E85: Digital Design and Computer Architecture

Problem Set 8

1) Assembly Language Programming

Translate the following code snippet into ARM assembly language.

```
unsigned int a[10]; // assume base address of a is in R4
unsigned int tmp; // assume tmp is in R5
int i, j; // assume i and j are in R6 and R7, respectively

for (i=1; i<10; i++)
      for (j=0; j<i; j++)
            if (a[i] > a[j]) {
                  tmp = a[i];
                  a[i] = a[j];
                  a[j] = tmp;
            }
```

2) Writing a Function in Assembly Language

Do Exercise 6.25(a) from the textbook.

3) Assembly Language to Machine Language

Translate the following assembly language code to ARM machine language:

```
Loop
        CMP R1, R2
        BEQ Done
        ADD R1, R1, #1
        B Loop
Done
```

4) Machine Language to Assembly Language

Translate the following machine language code to ARM assembly language:

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B381302A

5) Impact on Society: ARM typically collects a royalty of 1-2% of the selling price of a chip that includes one or more ARM processors. Suppose you design your own ARM-compatible processor from scratch and put it on a chip that you sell. Can ARM demand royalties? If so, on what grounds would their demand be enforceable in court?

How long did you spend on this problem set? This will not count toward your grade but will help calibrate the workload.