ECE 150 Digital Logic Design, Fall 2023

Quiz 1, September 13th 2023

Problem 1 (5 pts).

(a) Write the Hexadecimal number, $DF8_{16}$, as a sum of symbols (their equivalent decimal value) times weighting-factors (*1pts*).

(b) Convert $DF8_{16}$ to binary (*1pt*) and compute its sum with $0011\ 0000\ 1111_2$ (*2pts*).

(c) Convert the result of (b) back to Hex (*1pt*).

Solution.

(a)
$$DF8_{16} = 13 \times 16^2 + 15 \times 16^1 + 8 \times 16^0$$

(b) $DF8_{16} = 1101\ 1111\ 1000_2$.

$$
\begin{array}{rcccc}
\text{carry:} & 1 & 1111 & 1111 & 0000 \\
& & 1101 & 1111 & 1000_2 \\
+ & & 0011 & 0000 & 1111_2 \\
\hline
& 1 & 0001 & 0000 & 0111_2 \\
\end{array}
$$

(c) We convert by groups of 4, using leading zeros:
$$0001\ 0001\ 0000\ 0111_2 = 1107_{16}.$$

Problem 2 (5pts). Simplify the following boolean expression using a Karnaugh-Map.
$$X = \bar{A}\bar{B}CD + \bar{A}B\bar{C}\bar{D} + ABC\bar{D} + \bar{A}BC\bar{D} + AB\bar{C}\bar{D}$$

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:
$$X = BC + \bar{A}\bar{B}CD$$