes data to a pipe and child process reads the data from the pipe and prints it on the screen. Also Show the IPC mechanism using diagrams.
9. Write two C programs `Main.c` and `Test.c`. `Main.c` is invoked first and perform forking. The parent process has two local variables and show the multiplication of these local variables. The child process invoked `Test.c` program and passed the value of the both the local variables. The `Test.c` performs addition of the values got from the child process. Use `exec` system call to invoke `Test.c` in child process.