Vikas Rao
CS-6860 - HW-4

1-
Access order – L1 → L2 → L3 → main memory.
Since data access happens only after the tag hit occurs in case of serial tags, we need to consider the data penalty only for hits. But for a miss, the data penalty can be ignored.
For a single load instruction, the memory access time for the given structure is -
.5*1 + .5*(.55*(1+3+18) + .45*(.75*(1+3+25+85) + .25*(1+3+25+440))) = 52.16875
For 2000 load instructions the total number of cycles = 2000*52.16875 = 104337.5 cycles

2-
AMAT = $t_h + r_m * t_p$
AMAT = 5 + 0.2*150 = 35

3-
address bits (memory) = 8gb = 2^{33} B = 33

For L1 cache:
byte offset = 16B = 2^4 B = 4
index bits = $32*2^{10}/2^4 = 2^{11}$ B = 11
tag bits = 33-4-11 = 18
tag array = $(18*2^{11})/2^{13}$ = 18/4 KB = 4.5 KB
data array = 32 KB

For L2 Cache:
byte offset = 64B = 2^6 B = 6
index bits = $2^{20}/4*2^6 = 2^{12}$ B = 12
tag bits = 33-6-12 = 15
tag array = $(15*4*2^{12})/2^{13}$ = 30 KB
data array = 1MB

Vikas Rao
CS-6860 - HW-4

4-

a- first pattern

sequence	IDEAL					LRU					MRU				
	hit(0)/miss(1)	set1		set2		hit(0)/miss(1)	set1		set2		hit(0)/miss(1)	set1		set2	
C	1	C				1	C				1	C			
A	1	C	A			1	C	A			1	C	A		
B	1	C	B			1	B	A			1	C	B		
D	1	C	B	D		1	B	A	D		1	C	B	D	
B	0	C	B	D		0	B	A	D		0	C	B	D	
F	1	C	B	D	F	1	B	A	D	F	1	C	B	D	F
C	0	C	B	D	F	1	B	C	D	F	0	C	B	D	F
E	1	C	B	D	E	1	B	C	E	F	1	C	B	D	E
A	1	A	B	D	E	1	A	C	E	F	1	A	B	D	E
D	0	A	B	D	E	1	A	C	E	D	0	A	B	D	E
B	0	A	B	D	E	1	A	B	E	D	0	A	B	D	E
F	1	A	B	F	E	1	A	B	F	D	1	A	B	F	E
A	0	A	B	F	E	0	A	B	F	D	0	A	B	F	E
B	0	A	B	F	E	0	A	B	F	D	0	A	B	F	E
C	1	C	B	F	E	1	C	B	F	D	1	A	C	F	E
E	0	C	B	F	E	1	C	B	F	E	0	A	C	F	E
B	0	C	B	F	E	0	C	B	F	E	1	A	B	F	E
A	1	A	B	F	E	1	A	B	F	E	0	A	B	F	E
F	0	A	B	F	E	0	A	B	F	E	0	A	B	F	E
D	1	A	B	D	E	1	A	B	F	D	1	A	B	D	E
	11/20 = .55					15/20=7.5					11/20 = .55				
	55.00%					75.00%					55.00%				

b- second pattern

sequence	IDEAL					LRU					MRU				
	hit(0)/miss(1)	set1		set2		hit(0)/miss(1)	set1		set2		hit(0)/miss(1)	set1		set2	
D	1			D		1			D		1			D	
F	1			D	F	1			D	F	1			D	F
C	1	C		D	F	1	C		D	F	1	C		D	F
B	1	C	B	D	F	1	C	B	D	F	1	C	B	D	F
A	1	C	A	D	F	1	A	B	D	F	1	C	A	D	F
A	0	C	A	D	F	0	A	B	D	F	0	C	A	D	F
F	0	C	A	D	F	0	A	B	D	F	0	C	A	D	F
C	0	C	A	D	F	1	A	C	D	F	0	C	A	D	F
D	0	C	A	D	F	0	A	C	D	F	0	C	A	D	F
D	0	C	A	D	F	0	A	C	D	F	0	C	A	D	F
A	0	C	A	D	F	0	A	C	D	F	0	C	A	D	F
B	1	B	A	D	F	1	A	B	D	F	1	C	B	D	F
A	0	B	A	D	F	0	A	B	D	F	1	C	A	D	F
B	0	B	A	D	F	0	A	B	D	F	1	C	B	D	F
C	1	B	C	D	F	1	C	B	D	F	0	C	B	D	F
E	1	B	C	D	E	1	C	B	D	E	1	C	B	E	F
B	0	B	C	D	E	0	C	B	D	E	0	C	B	E	F
A	1	B	A	D	E	1	A	B	D	E	1	C	A	E	F
B	0	B	A	D	E	0	A	B	D	E	1	C	B	E	F
D	0	B	A	D	E	0	A	B	D	E	1	C	B	D	F
	9/20=.45					10/20=0.5					12/20=0.6				
	45.00%					50.00%					60.00%				