1. We will not discuss this question during class. The answer to this question is given at the end of this tutorial sheet. You should work out the answer yourself by tracing through the algorithms.

   A and B are the only two processes in the system. Both are in the ready state. A arrives before B but the difference in arrival time is negligible. A is a CPU bound process while B is a I/O bound process. The pseudocode for A and B are as follows:

   ```
   A:
      repeat 2 times:
         compute              (takes 4 unit time)
         write result to disk (takes 1 unit time)
      exit                    (takes negligible time)


   B:
      repeat 2 times:
         compute              (takes 2 unit time)
         write result to disk (takes 4 unit time)
      exit                    (takes negligible time)
   ```

   Assume that (i) I/O can be done concurrently, i.e., the time taken to write to disk will not be prolonged if both processes write to disk at the same time; (ii) the running time of A and B can be estimated accurately; (iii) time quantum for preemptive scheduler is 1 unit time.

   For each of the following algorithms:

   (a) First Come First Serve;
   (b) Shortest Job First;
   (c) Round Robin;
   (d) Shortest Remaining Time First;
   (e) Priority Scheduling with static priority. A has higher priority than B.

   compute (i) the turnaround time for A and B, T_A and T_B; (ii) the response time for A and B, R_A and R_B.

2. **MCQ.** For each of the question below, choose the most appropriate answer and the corresponding letter (A, B, C, or D) in the box provided.

   If none of the answers provided is appropriate, put an X in the answer box. If multiple answers are equally appropriate, pick one and write the chosen answer in the answer box. **Do NOT write more than one answers in the answer box.**

   (a) Which of the following scheduling algorithm will NOT lead to starvation?
      A. Shortest Job First
      B. Shortest Remaining Time First
      C. Priority Scheduling, with static priority
      D. Multilevel Feedback Queue, with periodic boosting of every process's priority to highest.

      Answer: ☐

   (b) Two computer systems, A and B, are exactly identical (including scheduling algorithms and set of processes) except that the CPU of A is faster than the CPU of B. Which of the following statement is FALSE?

    A. Throughput for processes in A will be lower than B.

    B. CPU utilization of A will be lower than B.

    C. Average turnaround time for processes in A will be lower than B.

    D. Average response time for processes in A will be lower than B.

Answer:

3. Argue why the Shortest Job First algorithm minimizes the average turnaround time.

4. k processes arrive in a system. Each process takes L seconds to run. The time quantum assigned to each process is t seconds. None of the process requires I/O, and no new process is created.

    (a) Suppose the Round Robin algorithm is used for scheduling. What is the maximum response time experienced by a process? What is the maximum turnaronud time experienced by a process?

    (b) Suppose the First Come First Serve algorithm is used for scheduling. What is the maximum response time experienced by a process? What is the maximum turnaronud time experienced by a process?

5. A preemptive, uni-processor, scheduling algorithm named Least Run First (LRF) always pick the process that ran the least amount of time in the last T seconds to run next. T is significantly larger than the time quantum.

    (a) Does LRF favor CPU-bound process or I/O-bound process?

    (b) Will LRF cause some process to starve?

Answer to Question 1:

Algorithm	R_A	R_B	T_A	T_B
FCFS	0	4	11	16
SJF	0	4	11	16
RR	0	1	14	15
SRTF	0	4	10	20
PS	0	4	10	20