H

Roll No. 2119301

TCS–502

B. TECH. (CSE) (FIFTH SEMESTER)
MID SEMESTER
EXAMINATION, Oct., 2023

OPERATING SYSTEMS

Time : 1½ Hours

Maximum Marks : 50

Note : (i) Answer all the questions by choosing any ***one*** of the sub-questions.

(ii) Each sub-question carries 10 marks.

1. (a) What is operating system structure ? Draw and explain OS layered and modular architecture and its services. (CO1)

OR

(b) Explain the User mode and Kernel mode with the help of a diagram. Which of the following instructions should be privileged or non-privileged ? (Also give a one-sentence explanation for why.) (CO1)

(i) Set value of timer P

(ii) Read The clock NP

P. T. O.

(iii) Clear memory
(iv) Turn off interrupts
(v) Switch from user to monitor mode
(vi) Issue a trap instruction
(vii) Modify entries in device-status table
(viii) Switch from user to kernel mode
(ix) Access I/O devices

2. (a) What are system calls ? Explain different types of system calls. What is the output of following code ? Explain with the help of a tree : (CO1)

```
#include <stdio.h>
#include <unistd.h>
int main()
{
if (fork()) {
 if (!fork()) {
    fork();
    printf("1");
 }
  else {
    printf("2") ;
  }
}
else {
 printf("3");
}
```

OR

(b) Explain the various sections inside a process layout with the help of a diagram.

3. (a) Consider 3 processes (P0, P1, P2) , arrival time of all process is zero with total execution time of 15, 20 and 25 units, respectively. Each process spends the first 1/5th part of execution time doing I/O, the next 3/5th part of execution time doing computation and the last 1/5th part of execution time doing I/O again. The operating system uses a shortest remaining time first scheduling algorithm and schedules a new process either when the running process gets blocked on I/O or when the running process finishes its compute burst. Assume that all I/O operations can be overlapped as much as possible. Draw Gantt chart for this and calculate average turn-around time, average waiting time, response time for each process and the total time does the CPU remain idle. (CO2)

OR

(b) Consider the following set of processes, with the length of the CPU-burst time given in milliseconds :

Process	CPU Burst Time	Priority
P1	10	3
P2	1	1
P3	2	3
P4	1	4
P5	5	2

The processes are assumed to have arrived in the order P1, P2, P3, P4, P5, all at time 0.

(i) Draw four Gantt charts illustrating the execution of these processes using FCFS, SJF, a non-preemptive priority (a smaller priority number implies a higher priority), and RR (quantum = 1) scheduling.

(ii) What is the turnaround time of each process for each of the scheduling algorithms in part (i) ?

(iii) What is the waiting time of each process for each of the scheduling algorithms in part (i) ?

(iv) Which of the schedules in part (i) results in the minimal average waiting time (over all processes) ?

4. (a) Consider a personal computer having a single processor environment. Then explain the phases of process transition from process creation to process termination state in detail for all possible cases. (CO2)

OR

(b) Let us consider the two processes P1 and P2 for accessing critical section as given below. The initial values of shared

Boolean variables B1 and B2 are randomly assigned :

Method used by P1	Method used by P2
while (B1 = = B2);	while (B1 ! = B2);
Critical section	Critical section
B1 = B2;	B1 = not (B2);

Analyze the above method and discuss the mutual exclusive, progress and bounded wait properties of the method.

5. (a) A shared variable COUNT, initialized to zero, is operated on by four parallel processes P1, P2, P3 and P4 as follows. Each of the processes P1 and P2 reads COUNT from memory, increments by one, stores it to memory, and then terminates. Each of the processes P3 and P4 reads COUNT from memory, decrements by two, stores it to memory, and then terminates. Each process before reading COUNT invokes the P operation (i.e., wait) on a counting semaphore S and invokes the V operation (i.e., signal) on

the semaphore S after storing COUNT to memory. Semaphore S is initialized to two. Processes can run in many ways and complete the execution. You have to discuss the case in which COUNT attains max value and also write the maximum value of COUNT. (CO2)

OR

(b) Explain the importance of Schedulers in operating system. What are different types of schedulers ? Differentiate among LTS, MTS and STS. (CO2)