CPRE 381- Intro to Computer Organization & Implementation

HW1

Due Date: Jan 27, 2017

1. Consider a processor running at 1GHz with the following CPI values:

ALU: 1.1; Memory: 1.3; Control: 1.5

Given a program with a loop with a loop body of 100 instructions iterated 1000 times, and the following instruction mix for the program (ALU- 30%; Memory- 35%; Control- 35%), what is the execution time of this program on this processor? [10 points]

2. The compiler found a magical way of transforming 15% of the control instructions into an equal number of memory instructions and ALU instructions equal to 20% of extra memory instructions. For every N control instructions eliminated (which is 15% of all control instructions), N memory instructions and 0.2\*N ALU instructions are introduced. What is the new execution time of the program in Problem 1 with this new transformation? [10 points]

3. Now let us consider an improved transformation. Compiler can convert a control instruction into corresponding 1.05 memory instructions (Some N control instructions get converted into 1.05\*N memory instructions). What fraction of the execution time of Program on Machine in Problem 1 can be enhanced with this transformation? What is the speed-up of this transformation? What is the asymptotic speed-up due to this transformation according to Amdahl’s law? [10 points]