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Department of Computer Science and Engineering
Midterm Examination Summer 2023
CSE 321: Operating Systems

Duration: 1 Hour 15 Minutes **Total Marks:** 25

Answer the following questions.
Figures in the right margin indicate marks.

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1. CO1

a) Why do we need cooperating processes, and what are the two models of interprocess communication? Additionally, **mention** the strengths and weaknesses of each approach? **[3]**

b) Discuss one drawback faced by multi-programmed OS architecture and suggest possible way(s) to overcome it. **[2]**

c) What is the purpose of system calls? **Which** of the following instructions should be privileged? **[1+1]**
i. Set value of timer **ii.** Read the clock **iii.** Clear memory **iv.** Issue a trap instruction. **v.** Turn off interrupts **vi.** Modify entries in device-status table

d) Find the output of the following code snippet. Your output should exactly match with the original output. **[3]**

```
int main() {
    pid_t child_pid;
    int global_a = 90, b = 11;
    char message[] = "Hello, from the ";
    printf("Parent process started\n");
    child_pid = fork();
    if (child_pid == -1) {
        printf("Fork Failed\n");
    } else if (child_pid > 0) {
        wait(NULL);
        global_a += 97;
        printf("%sAddition: %d + %d = %d\n", message,
global_a, b, global_a);
        printf("%sSubtraction: %d - %d = %d\n", message, b,
global_a, b);
    } else {
        b *= 7;
        printf("Multiplication: %d * %d = %d\n", global_a,
b, global_a);
        printf("Division: %d / %d = %d\n", b, global_a, b);
    }
    return 0;
}
```

2.
CO2

Processes	Arrival Time	Burst Time	Priority
P1	0	4	2
P2	6	4	1
P3	7	6	6
P4	7	1	3
P5	8	7	4
P6	19	7	5

a) Draw a Gantt chart and illustrate the execution of the process using the **Round Robin** scheduling algorithm **(time quantum = 5 units)**. **Calculate** the **average waiting** and **turnaround time.** **[3+2]**

b) Apply Preemptive Priority scheduling algorithm. **Draw** the Gantt chart and **Calculate** the **average waiting** and **turnaround time.** **[2+2]**

c) Compare the results and **identify** the most suitable scheduling algorithm in this scenario. **[1]**

3. **a) Explain data parallelism** with an example. **[1.5]**
CO3

b) You are developing a real-time embedded system for a safety-critical application, such as an advanced driver assistance system (ADAS) for autonomous vehicles. The system's primary goal is to process sensor data, make critical decisions, and take actions in real-time to ensure the safety of passengers and pedestrians. However, you may assume there's no limitation of computational resources on the project you are working on. **[1.5]**

Based on the scenario, **which** multi-threading model would you recommend for implementation? **Provide** necessary justification.

c) A system has processes to execute of which **30%** is serial. If the number of cores is decreased from **9** to **4**, **Explain** the change in the performance. **[2]**