MIDWESTERN STATE UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE

CMPS 4103- Introduction to Operating Systems

Fall semester 2021

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Assignment #1 – Introduction - due date 09/23

Problem Consider a computer with a single non hyper threaded processor able to run one single thread at a time. Suppose five programs P0, P1, P2, P3 and P4, consisting of a single thread each, are ready for execution at the same time. P0 requires 3 seconds, P1 needs 7 seconds, P2 uses 5 seconds, P3 uses 10 seconds and P4 will use 12 seconds. Assume that the programs are 100% CPU bound and do not block during execution, being interrupted by the OS every 500 msec.

a) Considering the OS overhead negligible, how long it will take to complete the execution of each of the programs, assuming that P0 will go first and then P1, P2 and so on.

Process	Time
P0	1.3 second
P1	28 seconds
P2	22 seconds
P3	34 seconds
P4	37 seconds

b) Considering a modified OS time slice, interrupting the processor at every 250 ms and assuming the OS usage of the processor is still negligible and the same start of execution sequence is followed, how long it will take to complete the execution of program P2

$90 \times 250 = 22500 \text{ ms} \simeq 22.50$

Solution:

a) P0

		m seconds	÷500 = #slots
P0	3 sec →	3000	6
P1	7 sec →	7000	14
P2	5 sec →	5000	10
P3	10 sec →	10000	20
P4	12 sec →	12000	24

P0	P1	P2	P3	P4	slot#
1	2	3	4	5	#1

26 27 28 29 30 #6 ⇝ 26 × 500 = 1300 ms

P0 ↳ 1.300 seconds

P2

P1	P2	P3	P4	slot#
31	32	33	34	7
35	36	37	38	8
39	40	41	42	9
43	44	45	46	10

44 × 500 = 22000 ms

P2 → 22.00 seconds

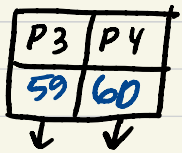
P1

P1	P3	P4	slot#
47	48	49	11
50	51	52	12
53	54	55	13
56	57	58	14

56 × 500 = 28000 ms

P1 → 28 seconds

P3



69 x 500 ≃ 34500 ms

P3 → 34.50

61	62	16
63	64	17
65	66	18
67	68	19
69	70	20

P4

P4	slot#
71	21
72	22
73	23
74	24

74 x 500 ≃ 37000

P4 → 37 seconds

b)

P0	P1	P2	P3	P4	slot#
1	2	3	4	5	1
56	57	58	59	60	12
	P1	P2	P3	P4	
	61	62	63	64	13
	65	66	67	68	14
	69	70	71	72	15
	73	74	75	76	16
	77	78	79	80	17
	81	82	83	84	18
	85	86	87	88	19
	89	90	91	92	20

#

12 ← P0 → 3000

28 ← P1 → 7000

20 ← P2 → 5000

40 ← P3 → 10000

48 ← P4 → 12000

P2 → 90 x 250 = 22500 m

22.5 second