ItI1100

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Question 1: (10 + 10 = 20 points)

(a) Perform the following arithmetic operations using non signed numbers representation.

1- $(1001.01)_2 - (10101.10)_2$ (show the carry after each addition of two digits)

2- $(10100.011)_2 + (11001)_2$ (show the carry after addition of each two digits)

(b) Convert $A = (15.5)_{10}$ and $B = (16.45)_{10}$ into binary format employing 6 bits for the integer part and 2 for the fractional part, including the sign bit. Perform the following operations using the signed 1's complement representation.

(i) $C = A + B$

(ii) $D = -A + B$

Question 2: (10 + 10 +10 = 30 points)

Given the following Boolean function together with the "*don't care*" conditions X:

$F(a,b,c,d) = \Sigma m(2,3,4,6,9, 11,12)$ and $X (a,b,c,d) = \Sigma m(0,1,14,15)$
$G(a,b,c,d) = \Sigma m(2,6,10,11,12)$ and $X (a,b,c,d) = \Sigma m(0,1,14,15)$

i. Find the minimal Sum-of- products expressions of the given functions using K-map.
ii. Implement your minimized functions with NAND gates only and draw the logic diagram of your circuit.
iii. Use a multiplexer to implement G (assume that any type of gates with any number of inputs are available)

Question 3: (15 points)
Design a ripple (asynchronous) counter with JK flip flops that having to count sequences from 0000 (zero) to 1001 (9) and draw the corresponding logic circuit.
(i) Build the state table for the counter the first 8 clock pulse
(ii) Draw the logic circuit
(iii) What is the Modulus of the counter?