Mark Mocek

1.9, 1.9.1, 1.9.3 (pg 56)

1.11, 1.11.1, 1.11.3, 1.11.5 (pg 57)

<u>1.9</u>

Assume for arithmetic, load/store, and branch instructions, a processor has CPIs of 1, 12, and 5, respectively. Also assume that on a single processor a program requires the execution of 2.56E9 arithmetic instructions, 1.28E9 load/store instructions, and 256 million branch instructions. Assume that each processor has a 2GHz clock frequency.
Assume that, as the program is parallelized to run over multiple cores, the number of arithmetic and load/store instructions per processor is divided by 0.7 x p (where p is the number of processors) but the number of branch instructions per processor remains the same.

<u>1.9.1</u>

Find the total execution time for this program on 1, 2, 4, and 8 processors, and show the relative speedup of the 2, 4, and 8 processor result relative to the single processor result.

CPIs	Arithmetic = 1	Load/Store = 12	Branch = 5	
1 proc	Arith 1.28e9	L/S 1.28e9	Brch 2.56e8	2GHz

Proc 1 CPU time = (1.28e9*1)+(12*1.28e9)+(5*2.56e8)/2,000,000,000 = 8.9675
Proc 2 CPU time = (1.28e9*1)+(12*1.28e9)+(5*2.56e8)/(2,000,000,000*2) = 4.48375
Proc 4 CPU time = (1.28e9*1)+(12*1.28e9)+(5*2.56e8)/(2,000,000,000*4) = 2.24188
Proc 8 CPU time = (1.28e9*1)+(12*1.28e9)+(5*2.56e8)/(2,000,000,000*8) = 1.12094

<u>1.9.3</u>

To what should the CPI of load/store instructions be reduced in order for a single processor to match the performance of four processors using the original CPI values?

CPI of load/store 3 in order to achieve same time as Proc.

<u>1.11</u>

The results of the SPEC CPU2006 bzip2 benchmark running on an AMD Barcelona has an instruction count of 2.389E12, an execution time of 750 s, and a reference time of 9650 s.

<u>1.11.1</u>

Find the CPI if the clock cycle time is 0.333 ns.

<u>1.11.3</u>

Find the increase in CPU time if the number of instructions of the benchmark is increased by 10% without affecting the CPI.

1.11.5

Find the change in the SPECratio for this change.