ECE 201 Spring 2022 - Homework 1

Assigned by Prof. Xiaochen Guo

Due Feb. 3rd, 2022 23:59pm

Please type/write your answers on a single document and submit through coursesite

1. (10 pts) Including the authors, how many Turing Laureates were mentioned in the 2019 Turing lecture article? Use your own words to describe the contributions each of them made that were recognized by the Turing award. It is encouraged to search for additional references to answer this question. Please cite those references properly.

2. (20 pts) CPI (Question 1.6 on textbook, note there are three sub questions)

1.6 [20] <§1.6> Consider two different implementations of the same instruction set architecture. The instructions can be divided into four classes according to their CPI (classes A, B, C, and D). P1 with a clock rate of 2.5 GHz and CPIs of 1, 2, 3, and 3, and P2 with a clock rate of 3 GHz and CPIs of 2, 2, 2, and 2.

Given a program with a dynamic instruction count of 1.0E6 instructions divided into classes as follows: 10% class A, 20% class B, 50% class C, and 20% class D, which is faster: P1 or P2?

a. What is the global CPI for each implementation?

b. Find the clock cycles required in both cases.

3. (20 pts) Performance improvement (Question 1.14 on textbook)

1.14 Assume a program requires the execution of 50×10^6 FP instructions, 110×10^6 INT instructions, 80×10^6 L/S instructions, and 16×10^6 branch instructions. The CPI for each type of instruction is 1, 1, 4, and 2, respectively. Assume that the processor has a 2 GHz clock rate.

1.14.1 [10] <§1.10> By how much must we improve the CPI of FP instructions if we want the program to run two times faster?

1.14.2 [10] <§1.10> By how much must we improve the CPI of L/S instructions if we want the program to run two times faster?

1.14.3 [5] <§1.10> By how much is the execution time of the program improved if the CPI of INT and FP instructions is reduced by 40% and the CPI of L/S and Branch is reduced by 30%?