CSE P548: Computer Architecture
Assignment 1
Due: Tuesday, April 8

This assignment is a low-overhead way to teach you how changes to the instruction set architecture can effect the size and performance of an executable. The assignment consists of a few problems from our text book and the one problem written below.

From the text:

- 2.5 For this problem instructions that are transfers of control but do not have an offset should be counted in a new miscellaneous category of ALU operations. Calls will be considered to use offsets, although in practice many calls are indirect jumps.
  As the text says, ALU instructions are 16 bits. Instructions with 8 bit offsets are 24 bits and those with 16 bit offsets are 32 bits.

- 2.6

- 2.11

- 2.22 Do this problem only if we can find machines with different architectures for you. Let us know what architectures you have available to you.

- 2.26 The processor the text talks about is undoubtedly the Transmeta Crusoe.

Suppose you had one opcode left and you wanted to add one more instruction to the MIPS ISA.

a) Which of the following 3 instructions could be encoded using one of the current MIPS instruction formats (which you will find in your lecture slides)? Assume that `address` and `immed` are 16-bit integers. Justify your choice by showing how the instruction is encoded. For the two you eliminate, say why they could not use any of the current MIPS formats.

```
addw    $rt, address($rs)          # rt = rt + Mem[rs+address]

add2w   $rd, $rt, address($rs)   # rd = rt + Mem[rs+address]

addiw   $rd, immed, address($rs) # rd =immed+Mem[rs+address]
```

b) [2 points] Assuming that you now include the instruction that can be encoded in one of the MIPS formats, can you still say that the MIPS ISA is a RISC machine? Justify your answer.