1. (10 points) Data Conversion Practice:
   a. Convert 16384 base 10 to a 16-bit two’s complement binary number.
   b. Convert -1023 base 10 to a 16-bit two’s complement binary number.
   c. Convert -32000 base 10 to a 16-bit two’s complement binary number.
   d. Convert 1111111111111111 two’s complement base 2 to a decimal number.
   e. Convert 01111111111101111 two’s complement base 2 to a decimal number.

2. (10 points) Problem 3.9

3. (10 points) Problem 3.12

4. (10 points) Problem 3.14

5. (20 points)
   (a) Find the shortest sequence of MIPS instructions to determine if there is a carry out from addition of two registers say $t3 and $t4. Place a 0 or 1 in register $t2 if the carry out is 0 or 1, respectively.

   (b) Find the shortest sequence of MIPS instructions to perform double precision integer addition. Assume that one 64-bit two’s complement number is stored in registers $t4 and $t5 and the other one is stored in register $t6 and $t7. The sum is placed in register $t2 and $t3. Even number registers store most significant parts.

6. (20 points) Hamming distance is a metric used to indicate how different two binary values are. Hamming distance is the number of bits that differ between two values. Consider 1101 and 1011. The Hamming distance is 2 because the two middle bits differ between the two values. The Hamming distance between 0001 and 0000 is 1 because the last bit differs between the two values. Write a MIPS routine to compute the Hamming distance between two 32-bit values. Your routine should use only a single jump or branch instruction. Run your routine in SPIM and test with the decimal values 16299 and -3.

7. (20 points) Perform the following operations by hand showing all work for X = 0001 1010 and Y = 1111 1100. Use tabular format for part c and part d.
   a. X + Y
   b. X – Y
   c. X * Y
   d. X / Y