

EC-340 Computer Architecture Quiz # 1 (Solution)

Q - 1 Answer the following questions.

a) Consider the ALU, as shown in Fig. 1, is the 1-bit 'slice' and in Fig. 2 is of how 4 slices can be combined into a 4-bit ALU.

The 4-bit ALU is capable of executing three types of instructions which can be selected using the following OpCode [S_1, S_0]; 00—AND, 01—OR, 10—ADD/SUB, 11—LOAD.

1. Is it possible to perform all the functions mentioned in part (b) by using existing select lines (2-bit OpCode)? Explain your answer, if Yes or No.

Sol: Yes, by using a multiplexer the existing Opcodes are enough to execute each function listed in table.

2. Due to design limitations, for each of the following operations give the required inputs (0 or 1) using 2-bit OpCode.

| Function | OpCode | | ENA | ENB | C_{in} |
|----------|--------|-------|-----|-----|----------|
| | S_1 | S_0 | | | |
| AND | 0 | 0 | 1 | 1 | 0 |
| OR | 0 | 1 | 1 | 1 | 0 |
| A+B | 1 | 0 | 1 | 1 | 0 |
| A-B | 1 | 0 | 1 | 1 | 1 |
| B | 1 | 0 | 0 | 1 | |
| A+1 | 1 | 0 | 1 | 0 | 1 |

Sol:

3. Identify the Control and Status signals, if any, which are present in 4-bit ALU design.

Control Signals— ENA, ENB, C_{in} , Add/Sub, OpCode
 Status Signals— No status signal present [Result is output, not status signal]

b)

- 1.** The size (or capacity) of a memory unit can be expressed in words, bytes, or bits. Express the size (capacity) of the $2^6 \times 8$ main memory in all three of them: words, bytes, and bits.
- 2.** Identify the starting and ending addresses of such memory unit.

Sol: 64 words,
 64 bytes,
 512 bits

Starting address = 0H and Ending address = 3FH

c) If a computer uses signed-2's complement representation and 8 bit registers, what range of integers can this computer represent?

Sol:

For signed 2's complement numbers, the general formula is: $-2^{n-1} \rightarrow 2^{n-1} - 1$
 -128 to 127

d) Apply 20-bit computer arithmetic to the following numbers (represented in hexadecimal).

Sol:

F000F
 + 30002

 12001

The final result will be 20011H with CF=1.

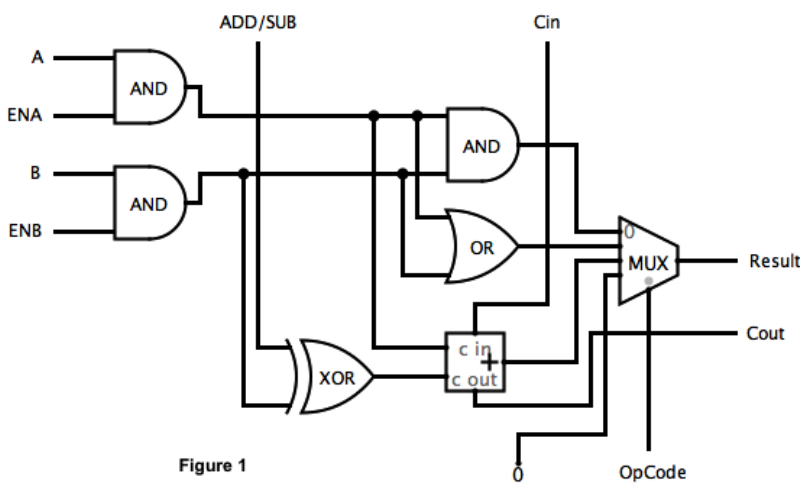


Figure 1

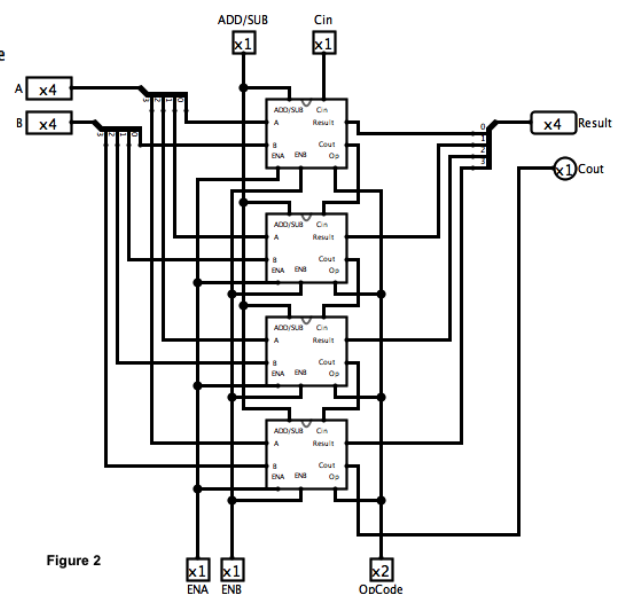


Figure 2