

CPSC 260 - Homework 5
(100 points)

Do the following problems and submit all your code files, as well as your written answers in a single pdf on the github repo.

1. Do Practice Problem 3.1 from the textbook and write down your answers. (10 points)
2. Do Practice Problem 3.2 from the textbook and write down your answers. (10 points)
3. Do Problem 3.58 in the textbook. (Note: the best way to test to make sure your translation is correct is to write both programs and compare the results). (10 points)
4. Translate the following C code into assembly. You should not perform any “optimizations” – i.e. you should do a straight translation to assembly based on the C statements without making any inferences about what the code is trying to accomplish. Determine which registers will be used to store which variables and provide this information in your code as comments. Demonstrate that your assembly program compiles and works correctly (via gdb). (20 points)

```
/* gallons in a rectangular tank with dimensions in inches */
int length = 24;
int height = 16;
int width = 12;
int gallons = (length * width * height) / 231;
/* horsepower generated */
int rpm = 5000;
int horsepower = 15 - (((rpm - 2000) * (rpm - 2000)) / 150000);
/* miles per hour from meters and seconds */
int meters = 5000;
int seconds = 960;
int mph = (3600 * meters) / (1609 * seconds);
/* mod 3 */
int x = ((17 * 23) / 3) % 3;
```

5. Write and run the “Hello World” program from the lecture notes for doing simple string manipulation that replaces both the “H” with a lowercase “h”, and the “e” with an uppercase “E”. Show that you were able to compile and run the program. (10 points)

6. Write and run an assembly program that starts with the string "Go Zags\n" and manipulates the string using assembly instructions to consist of all capital letters, and outputs the result (i.e., outputs "GO ZAGS\n"). (10 points)
7. State how you would change your program above (to print "GO ZAGS\n") so that it uses the lea (load effective address) instruction. The textbook describes the lea instruction starting on page 191, and in section 3. You should try to rewrite your program to test your answer, but you don't need to include the code you develop for this question with your assignment. (10 points)
8. Write a program that starts with the string "Hello World!\n" in memory, swaps the word "Hello" with "World" and prints the result (i.e., "World Hello!\n"). To implement your program, you must do five character swaps. Each character swap (which will involve multiple instructions) should be carried out using mov instructions with indirect addressing (i.e., of the form (%rax) and Imm(%rax), as described in Figure 3.3). (20 points)