CS220 Sample Exam 1

The only outside materials you may use on this exam is the MIPS green card and a calculator. You must show work or explain your answer to receive credit. Some correct answers are better than other correct answers and will receive full credit.

1. [5 points] What is the decimal value of the unsigned hexadecimal number **A7**?

2. [5 points] Write the decimal number -108 as an 8-bit two's complement binary number.

3. [5 points] Why does the MIPS multiply instruction use two registers, **HI** and **LO**, for the result?

4. [5 points] What decimal number does the 16-bit two's complement number 1111111111111001 represent?

5. [5 points] Assume signed integers are 8 bits and two's complement. What is the range of decimal values that can be represented?

6. [5 points] How many bits are required to represent a register number is a MIPS instruction?

7. [20 points] Write a MIPS assembly language program that reads an integer from the user, counts the number of times that integer can be divided by 2 before reaching zero and prints the count to the console. Your program should use prompts for input and output.

8. [20 points] Consider the definition of **list** below that contains eight numbers.

```
    .data
list: .word 43, 22, 77, 96, 20, -15, 0, 10
```

Write a MIPS program that writes the list in reverse order to the console (10, 0, -15, etc.) Your program should be general and work if I modify the list of numbers.

9. [10 points] Suppose processor $\mathbf{P_1}$ has a cycle time of 1 nanosecond and processor $\mathbf{P_2}$ has a cycle time of 0.5 nanoseconds. Furthermore $\mathbf{P_1}$ has a CPI of 2.5 for a program and $\mathbf{P_2}$ has a CPI of 5 for the same program. Which machine is faster for the program and by what factor?

10. [10 points] Assume that the execution time of a program **p** on a processor is 200 seconds. Also assume that **p** spends 20% of the execution time doing floating-point multiplications. What would the execution time be if we quadrupled (four times) the performance of floating-point multiplication? What is the overall performance improvement of **p** running on the modified processor?

11. [5 points] If the clock cycle time for a processor is 2×10^{-9} seconds what is the clock rate?