# ECE 429 / 629 Homework #3

1. Classify the instructions listed in Fig. 2.32 on p. 138 into the following categories: ALU instructions, memory loads/stores, conditional branches, and unconditional jumps. Be careful to think through the meaning of each instruction, because some instructions have potentially misleading names (e.g., load immediate, conditional move). Now suppose we have the following measurements of average CPI for the instruction categories:

| instruction type | clock cycles |
|---|---|
| ALU | 1.0 |
| memory load/store | 1.4 |
| conditional branch | |
| taken | 2.0 |
| not taken | 1.5 |
| unconditional jump | 1.2 |

   Suppose that 60% of the conditional branches are taken. Using the gcc instruction mix in Fig. 2.32, compute the effective CPI.

2. Translate the following C code to MIPS assembly language and machine code:

```
while (i != j) {
    j = j+i;
    i++;
}
```

   Assume R6 contains `i` and R7 contains `j`. Make the loop as tight as possible.

Text: Hennessy and Patterson, *Computer Architecture: A Quantitative Approach*, 3rd edition, Morgan Kaufmann, 2003. (Problem #1 adapted from 2.11 of the text.)