Roll Number:_____________ Name_____________ Group_____________

THAPAR INSTITUTE OF ENGINEERING &TECHNOLOGY, PATIALA
Department of Computer Science & Engineering
Operating System (UCS303) – Mid Semester Examination
Date: 29/09/2023 & Time: 11:00AM **_MM: 35 & MT: 120 Min_**

Attempt/Answer all sub-parts like (a), (b), (c) for each question at one place. Do mention Page No. of your attempt at front page of the answer sheet. *Assume missing data (if any). Show all intermediate computations properly.*

Q1. (a). Consider a system with 6 processes where multilevel queue scheduling has been deployed using three queues labelled as Q1, Q2 and Q3, with priorities of queues are like, Q1 > Q2 > Q3. The Q1, Q2, and Q3 queues use the shortest remaining time first (SRTF), first come first serve (FCFS), and round robin (RR) scheduling with 2 ms time quantum, respectively. The arrival time (ms), burst time (ms), and execution queues of the processes are given in table below. [5]

Process Id	Arrival Time	Burst Time	Queue No.
P1	0	3	Q1
P2	0	4	Q1
P3	7	2	Q2
P4	6	4	Q2
P5	10	5	Q1
P6	5	3	Q3

Considering scheduling and context switching overhead as negligible, answer the following:

1. Draw the Gantt chart showing the sequence of execution for the processes involved in the system, and also specify the status of Q1, Q2, and Q3 at time instance t=20, i.e. the processes that reside in the said queues.
2. What is the turn-around time of processes P4 and P6?
3. What are the number context of switches after execution of all process?

(b). With a suitable diagram explain Computer System Structure with its four component. [2]

Q2. (a). With suitable diagrams explain inter-process communication models. Also, explain ways to implement logical link in message passing inter-process communication model with related issues. [2]

(b). In a system, the following state of process and resources are given: P1→R1, P5→R3, R1→P2, P2→R3, P2→R2, R2→P3, P3→R3, R3→P4, P4→R4, R4→P5, P5→R5, R5→P1. Draw a suitable resource allocation graph and its corresponding wait-for-graph. [2.5]

(c). Draw a labelled diagram to showcase the various states of a process. Also, label the suitable transition arrow for short, mid, and long term scheduler for their specific working. [2.5]

Q3. (a). A system has 5 processes and 4 resource types. The current location and maximum need are depicted in Table below. Assume that whenever there will be a choice, the process with smaller id will be allocated the resources first. [5]

Process Ids	Maximum Need				Current Allocation			
	R1	R2	R3	R4	R1	R2	R3	R4
P1 (ID = 095)	4	0	2	4	3	0	1	2
P2 (ID = 101)	2	6	6	0	2	0	1	0
P3 (ID = 118)	3	2	6	7	0	1	6	5
P4 (ID = 131)	1	6	3	2	0	6	2	2
P5 (ID = 141)	9	4	5	6	1	0	1	2

Considering maximum need and current allocation as given above, answer the following:

1. If Available = [Z 2 1 1], what is the smallest value of Z for which this system is in safe state? Explain how you compute this smallest value.
2. Consider an independent request REQ1 = [1 0 1 0] for additional resources; Can the request be granted immediately so the system still in deadlock-free state? Consider available resources [Z 2 1 1], where Z will be calculated from previous part.

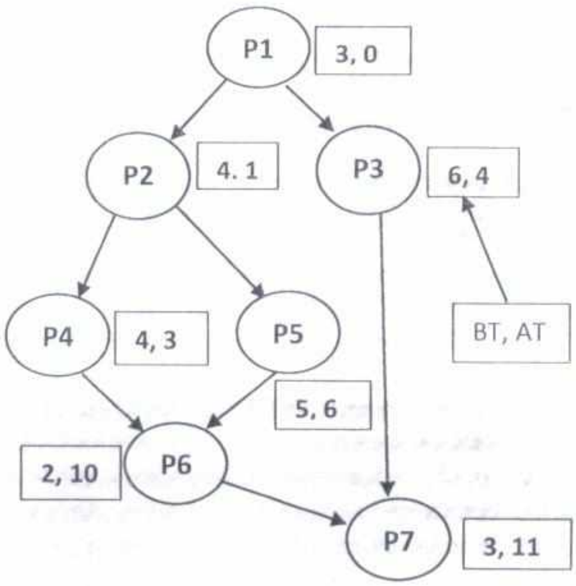
(b). Draw the diagrams for four multi-threading models. [2]

Q4. (a). With a suitable diagram explain symmetric and asymmetric multiprocessor systems. [2]

(b). Draw an annotated parent - child tree structure [including the return value of each fork ()] for the code snippet given below. Also, comment on the total count of occurrences for "Mid Semester", and "2023". [Here, L1,2,3…denotes line number] [5]

```
1.  int main()
2.  {
3.  fork();
4.  if (fork() && fork())
5.  {
6.       printf("Mid Semester");
7.       fork();
8.  }
9.  fork();
10. printf("2023");
11. return 0;
12. }
```

Q5. (a). Consider a system with two CPUs as CPU1 and CPU2. Graph depicts execution dependency among various processes P1 to P7. Edge Pi → Pj denotes that the process Pj is dependent on process Pi and will start execution after Pi completes its execution. Draw the GANTT chart for both the CPUs and compute the minimum time needed to execute all processes in the system. Assume that processes in the system execute in Round Robin mode with time quantum 2 ms, and the system has started at time t=0, with Process P1 at CPU1. Also, a process cannot share two CPUs at the same time but different timestamp. [Here, AT and BT denotes arrival time and burst time respectively.] [5]



(b). System call provides the means for a user program to ask the operating system to perform tasks reserved for the operating system on the user program's behalf. Explain using diagram the transition from user to kernel mode & vice versa while executing the system call. [2]