E85: Digital Design and Computer Engineering
Problem Set 8

1) Assembly Language Programming

Translate the following code snippet into RISC-V assembly language.

```
unsigned int a[10]; // assume base address of a is in t0
unsigned int tmp; // assume tmp is in t1
int i, j; // assume i and j are in t2 and t3, 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
The high-level function `strcpy` copies the character string `src` to the character string `dst`.

```
// C Code
void strcpy(char dst[], char src[]){
  int i = 0;
  do {
    dst[i] = src[i];
  } while (src[i++]);
}
```

Implement the `strcpy` function in RISC-V assembly code. Assume the base address of `dst` is stored in `s0` and the base address of `src` is stored in `s1`. Use `s2` for `i`.

3) Assembly Language to Machine Language
Translate the following assembly language code to RISC-V machine language:

```
loop:
     beq s0, s1, done
     addi t0, t0, 1
     j loop
done:
```

4) Machine Language to Assembly Language
Translate the following machine language code to RISC-V assembly language:

```
0x08042283
0x02A2E313
```

5) Impact on Society: Research and write a paragraph biography about a person who contributed to the development of digital technology. What made her/his achievements notable at the time? In what ways did the person's work lead to positive or negative societal change?

6) AI Question (Optional)
This question must be solved by AI. Report what the AI produces, whether you believe it is accurate or a hallucination, and whether the solution is similar, better, or worse than what you would have done yourself in a reasonable amount of time.

Write a C `strlen` function that returns the length of a string. Show the corresponding assembly language code.

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