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Daffodil International University

Faculty of Science & Information Technology

Department of Computer Science & Engineering

Midterm Examination, Spring 2026

Course Code: CSE 323 , Course Title: Operating Systems

Level: 3 Term: 3 Batch: 65

Time: 01:30 Hrs **Marks: 25**

Answer ALL Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

1.	A university computer lab consists of several desktop computers connected to a central server. Students perform multiple tasks such as programming, browsing, and submitting assignments at the same time. The lab also uses a shared printer. At times, the CPU repeatedly checks the printer status to detect completion, while in other cases the printer sends a direct signal with the address of the required service routine to the CPU.			**CO1**
	a)	Describe how time-sharing (multitasking) allows multiple programs to appear as if they are running at the same time.	**[2]**	
	b)	Name the two mechanisms used for handling the printer and differentiate between them in terms of CPU efficiency and response handling.	**[3]**	
2.	A software developer is building a file-management application on a computer system. The application allows users to open, read, write, and save files. When the user clicks the "Save File" button, the program uses a function such as: `fopen("data.txt", "w");` The developer notices that although this function is part of the API library, the actual process of saving the file requires interaction with the Operating System kernel.			**CO2**
	Demonstrate with a diagram how API calls interact with the OS kernel through system calls.		**[3]**	
3.	A Linux-based server is running a multi-user web application. When a user submits a request through the browser, the server creates a process. The process then replaces its address space using necessary system calls to run a request-handling program. Meanwhile, the parent process continues to serve other incoming requests without waiting for the child to terminate. After several hours of operation, the system administrator notices that system performance is degrading, and the process table shows a large number of zombie processes.			**CO2**
	a)	Construct the process state diagram from the given scenario and show all state transitions with proper justification.	**[3]**	
	b)	Identify the reason why zombie processes are created in this system and how this can be prevented here.	**[2]**	

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4.	*a)*	A single-processor system uses Round Robin scheduling with time quantum = 4 units. Each context switch takes 0.2 units and must be included in all calculations. (There is no context switch before the first process starts, but one occurs whenever the CPU switches between processes.)	[6]	CO3

The system receives the following processes:

Process	Arrival Time	Burst time
P1	0	11
P2	2	5
P3	4	7
P4	6	9
P5	8	6

The ready queue follows FIFO order.

i) Construct the complete Gantt chart showing all process executions and context-switch intervals.

ii) Compute the Completion Time (CT), Turnaround Time (TAT), and Waiting Time (WT) for each process.

iii) Analyze how the inclusion of context-switch overhead affects overall scheduling performance.

b) A CPU uses Shortest Job First (SJF) scheduling. **[6]**

The following processes are given:

Process ID	Burst Time	Arrival Time
P1	6	5
P2	1	8
P3	3	13
P4	2	3
P5	8	24

i) Construct the Gantt chart based on SJF scheduling.

ii) Compute the Completion Time (CT) for each process and calculate the average Turnaround Time and average Waiting Time.

iii) Examine the scheduling outcome and explain how SJF improves or affects system performance compared to FCFS.