



SPRING MID SEMESTER EXAMINATION-2024

School of Computer Engineering
Kalinga Institute of Industrial Technology, Deemed to be University
Operating System
(CS20002/IT 20002/CC20002/CM20002/CS2002)

Time: 1 1/2 Hours

Full Mark: 20

*Answer Any four questions including question No.1 which is compulsory.
The figures in the margin indicate full marks. Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only.*

1. Answer all the questions. [1 X 5]
- Which of the following below statements are correct with respect to user level and kernel level threads:
 - Context switch is faster in kernel threads
 - A system call in user thread can block the entire process
 - User threads are transparent to kernel
 - All of the above
 - Assume that each process requires 2 seconds of service time in a single-processor system. If new processes are arriving at the rate of 40 processes per two minutes, then calculate the CPU idle rate?
 - Take a look at the following statements on process state transition for systems that make use of preemptive scheduling.
 - A running process can move to ready state.
 - A ready process can move to running state.
 - A blocked process can move to running state.
 - A blocked process can move to ready state.Which of the above statement(s) is/are TRUE?
 - What happens to the process control block (PCB) during a context switch?
 - It is copied to secondary storage.
 - It is swapped out of memory to make space for new processes.
 - It is saved and updated with the current state of the process.
 - It is deleted from memory to free up resources.
 - A shared variable X is initialized to 5 and three concurrent processes, P, Q and R are executed with the following code:

```
Read(X);  
X++;  
Store(X);
```

Find out the minimum and maximum values of X after completion of process P, Q, and R.

2. [2 x 2.5]
- What is context switching in OS? Explain the steps involves in context switching of two processes with a neat diagram. What are the triggers that lead to context switches in a system?

- b. Data segment of an address space for a process consist of two parts, called initialized and uninitialized data segments. Describe the need of dividing the data segment further in to two sub parts along with their usability.

3. As many as 4 processes arrive in the ready queue as given below: [5]

Process Name	Arrival Time in ms	CPU Burst Time in ms	Priority
A	0	5	3
B	2	4	7
C	5	8	2
D	10	6	6

After 2ms of execution, the process B has to wait for 6ms for a resource to continue its execution. Draw the Gantt chart and calculate the waiting time of each process for the following scheduling policies:

- Round Robin with 3ms time quantum
- Non-preemptive Priority with higher digit indicates higher priority .

4. [2 x 2.5]

- Differentiate between multi-programming, multitasking, and multiprocessing and multi-threading.
- A shared variable 'x' is initialized to zero, is operated by four processes 'W', 'X', 'Y', 'Z'. Processes 'W' and 'X' increment 'x' by one, while processes 'Y' and 'Z' decrement 'x' by two. Each processes before reading perform 'wait' on semaphore's and 'signal' on 's' after writing . If semaphore's is initialized to two. Find what the maximum possible value of 'x' after all processes completed execution and explain your answer.

W	X	Y	Z
Wait(s)	Wait(s)	Wait(s)	Wait(s)
Read(x)	Read(x)	Read(x)	Read(x)
x=x+1	x=x+1	x=x-2	x=x-2
Write(x)	Write(x)	Write(x)	Write(x)
Signal(s)	Signal(s)	Signal(s)	Signal(s)

5. [2 + 3]

- What is the difference between hardware lock and software lock for critical section? (Do not write down different hardware and software locks.). Determine which critical section requirements are satisfied in the context of two process software solutions as given below.

Process P0	Process P1
turn = 1; flag[0] = true; while(flag[1] && turn==1); critical section flag[0] = false;	urn = 0; flag[1] = true; while(flag[0] && turn==0); critical section flag[1] = false;

- Subsequently, write a proof for each of the critical section requirement, indicating whether it is satisfied or not within the aforementioned two-process solution.