

Class	CS47, Sec 01
Homework	II
Due Date	Nov 21, 2016 11:59 PM PST

- Instructions
- There are 5 questions with total 10 points.
 - Please create electronic document with your answer.
 - There is no need to include the question itself. However, you **MUST** include question number and sub-part index if any. Example: 9(b)
 - Please create a PDF document hw2.pdf and upload that in Canvas assignment page by the due date.
 - **Please re-check you submission for any logistic errors (empty file, corrupted PDF, and many more) and re-submit if needed. Once grading is started, any file with logistics errors will be given 0 point.**
 - **NO** handwritten document is accepted.
 - **NO LATE SUBMISSION.**
 - **Please explain your answer clearly – just writing the final answer in a word or two is not sufficient in most of the cases.**

1. Using 2's complement binary arithmetic [3pts]
 - (a) What are the 5-bit 2's complement binary bit patterns for $a = 5_{10}$ and $b = -10_{10}$
 - (b) Find product of a and b using “paper and pencil” method, i.e. first calculating partial products and then performing summation of partial products. Assume that a and b are 5-bit two's complement binaries. Show all necessary steps. Assume result is a bit number in 2's complement format.
 - (c) Perform (i) zero-extension and (ii) sign-extension of numbers a and b to get 8-bit binaries. You should report 4 numbers.
2. Derive truth tables for the following Boolean functions. [1pts]
 - (a) $F(x, y, z) = x + y + z'$
 - (b) $F(x, y, z) = x'y' + yz$
3. Prove by Boolean algebraic manipulation that the following expressions are valid. [1pts]
 - (a) $x'z + y + xy' = x + y + z$
 - (b) $abc' + bc'd' + bc + c'd = b + c'd$
4. Using K-Map technique perform the following. [2pts]
 - (a) Simplify the following function:
$$f(A, B, C, D) = \sum m(0, 1, 5, 7, 8, 10, 14, 15)$$

Show all the “prime-implicants” and “Essential prime implicants”
 - (b) Find a minimum SOP expression for:
$$f(w, x, y, z) = \sum m(2, 4, 9, 12, 15) + d(3, 5, 6, 13)$$

Show all the “prime-implicants” and “Essential prime implicants”
5. Design and implement a digital circuit which takes a 4-bit unsigned integer and check if it is even number between 5 to 12. Show the truth table, K-map optimization and draw the schematic diagram. [3pts]