CS471: Operating System Concepts
Fall 2006
(Lecture: TR 11:25-12:40 PM)
Homework #2
Points: 20
Due: September 14, 2006

Question 1 [Points 15] Exercise 5.4 using the following data

Process	Arrival Time	Burst Time	Priority
P1	5	10	3
P2	2	15	4
P3	9	5	5
P4	15	20	1
P5	12	4	2

Solution:

FCFS:

0-2	Idle
2-17	P2
17-27	P1
27-32	P3
32-36	P5
36-56	P4

Waiting time =   Process start time – Arrival time

Turnaround time = Process finish time – Arrival time

Process	Arrival time	Burst time	Priority	Finish time	Waiting time	Turnaround time
P1	5	10	3	27	12	22
P2	2	15	4	17	0	15
P3	9	5	5	32	18	23
P4	15	20	1	56	21	41
P5	12	4	2	36	20	24
Average					14.2	25

Round Robin:

0-2	Idle
2-5	P2
5-6	P1
6-7	P2
7-8	P1
8-9	P2
9-10	P1
10-11	P3
11-12	P2
12-13	P1
13-14	P3
14-15	P5
15-16	P2
16-17	P1
17-18	P3
18-19	P4
19-20	P5
20-21	P2
21-22	P1
22-23	P3
23-24	P4
24-25	P5
25-26	P2
26-27	P1
27-28	**P3 (Finish)**
28-29	P4
29-30	P2
30-31	**P5 (Finish)**
31-32	P1
32-33	P4
33-34	P2
34-35	P1
35-36	P4
36-37	P2
37-38	**P1 (Finish)**
38-39	P4
39-40	P2
40-41	P4
41-42	P2
42-43	P4
43-44	**P2 (Finish)**
44-56	**P4 (Finish)**

Process	Arrival time	Burst time	Priority	Finish time	Waiting time	Turnaround time
P1	5	10	3	38	23	33
P2	2	15	4	44	27	42
P3	9	5	5	28	14	19
P4	15	20	1	56	21	41
P5	12	4	2	31	15	19
Average					20	30.8

SJF (Non-preemptive):

0-2	Idle
2-17	P2
17-21	P5
21-26	P3
26-36	P1
36-56	P4

Process	Arrival time	Burst time	Priority	Finish time	Waiting time	Turnaround time
P1	5	10	3	36	21	31
P2	2	15	4	17	0	15
P3	9	5	5	26	12	17
P4	15	20	1	56	21	41
P5	12	4	2	21	5	9
Average					11.8	22.6

SJF (Preemptive):

0-2	Idle
2-5	P2
5-9	P1
9-12	P3
12-14	P3
14-18	P5
18-24	P1
24-36	P2
36-56	P4

Process	Arrival time	Burst time	Priority	Finish time	Waiting time	Turnaround time
P1	5	10	3	24	9	19
P2	2	15	4	36	19	34
P3	9	5	5	14	0	5
P4	15	20	1	56	21	41
P5	12	4	2	18	2	6
Average					10.2	21

Non-Preemptive Priority:

0-2	Idle
2-17	P2
17-37	P4
37-41	P5
41-51	P1
51-56	P3

Process	Arrival time	Burst time	Priority	Finish time	Waiting time	Turnaround time
P1	5	10	3	51	36	46
P2	2	15	4	17	0	15
P3	9	5	5	56	42	47
P4	15	20	1	37	2	22
P5	12	4	2	41	25	29
Average					21	31.8

b) Turnaround time:

Process	FCFS	SJF(preemptive)	SJF(Non-preemptive)	Non-preemptive priority	Round Robin
P1	22	19	31	46	33
P2	15	34	15	15	42
P3	23	5	17	47	19
P4	41	41	41	22	41
P5	24	6	9	29	19

c) Waiting time:

Process	FCFS	SJF(preemptive)	SJF(Non-preemptive)	Non-preemptive priority	Round Robin
P1	12	9	21	36	23
P2	0	19	0	0	27
P3	18	0	12	42	14
P4	21	21	21	2	21
P5	20	2	5	25	15

d) Average waiting time:

FCFS = 14.2
SJF (preempt) = 10.2
SJF (Non-preempt) = 11.8
Non-preemptive = 21
RR = 20

Of all scheduling algorithms, SJF (preemptive) has the minimum average waiting time.

Question 2 [Points 5] Consider the exponential average formula used to predict the length of the next CPU burst of a process. The initial estimate of the CPU burst time is $\tau 0 = 100$ milliseconds and $\alpha = 0.8$. The following are the actual CPU burst observed. t0=80msec; t1=120msec; t2=60msec. Compute $\tau 1$, $\tau 2$, and $\tau 3$.

Given:

$\alpha = 0.8$
t0=80msec
t1=120msec
t2=60msec
T0 = 100

$T(n+1) = \alpha\ t(n) + (1-\alpha)T(n)$

$T1 = \alpha\ t0 + (1-\alpha)T0$
$= .8*80 + (1-.8)100$
$= 84$

T2 = α t1 + (1-α) T1
= .8*120 + (1-.8)84
= 96+16.8
=112.8

T3 = α t2 + (1-α) T2
= .8*60 + (1-.8)112.8
=48+22.56
=70.56