University	: Menoufia		Date	: 20/6/2019
Faculty	: Electronic Engineering.		Time	: 3 Hours
Department	: Computer Science & Eng.		No. of pages	: 1
Academic level	: 1st Year, 2nd Term		Full Mark	: 70 Marks
Course Name	: "Computer Organization".		Exam	: Final Exam
Course Code	: CSE 126		Examiner	: Dr. A. SHOUMAN

Answer all the following questions:

First Question   (20 Marks)

a) Draw the 4-bit Bus system for four registers using multiplexers.

b) Explain and Draw the operation of the 4-bit Binary Adder-Subtractor.

c) If you have 4-bit adder-subtractor circuit has the following values for input mode M and data inputs A and B. In each case, determine the values of the outputs: $S_0, S_1, S_2, S_3,$ and C_4.

	M	A	B
1.	1	0101	1010
2.	1	1100	1000
3.	1	0111	0110
4.	0	1000	1001
5.	0	0000	0001

Second Question   (19 Marks)

a) Draw the Flowchart for program interrupt cycle.

b) Draw the Block diagram of Control unit of basic computer.

c) The content of PC (program counter) in the basic computer is 3AF (all numbers are in hexadecimal). The content of AC is 8EC3. The content of memory at address 3AF is 132E. The content of memory at address 32E is 08 AC. The content of memory at address 9AC is 7EC3.

   1. What is the instruction that will be fetched and executed next?
   2. Show the binary operation that will be performed in the AC when the instruction is executed.
   3. Give the contents of registers PC, AR, DR, AC, and IR in hexadecimal and the values of I, and the sequence counter SC in binary at the end of the instruction cycle.

Third Question   (20 Marks)

a) Convert the following arithmetic expressions from infix to reverse Polish notation:

   1. $A * B + C * D + E * F$
   2. $A * B + A * (B * D + C * E)$
   3. $A + B * [C * D + E * (F + G)]$
   4. $\dfrac{A * [B + C * (D + E)]}{F * (G + H)}$

b) How many times does the control unit refer to memory when it fetches and executes an indirect addressing mode instruction (Assuming one word per instruction or operand) if the instruction is:
   1. A computational type requiring an operand from memory.   2. A branch type.

c) A two-word instruction is stored in memory at an address designated by the symbol W. The address field of the instruction (stored at W + 1) is designated by the symbol Y. The operand used during the execution of the instruction is stored at an address symbolized by Z. An index register contains the value X. State how Z is calculated from the other addresses if the addressing mode of the instruction is:
   1. direct.   2. Indirect.   3. Relative.   4. Indexed.

Fourth Question   (11 Marks)

a) Write a program to evaluate the arithmetic statement: X = (A - B) * (C - D).
   1. Using a general register computer with three address instructions.
   2. Using a general register computer with two address instructions.
   3. Using an accumulator type computer with one-address instructions.
   4. Using a stack-organized computer with zero-address operation instructions

b) Given the 16-bit value 1001101011001101. What operation must be performed in order to:
   1- Clear to 0 the first four bits?   2- Set to 1 the last four bits?   3- Complement the first eight bits?

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