

CHAPTER 8

Problem 8.1

Let H be the hit rate of the L2 cache and A be the accuracy of the L2-cache hit/miss predictor. The following table gives the penalty associated with the four scenarios.

Table 67: Penalties

Hit/Miss	Prediction	Outcome	Fraction	Penalty
Hit	Hit	Success	$H \cdot A$	0
Hit	Miss	Failure	$H \cdot (1-A)$	120
Miss	Hit	Failure	$(1-H) \cdot (1-A)$	60
Miss	Miss	Success	$(1-H) \cdot A$	20

Therefore the total penalty with the added predictor is:

$$H \cdot (1-A) \cdot 120 + (1-H) \cdot (1-A) \cdot 60 + (1-H) \cdot A \cdot 20$$

The penalty without any predictor is: $(1-H) \cdot 60$.

The predictor is beneficial if $(1-H) \cdot 60 > H \cdot (1-A) \cdot 120 + (1-H) \cdot (1-A) \cdot 60 + (1-H) \cdot A \cdot 20$

$$\text{or } 60 - 60H > 60H - 40A - 80H \cdot A + 60$$

$$\text{or } A > 3H / (2 \cdot H + 1)$$

If $H=0.50$ the predictor is beneficial if A is at least 75%.

If $H=0.80$ the predictor is beneficial if A is at least 92.3%.

Problem 8.2

Execution schedule for block (coarse grain) multithreading:

Table 68: Block multithreading

Instruction (latency)	Dispatch (issue Q)	Issue	Register fetch	Exec start	Exec complete	CDB	Retire (T1)	Retire (T2)
X1(2)	1(1)	2	3	4	5	6	7	
X2(2)	1(2)	4	5	6	7	8	9	
X3(4)	2(3)	4	5	6	9	10	11	
X4(2)	2(4)	8	9	10	11	12	13	
X5(1,20)	9(3)	10	11	12	12	13	14	
X6(1)	9(4)	11	12	13	13	14	15	
Y1(2)	15(1)	16	17	18	19	20		21
Y2(3)	15(2)	18	19	20	22	23		24
Y3(2)	16(3)	21	22	23	24	25		26
Y4(2)	16(4)	23	24	25	26	27		28
Y5(3)	24(3)	25	26	27	29	30		31
Y6(1)	24(4)	28	29	30	30	31		32