1. Three processes A, B, C start at the same time in that order, each has a series of alternating CPU bursts and I/O bursts as follows:

   A: 14ms (CPU), 3ms (I/O), 6ms (CPU) 23
   B: 4ms (CPU), 8ms (I/O), 7ms (CPU) 19
   C: 2ms (CPU), 1ms(I/O), 3ms (CPU), 1ms (I/O), 1ms (CPU) 8

   What would be the **turnaround (completion) and wait times** of all processes using each of the following scheduling algorithms?

   Round Robin (RR) with **5ms** time quantum,
   Shortest Job First (SJF).

   For simplicity, assume context switch time and other overheads are comparatively negligible. **NOTE:**

   - **Wait time** is the wait time each process spends in the process READY queue.
   - **Turnaround time = CPU bursts + I/O bursts + Wait time**

   Fill in the following table with your answers, and you **must show** the steps of your calculation (follow the hints below).

	Turnaround Time			Wait Time	
	RR	SJF		RR	SJF
A	37	37		14	14
B	36	31		17	12
C	29	24		21	16
Average	34	30.67		17.33	14

   Hint: Use notation p (e, s, r) to track CPU execution of a process over the time:

   e - total CPU burst time that has been executed for a particular process,
   s - total system time passed from the beginning of executing first process,
   r - the reason why the process is stopped along the execution (either suspended or completed) due to:

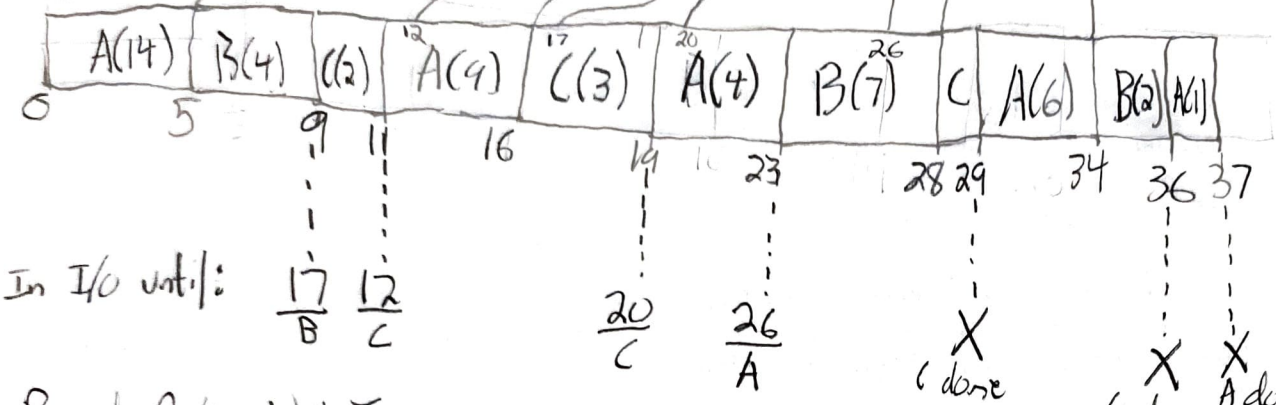
   - t - time quantum expired during RR (only applicable to RR),
   - i - process initiated an I/O,
   - c - process completed execution
   - For example: A(10, 16, t) means total CPU burst time that has been executed for process A is 10ms, total system time passed is 16ms since the beginning of executing the first CPU burst, and process A is suspended due to expiration of time quantum.

Round Robin Turnaround Time

Ready Queue:

A(14) B(4) C(2) A(9) C(3) A(4) B(7) C(1) A(6) B(2) A(1)

CPU#2 CPU#2 CPU#3 CPU#2



In I/O until: 17/B, 12/C, 20/C, 26/A, X (C done), X (6 done), X (A done)

Round Robin Wait Time

TWait Time = TAT - I/O - CPU burst

Wait Time = TAT - bursts

TAT	C	B	A
	29	36	37

C = 29 - 8 = 21

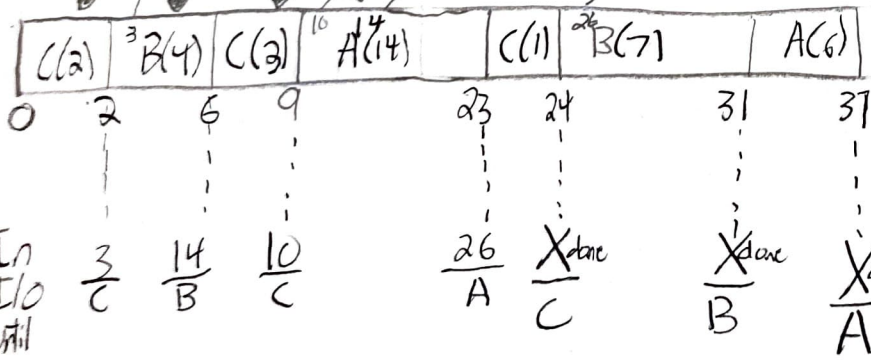
B = 36 - 19 = 17

A = 37 - 23 = 14

SJF Turnaround Time

Ready Queue

A(14) B(4) C(2) C(3) C(1) B(7) A(6)



In I/O until: 3/C, 14/B, 10/C, 26/A, X done C, X done B, X done A

TAT	C	B	A
	24	31	37

SJF Wait Time

Wait Time = TAT - bursts

C = 24 - 8 = 16 B = 31 - 19 = 12 A = 37 - 23 = 14