CS3650 Homework #2 (20 points)

1. (3 points) Currently computers are designed based on stored program concept.

    a. What is the stored program concept?
    b. List the main steps of instruction execution of the stored-program-concept based computers.

2. (4 points) Please answer the following questions in terms of **MIPS** Architecture and **MIPS** instruction set.

    a. How many general purpose registers are available? How many bits are there for the content of each register? How many bits are needed to address each register?

    b. How many bits are used for memory addresses? Is the memory byte-addressed or word-addressed? What's the largest memory size (in terms of MByte or GByte) that we can address directly?

    c. If 6 bits are used for the opcode field, how many different operations can be represented? How does MIPS instruction set provide extra operations beyond that can be represented by the 6-bit opcode?

3. (4 points) Please convert the following instructions to the binary format:

      or $R12, $R15, $R16
      sw $R2, 0xA012($R20)

4. (4 points) Please convert the following bit pattern to a MIPS instruction.
      0000 0001 0110 0110 0100 1000 0010 0000
      1000 1101 1001 1010 0000 0000 0001 1100

5. (4 points) Decode the following MIPS instruction (in hex representation)
      0x360B0019

    a. What type/format of instruction is it?
    b. What addressing mode is being used?
    c. Write the answer as a complete MIPS Assembly Instruction

6. (1 point) MIPS has memory alignment restriction. If we'd store a 32-bit integer (i.e. 4 bytes) in memory locations and the current memory status as follows (shaded ones indicating memory occupied) how many different ways/locations you could store that integer. Note: the memory is byte addressed.

Mem addr	Mem content
0000	
0001	▓▓▓▓
0010	
0011	
0100	
0101	
0110	▓▓▓▓
0111	▓▓▓▓
1000	
1001	
1010	
1011	
1100	
1101	
1110	▓▓▓▓
1111	