

ECE 150 Digital Logic Design, Fall 2024

Quiz 1, September 18th 2024

Problem 1 (5 pts).

- (a) Write the Hexadecimal number, $A3C_{16}$, as a sum of symbols (their equivalent decimal value) times weighting-factors (*1pts*).
- (b) Convert $A3C_{16}$ to binary (*1pt*) and compute its sum with $0101\ 1010\ 0111_2$ (*2pts*).
- (c) Convert the result of (b) back to Hex (*1pt*).

Solution.

(a)

$$A3C_{16} = 10 \times 16^2 + 3 \times 16^1 + 13 \times 16^0$$

(b) $A3C_{16} = 1010\ 0011\ 1100_2$.

carry: 0	0000	0111	1000 ₂
	1010	0011	1100 ₂
	+	0101	1010
		0111	0111 ₂
	0	1111	1110
			0011 ₂

(c) We convert by groups of 4:

$$1111\ 1110\ 0011_2 = FE3_{16}.$$

check: $0101\ 1010\ 0111_2 = 5A7_{16}$.

carry: 010 ₁₆
$A3C_{16}$
+
$5A7_{16}$
$FE3_{16}$

Problem 2 (5pts). Simplify the following boolean expression using a Karnaugh-Map.

$$X = \bar{A}\bar{B}\bar{C}\bar{D} + A\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}CD + \bar{A}B\bar{C}\bar{D} + \bar{A}BCD + A\bar{B}C\bar{D}$$

Solution.

We fill in a K-map with the SOP min-terms and circle-1s in powers of 2:

		<i>CD</i>			
		00	01	11	10
<i>AB</i>	00	1	1	1	0
	01	0	1	1	0
	11	0	0	0	0
	10	1	0	0	1

Each circled term gives a single expression in a simplified sum of products:

$$X = A\bar{B}\bar{D} + \bar{A}\bar{B}C + \bar{A}D$$