5. [CO1] 1.a) Answer the following question: **[3 Marks]** 3 points

In a busy computer lab during finals week at a university, many students need access to a limited number of computers for their assignments and exams. To ensure fair and efficient resource allocation, which concept of operating system can be employed to address the issue? Explain how this method can solve the problem and mention the benefits it offers.

6. [CO1] 1.b) Answer the following question: **[2 Marks]** 2 points

What specific problem(s) of the monolithic structure were addressed through the adoption of a layered structure, and how were they resolved?

7. [CO1] 1.c) Find the output of the following code snippet. You need to type the answer in this form (as a response to this question) and show your working / tracing on paper. **Your output should exactly match with the original output. [3 Marks]** 3 points

```
int main(){
	int a=9;
	int b=3;
	i=fork();
	if(i<0){
		printf("fork failed\n");
	}
	else if(i==0){
		j=fork();
		if(j<0){
			printf("fork failed\n");
		}
		else if(j==0){
			a=a*b;
			b=a/b;
		}
		else{
			wait();
			a=a+b;
			b=b-a;
		}
	}
	else{
		wait();
		a=a-b;
		b=b+a;
	}
	printf("value of a: %d\n",a);
	printf("value of b: %d\n",b);

	return 0;
}
```

8. [CO1] 1.d) Answer the following question: **[3 Marks]** 3 points

In a Google Classroom, there are two types of users: teachers and students. Teachers create assignments with instructions and attached problem files, resulting in assignment slots in the classroom. Each slot contains instructions, the attached file, and individual placeholders for students to submit their assignments. Students can access instructions and problems from the attached files within these slots. When students submit assignments, they use designated placeholders within the assignment slots. Teachers review student assignments by accessing the files from these placeholders.

Logically explain what type of communication method was used in the above given scenario.

9. [CO2] 2.a) Type the average waiting time and turnaround time in this form (as a response to this question) and show your calculation on paper : **[5 Marks]** 5 points

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.**

Process ID	Burst Time	Arrival Time	Priority
P1	5	2	1
P2	6	6	5
P3	13	6	4
P4	15	10	222222
P5	9	12	3

10. [CO2] 2.b) Answer the following question: **[2 Marks]** 2 points

Due to a calculation error, P4 has received an abnormally high priority value compared to other processes. Describe the problem this situation might cause by providing a scenario illustrating the issue, and suggest how to address it.

11. [CO3] 3.a) Type the answer in this form (as a response to this question) and show your calculation on paper : **[3 Marks]** 3 points

A system has processes to execute of which are 86% parallel. The number of cores currently available is 2. Calculate the number of cores required in order to increase the speedup approximately 2 times.

12. [CO3] 3.b) Answer the following question: **[2 Marks]** 2 points

Imagine you have a text editor that is running on multiple threads and has a python code execution feature. To achieve the code execution, the editor creates a child process and loads the python interpreter as a separate program. In this scenario, should the child process be a single-threaded or multi-threaded program? State your reasons.

13. [CO3] 3.c) Answer the following question: **[2 Marks]** 2 points

Suppose an organization has a million employees. They preserve both HR management data including their demographic data. At an annual meeting on 31st December the CEO of the company wanted to pay a 20% bonus to employees whose age is more than 50 and achieved 90% KPI on 1st January. As the time is limited the data analyst used many nodes to make the search and generate the result. **Identify** which parallelism technique can be applicable here?