**Tutorial 7:** WRES1201 – Computer System Architecture

1. What are the typical elements of a machine instruction?
2. What type of locations can hold source and destination operands?
3. If the instruction contains four addresses, what might be the purpose of each address?
4. List and briefly explain five important instruction set design issues?
5. What is the difference between an arithmetic shift and logical shift?
6. Why are transfer of control instruction needed?
7. List all the instruction to perform X = (A + B × C)/(D – E × F) for each following machine:
   1. One-Address Machine
   2. Two-Addresses Machine
   3. Three-Addresses Machine

Instructions that can be use are:

|  |  |  |
| --- | --- | --- |
| One-Address | Two-Address | Three-Address |
| LOAD M  STORE M  ADD M  SUB M  MUL M  DIV M | MOVE (X ← Y)  ADD (X ← X + Y) SUB (X ← X - Y) MUL (X ← X × Y) DIV (X ← X / Y) | MOVE (X ← Y)  ADD (X ← X + Z) SUB (X ← X - Z) MUL (X ← X × Z) DIV (X ← X / Z) |

Assume that T1, T2, T3 and etc are temporary storage, and for 2 and 3 addresses machine, we have register R1, R2, R3, …… as temporary storage.

1. Given the original bit = 10101110. Find the bit after the following shifting.
   1. Logical right shift (4 bits)
   2. Logical left shift (4 bits)
   3. Arithmetic right shift (4 bits)
   4. Arithmetic left shift (4 bits)
   5. Right rotate (4 bits)
   6. Left rotate (4 bits)