

Homework #1 (Covers Unit-1, Unit-2 and Unit-3)

CDA Computer Logic Design

Total Points: 100

Notes:

- 1. All homework should be done and submitted individually**
- 2. Show all steps for each question to get full points (Use extra pages if required)**
- 3. Submit electronically in canvas as a single pdf file**
- 4. Follow instructions for each question**
- 5. A' is the complement of A**

Q1. Write True or False after each question. Subscript defines the base format. (8*3 = 24 points)

(a) Addition in binary: $(100010)_2 + (111000)_2 + (001101)_2 = (1100111)_2$

Answer:

(b) Subtraction in octal: $(7305)_8 - (5274)_8 = (2011)_8$

Answer:

(c) Division of $(110011)_2$ by $(1100)_2$ produces remainder $(10)_2$

Answer:

(d) Multiplication in hexadecimal: $(5E2)_{16} \times (F04)_{16} = (585588)_{16}$

Answer:

(e) Conversion: $(1011.101)_2 = (11.5)_8$

Answer:

(f) Conversion: $(1011.1101)_2 = (C.B)_{16}$

Answer:

(g) Conversion: $(5752.777)_8 = (BEA.1FF)_{16}$

Answer:

(h) DeMorgan's law is limited to 2 variables.

Answer:

Q2. Conversion of numbers. ($5 \times 3 = 15$ points)

- (a) Hexadecimal 1FB to decimal
- (b) Octal 374 to Binary
- (c) Binary 101111110110 to Hexadecimal
- (d) Decimal 627 to Trinary (Base 3)
- (e) What is the base x in $(2400)_x = (1010)_7$

Answers:

(a)

(b)

(c)

(d)

(e)

Q3. (a) A decimal integer is in the range of 102 to -102. How Many bits are required to represent any value in this range in 2's complement representation? (3 points)

(b) Assume the same number of bits as part (a), compute the following using 2's complement method and comment on the correctness of the result. (4*3 = 12 points)

(b1) $75 - 32$

(b2) $-57 + 99$

(b3) $-52 - 84$

(b4) $37 + 93$

Answers:

(a)

(b1)

(b2)

(b3)

(b4)

Q4. Simplify the following Boolean functions (3*5 = 15 points)

(a) $F = XY + XY'$

(b) $F = (X + Y) (X + Y')$

(c) $F = Y'Z + X'YZ + XYZ$

(d) $F = (X + Y) (X' + Y + Z) (X' + Y + Z)$

(e) $F = X + XYZ + X'YZ + X'Y + WX + WX'$

Answers:

(a)

(b)

(c)

(d)

(e)

Q5. We can perform logical operations on strings of bits by considering each pair of bits separately (called bitwise operation). (3*3 = 9 points)

Given two strings A and B

A = 10110110

B = 11001000

Perform the bitwise operation using the following functions

(a) NAND

(b) NOR

(c) XOR

Answers:

(a)

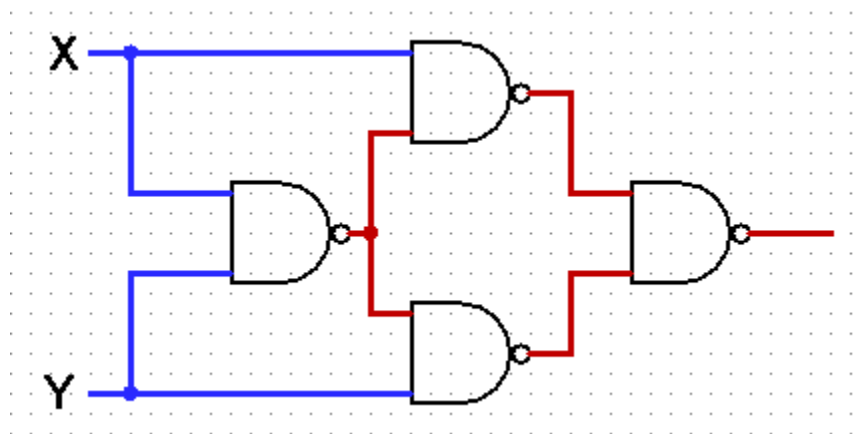
(b)

(c)

Q6. (2*3 = 6 points)

(a) Draw the logic diagram for $F = X + XY'Z + W(X+Z')$

(b) Obtain the Reduced Boolean expression for the following circuit diagram (ignore coloring)



Q7. Use DeMorgan's theorem to simplify the following expressions: (2*3 = 6 points)

(a) $((A' + B)' (C' + D')')'$

(b) $((AB'C)' + (AB')')'$

(a)

(b)

Q8. Kyle, Patrick, Jorge and Steven are hungry college students. They want a quicker way to decide where to go for lunch, the Marshall Center or Juniper. The majority wins, except when Jorge and Steven both agree, then they win. Any other ties end with a trip to Juniper. What would be the design of the logic circuit that automatically selects the restaurant when everyone votes? Show truth table, minimized Boolean expression, and circuit diagram. (10 points)