Homework 12

Problem I

1. Compute the response time and turnaround time when running three jobs of length 200 with the SJF, FIFO and RR (with a time-slice of 1) schedulers.

Tr(FIFO)=Tr(SJF)=(0+200+400)/3=200

Tt(FIFO)=Tt(SJF)=(200+400+600)/3=400

Tr(RR)=(0+1+2)/3=1

Tt(RR)=[(200+199*2)+(200*2+199)+(200*3)]/3 = 599

2. How about with jobs of different lengths: 300, 200, and 100?

Tr(FIFO)=(0+300+500)/3 = 800/3

Tt(FIFO)=(300+500+600)/3=1400/3

Tr(SJF)=(0+100+300)/3=400/3

Tt(SJF)=(100+300+600)/3=1000/3

Tr(RR)=(0+1+2)/3=1

Tt(RR)=[300+(300+200)+600]/3=1400/3

Problem II

1. For what types of workloads and quantum lengths does SJF deliver the same response times as RR?

The longest job comes at last, and quantum lengths larger than runtime of every earlier job.

2. What happens to response time with RR as quantum lengths increase? Given N jobs, what's the worst-case response time?

The response time will increase till quantum lengths is larger than the longest runtime of jobs. The worst-case response time is [0+Runtime1+(Runtime1+Runtime2)+...+(Runtime1+...+RuntimeN-1)]/N=[(N-1)Runtime1+(N-2)Runtime2+...+RuntimeN-1]/N

Problem III

Suppose we use following MLFQ scheduling poclicy.

a) There are 3 priority queues Q0, Q1, Q2. Q0 has the lowest priority, Q2 has the highest priority.
b) FIFO is used in each queue.
c) The time slices are 8ms(Q0), 4ms(Q1), 2ms(Q2).
d) Priority boosting is not supported.
e) Scheduling is carried out only at completion of processes or time slices.

Given the information of jobs in the workload: (NOTE: No I/O issues are involved)

Job	Arrival Time	Runtime
A	0ms	7ms
B	3ms	5ms
C	6ms	13ms
D	12ms	8ms

1.Please draw the table showing the state of MLFQ and processing of CPU.

Following is an example of the first 6ms.

Timeline	0	2	3	6
CPU	A->2	A->6	A->6	B->8
Q2	A(7)		B(5)	B(5)C(13)
Q1		A(5)	A(4)	
Q0				A(1)

Timeline	0	2	3	6	8	10	12	13
CPU	A->2	A->6	A->6	B->8	C->10	B->13	B->13	D->15
Q2	A(7)		B(5)	B(5)C(13)	C(13)		D(8)	D(8)
Q1		A(5)	A(4)		B(3)	B(3)C(11)	B(1)C(11)	C(11)
Q0				A(1)	A(1)	A(1)	A(1)	A(1)

Timeline	15	19	23	24	31	33
CPU	C->19	D->23	A->24	C->31	D->33	
Q2						
Q1	C(11)D(6)	D(6)				
Q0	A(1)	A(1)C(7)	A(1)C(7)D(2)	C(7)D(2)	D(2)	

2. Compute the response time and turnaround time. Is the turnaround time good as expected? If not,try to tell the reason.

Tr = (0+3+2+1)/4=1.5ms

Tt=(24+10+25+21)/4=20ms

No. Long jobs which came early are starved for a long time.

Problem IV

Imagine a system with the following attributes:

a) The system has 1MB of virtual memory

b) The system has 256KB of physical memory

c) The page size is 4KB

d) The TLB is 4-way set associative with 16 total entries

e) The L1 d-cache has 4 sets and 4 bytes in each line

The content of TLB, the first 20 entries of page table, and content of L1 d-cache are given below.

TLB												
Ind	Tag	PPN	Valid	Tag	PPN	Valid	Tag	PPN	Valid	Tag	PPN	Valid
00	03	-	0	09	0D	1	00	-	0	07	02	1
01	03	2D	1	02	-	0	04	-	0	0A	-	0
10	02	-	0	08	-	0	06	-	0	03	-	0
11	07	-	0	04	0D	1	0A	34	1	02	-	0

Page Table											
VPN	PPN	Valid	VPN	PPN	Valid	VPN	PPN	Valid	VPN	PPN	Valid
00	28	1	05	-	0	0A	1C	1	0F	-	0
01	-	0	06	-	0	0B	-	0	10	-	0
02	33	1	07	17	1	0C	-	0	11	3A	1
03	02	1	08	-	0	0D	2D	1	12	22	1
04	-	0	09	02	1	0E	-	0	13	0D	1

L1 d-cache						
Index	Tag	Valid	block0	block1	block2	block3
0	D27	1	0x0A	0x0B	0x0C	0x0D
1	-	0	-	-	-	-
2	1c28	0	0x1A	0x1B	0x1C	0x1D
3	D27	1	0x00	0x01	0x02	0x03

Step through the following address translation and cache accessing. If there is a cache miss, enter "-" for "Cache Byte returned". If there is a page fault, enter "-" for "PPN"&"Physical address" and leave the second table empty.

1. VA: 0x1327c

Parameter	**Value**
VPN	0x13
TLB index	0x3
TLB tag	0x04
TLB hit?(Y/N)	Y
Page fault?(Y/N)	N
PPN	0x0D
Physical Address	0x0D27c

Parameter	**Value**
Byte Offset	0
Cache index	3
Cache tag	0xD27
Cache hit?(Y/N)	Y
Cache Byte returned	0x00

2. VA: 0x0A289

Parameter	**Value**
VPN	0x0A
TLB index	0x2
TLB tag	0x02
TLB hit?(Y/N)	N
Page fault?(Y/N)	Y

PPN	0x1C
Physical Address	0x1C289

Parameter	**Value**
Byte Offset	0x1
Cache index	0x2
Cache tag	0x1c28
Cache hit?(Y/N)	N
Cache Byte returned	-