Q1.

Consider two types of programs: i) I/O-bound ii) CPU-bound, which is more likely to have **voluntary context switches**, and which is more likely to have **nonvoluntary context switches**? Explain your answer after defining the bold terms.

Q2. Consider the following set of processes, with the length of the CPU burst given in milliseconds:

The processes are assumed to have arrived in the order P1, P2, P3, P4, P5, all at time 0.

Process	Burst Time	Priority
P_1	5	4
P_2	3	1
P_3	1	2
P_4	7	2
P_5	4	3

a) Draw Gantt chart that illustrates the execution of these processes using the round robin. Select the value of quantum as the leftmost non-zero number of your roll number (e.g. for 20K-3400 it is 4).
b) What is the turnaround time of each process in part a?
c) What is the waiting time of each process?
d) What is the average waiting time (over all processes)?

Q3. Suppose there are three threads created inside a process. What information needs to be preserved during thread scheduling and why. Explain using diagrams and small explanations.

Q4. Show C code snippet (that uses Pthread library to create threads) where 5 threads work together to sum data from an integer array of size 500 into a global variable. Assume data in the array. No input and output statements needed.