**CS3853: Computer Architecture**

**Prof. Vijayalakshmi Saravanan**

**Assignment 2**

**FALL 2017**

**Total Marks: 36**

Name:

Banner Id:

1. (a) [2 pt] If system A has a speed up of n over system B, what is the performance improvement of A in terms of percentage?

(b) [2 pt] If system A performs n% better than system B, what is the speed up of system A over system B?

2. An application spends 25% of its time in computation that is inherently serial, and the rest can be run in parallel. Assume an ideal speed up for the parallel section

(a) [4 pt] How much faster will this application run on 50 processors?

(b) [4 pt] How about 500 processors?

(c) [4 pt] What is the maximum speed up possible by means of multiple processors?

3. We are examining improving an existing architecture by adding an external cache and a faster disk. For the target application, it is predicted the cache will cause loads to complete twice as fast, while the new disk causes the average I/O request to experience a speedup of 1.5. The present system spends 25% of its time doing loads, and 40% of its time doing I/O.

(a) [4 pt] What speedup will we expect from adding both enhancements at the same time?

(b) [4 pt] If we want to make the application get the same speedup while improving only the disk, how much speedup will the disk need to provide?

4. Table 1 gives the frequency and CPI of different type of instructions for a particular machine.

|  |  |  |
| --- | --- | --- |
| Instruction Type | Frequency | Average CPI |
| ALU Operations | 63% | 1 |
| Loads | 15% | 1.5 |
| Stores | 13% | 1.5 |
| Branches | 9% | 4 |

Table 1: Information about different instruction type

(a) [4 pt] What is the overall CPI of this machine?

(b) [4 pt] A student designs a new instruction that combines a load with an ALU operation. If 40% of the original loads can be replaced with this new instruction, what would be the new frequency of different type of instructions?

(c) [4 pt] If the CPI of the new instruction is 2.5, what is the overall CPI?