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 0111₂ (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 0111₂
0 1111 1110 0011₂

(c) We convert by groups of 4:

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

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

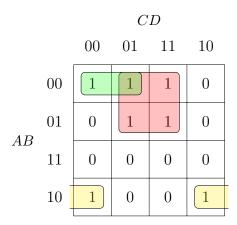
carry:
$$010_{16}$$
 $A3C_{16}$
 $+ 5A7_{16}$
 $FE3_{16}$

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

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

Solution.

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



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

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