Homework 6 ● GRADED

Q1 Processor Scheduling Concepts
8 Points

Below are some true/false conceptual questions on processor scheduling.

Q1.1 Round Robin
2 Points

Round Robin is a preemptive algorithm:

- (●) True
- ( ) False

Q1.2 I/O Queue
2 Points

The I/O queue is a priority queue that prioritizes on shorter jobs:

- ( ) True
- (●) False

Q1.3 FCFS
2 Points

One may experience a higher variance in response time for FCFS:

- (●) True
- ( ) False

Q1.4 Priority Scheduler
2 Points

Priority Scheduler prevents long-running computations from blocking shorter jobs:

- (●) True
- ( ) False

1.4 Priority Scheduler **0** / 2 pts

+ 2 pts Correct

✔ + 0 pts Incorrect

Q2 Shortest Remaining Time First (SRTF)
30 Points

Assume the scheduler uses the Shortest Remaining Time First (SRTF) algorithm. Consider the following three processes which each require **one** CPU burst followed by **one** I/O burst, followed by **one** final CPU burst. The scheduling starts at time T0.

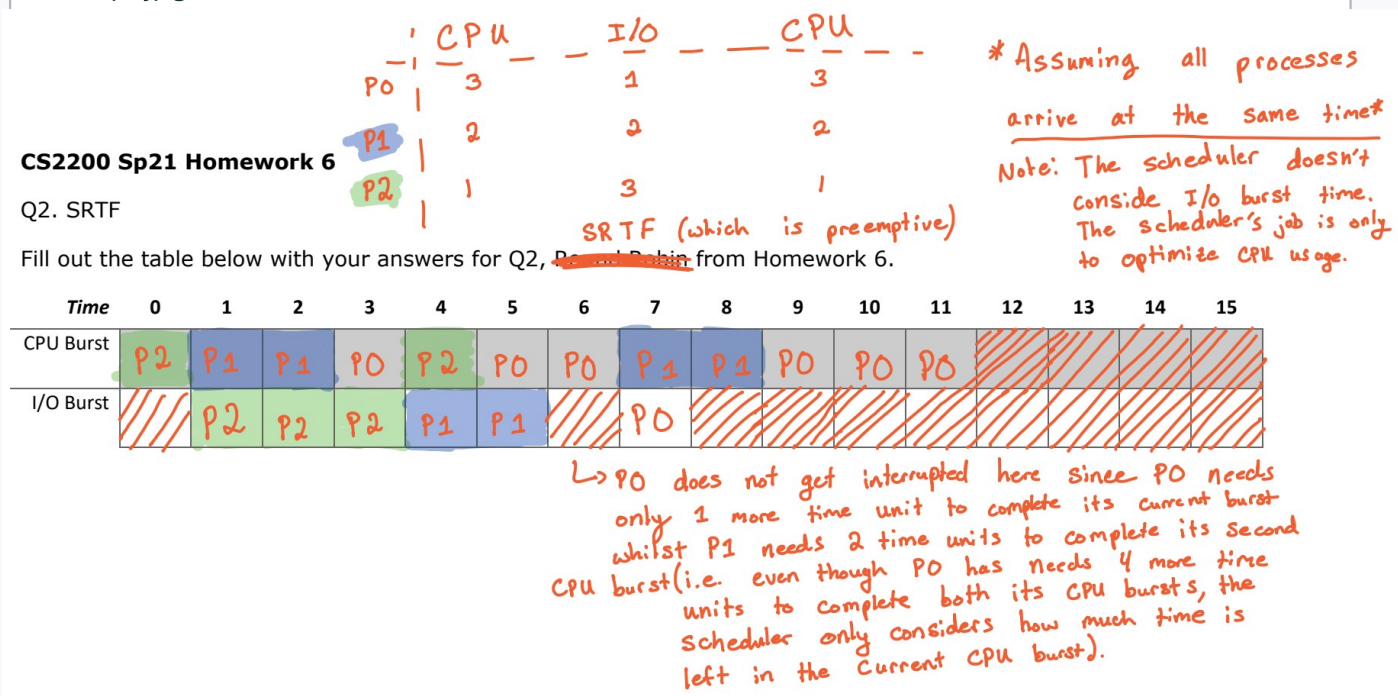
Process ID	CPU burst #1 and #2	I/O burst
P0	3	1
P1	2	2
P2	1	3

Create a process diagram showing the current process on the CPU and the current process performing I/O at each unit of time. Download the template from Canvas, "Homework 6 - extra downloads" under Modules and fill out the process diagram. Attach **a screenshot (PNG/JPG)** of the complete template to the file attachment tab below.

For an example of what your table should look like, see "Homework 6 - extra downloads".

Answer (screenshot of table)

h6 q2.jpg — Download



Q3 FCFS with Preemption

30 Points

Assume we schedule processes based on the FCFS with preemption algorithm and the process with the smallest ID takes higher priority *when breaking ties*. Consider the following three processes which each require **one** CPU burst followed by **one** I/O burst, followed by **one** final CPU burst.

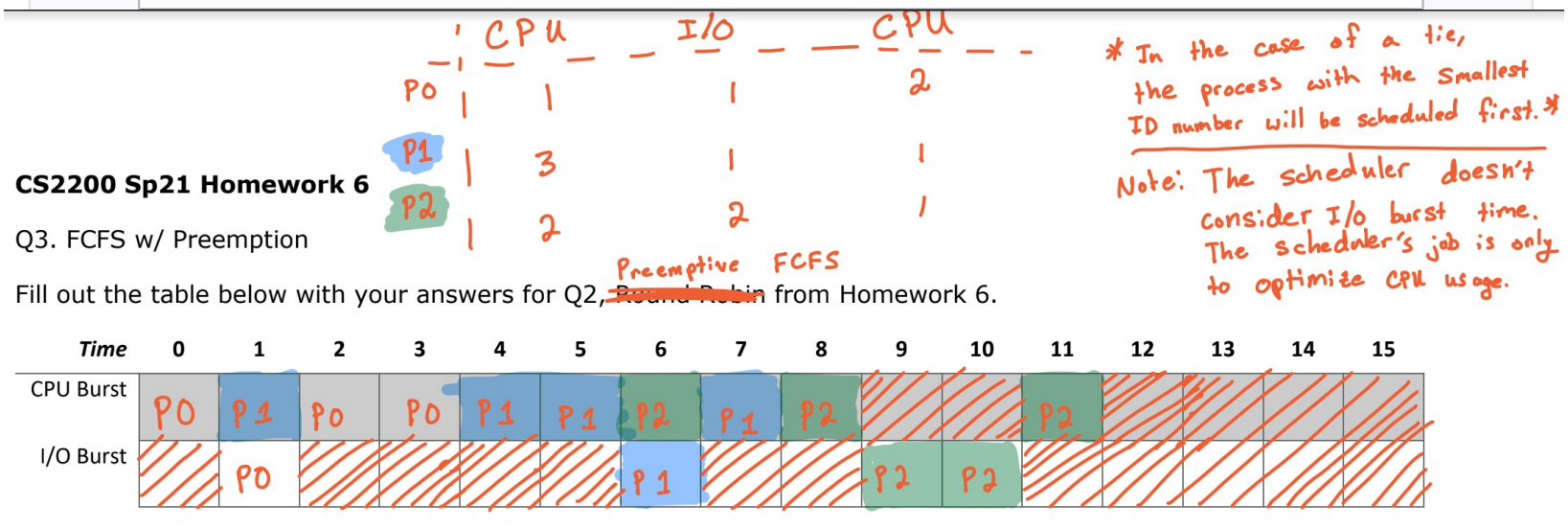
Process ID	CPU burst #1	I/O burst	CPU burst #2
P0	1	1	2
P1	3	1	1
P2	2	2	1

Create a process diagram showing the current process on the CPU and the current process performing I/O at each unit of time. Download the template from Canvas, "Homework 6 - extra downloads" under Modules and fill out the process diagram. Attach **a screenshot (PNG/JPG)** of the complete template to the file attachment tab below.

For an example of what your table should look like, see "Homework 6 - extra downloads".

Answer (screenshot of table)

hw6 q3.jpg — Download



Q4 Waiting and Turnaround Times

32 Points

The next question is regarding the Waiting Time and Turnaround Time for the Shortest Remaining Time First (SRTF) and FCFS with preemption algorithms shown in Questions 2 and 3.

Q4.1 Turnaround Time (Q2)

8 Points

What is the average turnaround time for the system in Question 2 (Round to 2 decimal places if needed)?

8.67

Q4.2 Waiting Time (Q2)

8 Points

What is the average waiting time for the system in Question 2 (Round to 2 decimal places if needed)?

2.67

Q4.3 Turnaround Time (Q3)

8 Points

What is the average turnaround time for the system in Question 3 (Round to 2 decimal places if needed)?

8

Q4.4 Waiting Time (Q3)

8 Points

What is the average waiting time for the system in Question 3 (Round to 2 decimal places if needed)?

3.33

Q4.5 Work

0 Points

If you would like partial credit in case of a wrong answer, include or attach your work here.

See attached files.

▾ H6 q2 work.jpg Download

	CPU	I/O	CPU
P0	3	1	3
P1	2	2	2
P2	1	3	1

SRTF (which is preemptive)

* Assuming all processes arrive at the same time*

Note: The scheduler doesn't consider I/O burst time. The scheduler's job is only to optimize CPU usage.

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Q2. SRTF

Fill out the table below with your answers for Q2, ~~Round Robin~~ from Homework 6.

Time	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CPU Burst	P2	P1	P1	P0	P2	P0	P0	P1	P1	P0	P0	P0				
I/O Burst		P2	P2	P2	P1	P1		P0								

↳ P0 does not get interrupted here since P0 needs only 1 more time unit to complete its current burst whilst P1 needs 2 time units to complete its second CPU burst (i.e. even though P0 has needs 4 more time units to complete both its CPU bursts, the scheduler only considers how much time is left in the current CPU burst).

Q4.1: System Turnaround time:

Turnaround time is how many jobs the CPU completes after a certain amount of time has elapsed.

$$(t_{turnaround})_{avg} = \frac{t_1 + t_2 + \dots + t_n}{n}$$

where n is the number of jobs.

$$(t_{turnaround})_{avg} = \frac{t_{P0} + t_{P1} + t_{P2}}{3} = \frac{12 + 9 + 5}{3}$$

$$= \frac{26}{3} \simeq 8.67 \text{ time units}$$

Q4.2: Average Waiting time:

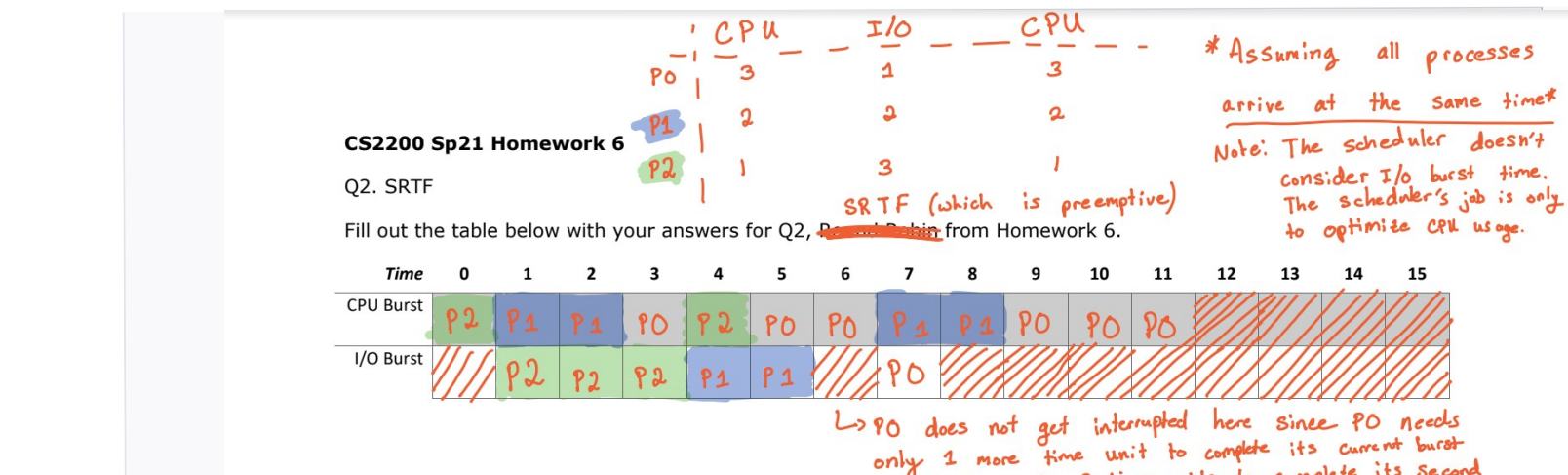
Amount of time the processor is running and is not working on a process after it arrives.

$$(t_{wait})_{avg} = \frac{(t_{P0} - e_{P0}) + \dots + (t_{Pn} - e_{Pn})}{n}$$

e = Process execution time

$$(t_{wait})_{avg} = \frac{(12-7) + (9-6) + (5-5)}{3} = \frac{5 + 3 + 0}{3}$$

$$= \frac{8}{3} \simeq 2.67 \text{ time units}$$



h6 q3 work.jpg Download

	CPU	I/O	CPU
P0	1	1	2
P1	3	1	1
P2	2	2	1

Preemptive FCFS

* In the case of a tie, the process with the smallest ID number will be scheduled first.*

Note: The scheduler doesn't consider I/O burst time. The scheduler's job is only to optimize CPU usage.

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Q3. FCFS w/ Preemption

Fill out the table below with your answers for Q2, ~~Round Robin~~ from Homework 6.

Time	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CPU Burst	P0	P1	P0	P0	P1	P1	P2	P1	P2			P2				
I/O Burst		P0					P1			P2	P2					

Q4.3: System Turnaround time:

Turnaround time is how many jobs the CPU completes after a certain amount of time has elapsed.

$$(t_{turnaround})_{avg} = \frac{t_1 + t_2 + \dots + t_n}{n}$$

where n is the number of jobs.

$$(t_{turnaround})_{avg} = \frac{t_{P0} + t_{P1} + t_{P2}}{3} = \frac{4 + 8 + 12}{3}$$

$$= \frac{24}{3} = 8 \text{ time units}$$

Q4.4: Average Waiting time:

Amount of time the processor is running and is not working on a process after it arrives.

$$(t_{wait})_{avg} = \frac{(t_{P0} - e_{P0}) + \dots + (t_{Pn} - e_{Pn})}{n}$$

e = Process execution time

$$(t_{wait})_{avg} = \frac{(4-4) + (8-5) + (12-5)}{3} = \frac{0 + 3 + 7}{3}$$

$$= \frac{10}{3} \simeq 3.33 \text{ time units}$$

Homework 6

GRADED

STUDENT
Eric Anders Gustafson

TOTAL POINTS
98 / 100 pts

QUESTION 1

Processor Scheduling Concepts — **6** / 8 pts

1.1	Round Robin	**2** / 2 pts
1.2	I/O Queue	**2** / 2 pts
1.3	FCFS	**2** / 2 pts
1.4		**0** / 2 pts

Priority Scheduler

+ 2 pts Correct

✔ + 0 pts Incorrect

QUESTION 2

Shortest Remaining Time First (SRTF) **30** / 30 pts

QUESTION 3

FCFS with Preemption **30** / 30 pts

QUESTION 4

Waiting and Turnaround Times **32** / 32 pts

4.1 Turnaround Time (Q2) **8** / 8 pts

4.2 Waiting Time (Q2) **8** / 8 pts

4.3 Turnaround Time (Q3) **8** / 8 pts

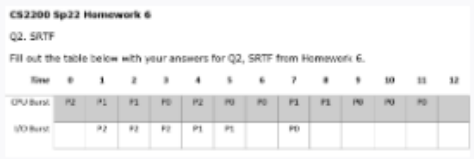
4.4 Waiting Time (Q3) **8** / 8 pts

4.5 Work **0** / 0 pts

QUESTION 2

Shortest Remaining Time First (SRTF) **30** / 30 pts

✔ − 0 pts Correct



− 5 pts Scheduled the wrong process once

− 5 pts Scheduled the wrong process once (P1 at t = 4 instead of P0, etc.)

− 10 pts Scheduled the wrong process twice

− 15 pts Performs SJF (i.e. Does not preempt a running process)

− 2 pts Submitted a word document/other file instead of a screenshot or PDF

− 30 pts Blank/no answer/Incorrect

CS2200 Sp22 Homework 6

Q2. SRTF

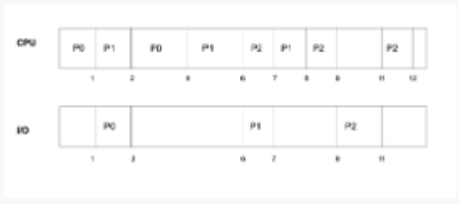
Fill out the table below with your answers for Q2, SRTF from Homework 6.

Time	0	1	2	3	4	5	6	7	8	9	10	11	12
CPU Burst	P2	P1	P1	P0	P2	P0	P0	P1	P1	P0	P0	P0	
I/O Burst		P2	P2	P2	P1	P1		P0					

QUESTION 3

FCFS with Preemption **30** / 30 pts

✔ − 0 pts Correct



− 5 pts Scheduled the wrong process once

− 10 pts Schedule the wrong process twice

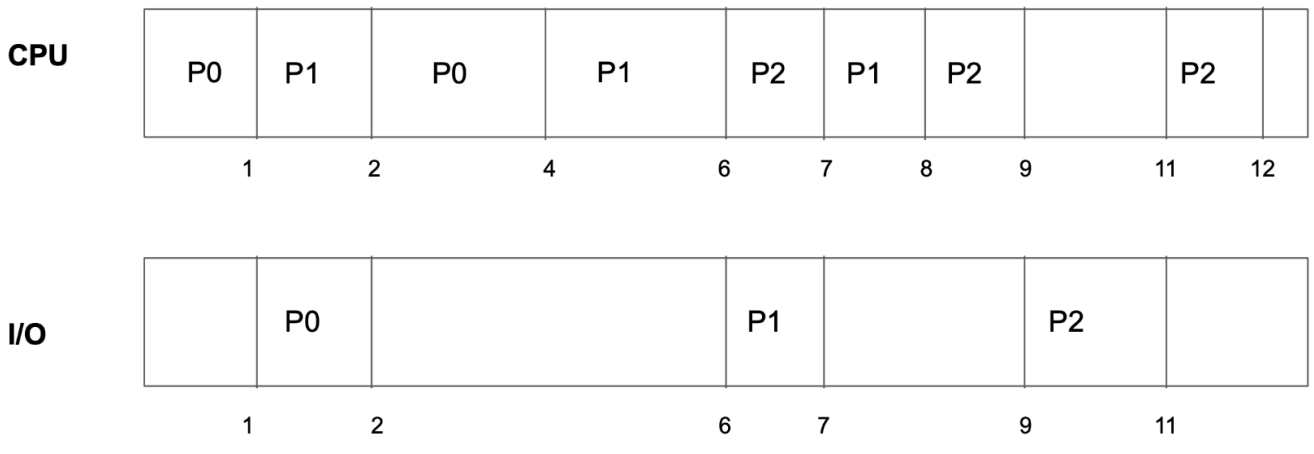
− 15 pts Schedule the wrong process three times

− 10 pts Uses Non Preemptive FCFS

− 10 pts Incorrect understanding of FCFS (ready queue sorted based on when the process FIRST enters the queue)

− 2 pts Submits something other than a pdf or image

− 30 pts Blank/no answer



4.1 Turnaround Time (Q2) — 8 / 8 pts

	− 0 pts	Correct
	− 8 pts	Incorrect
✔	− 0 pts	Correct (8.66 +-.01)
	− 2 pts	Off by 1 (7.66 +-1)
	− 2 pts	Incorrect P0 turnaround time (5)
	− 2 pts	Incorrect P1 turnaround time (9)
	− 2 pts	Incorrect P2 turnaround time (12)
	− 2 pts	Error in averaging
	− 8 pts	Wrong formula / calculated something other than turnaround time
	− 8 pts	Incorrect answer (no work)
	− 8 pts	Blank/no answer

4.2 Waiting Time (Q2) — 8 / 8 pts

	− 8 pts	Incorrect
	− 0 pts	Correct
✔	− 0 pts	Correct (2.66 +- .01)
	− 8 pts	Off by 1 (1.66 +-.01)
	− 2 pts	Incorrect P0 waiting time (0)
	− 2 pts	Incorrect P1 waiting time (3)
	− 2 pts	Incorrect P2 waiting time (5)
	− 2 pts	Error in averaging
	− 8 pts	Wrong formula / calculated something other than waiting time
	− 8 pts	Incorrect answer (no work)
	− 8 pts	Blank/no answer

4.3 Turnaround Time (Q3) — 8 / 8 pts

	− 0 pts	Correct
	− 8 pts	Incorrect
✔	− 0 pts	Correct (8)
	− 2 pts	Off by 1 (7)
	− 2 pts	Incorrect P0 turnaround time (4)
	− 2 pts	Incorrect P1 turnaround time (8)
	− 2 pts	Incorrect P2 turnaround time (12)
	− 2 pts	Error in averaging
	− 8 pts	Wrong formula / calculated something other than turnaround time
	− 8 pts	Incorrect answer (no work)
	− 8 pts	Blank/no answer

4.4 Waiting Time (Q3) — 8 / 8 pts

	− 0 pts	Correct
	− 8 pts	Incorrect
✔	− 0 pts	Correct (3.33 +-.01)
	− 8 pts	Off by 1 (3)
	− 2 pts	Incorrect P0 waiting time (0)
	− 2 pts	Incorrect P1 waiting time (3)
	− 2 pts	Incorrect P2 waiting time (7)
	− 2 pts	Error in averaging
	− 8 pts	Wrong formula / calculated something other than waiting time
	− 8 pts	Incorrect answer (no work)
	− 8 pts	Blank/no answer