Digital engineering 2st report

디지털 공학 과제 주의사항

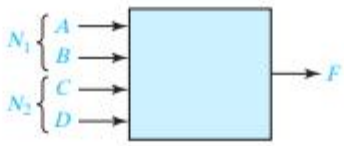
과제는 반드시 **자필**로 작성하셔야 합니다.
문제 풀이 과정이 다 들어가 있어야 하며, 제출 기한은 **4월 21일 시험시간 전까지**입니다,
A4용지에 반드시 풀이과정과 학번 이름을 포함하여 **시험시간 전 시험장 교탁 위**에 제출 해주시기 바랍니다. (늦게 제출 시 페널티 감점 있습니다.)
문제는 **7판 원서** 기준으로 출제되었습니다.

3.11 Simplify algebraically to a minimum sum of products (five terms):
$(A + B' + C + E')(A + B' + D' + E)(B' + C' + D' + E')$

3.26 Simplify to a sum of three terms:
(a) $A'C'D' + AC' + BCD + A'CD' + A'BC + AB'C'$
(b) $A'B'C' + ABD + A'C + A'CD' + AC'D + AB'C'$

3.32 Which of the following statements are always true? Justify your answers.
(a) If $A + B = C$, then $AD' + BD' = CD'$
(b) If $A'B + A'C = A'D$, then $B + C = D$
(c) If $A + B = C$, then $A + B + D = C + D$
(d) If $A + B + C = C + D$, then $A + B = D$

4.8 A switching circuit has four inputs as shown. A and B represent the first and second bits of a binary number N_1. C and D represent the first and second bits of a binary number N_2. The output is to be 1 only if the product $N_1 \times N_2$ is less than or equal to 2.
(a) Find the minterm expansion for F.
(b) Find the maxterm expansion for F.
Express your answers in both decimal notation and algebraic form.



4.13 A combinational logic circuit has four inputs (A, B, C, and D) and one output Z. The output is 1 iff the input has three consecutive 0's or three consecutive 1's. For example, if $A = 1, B = 0, C = 0$, and $D = 0$, then $Z = 1$, but if $A = 0, B = 1, C = 0$, and $D = 0$, then $Z = 0$. Design the circuit using one four-input OR gate and four three-input AND gates.

5.8 Find the minimum sum of products and the minimum product of sums for each function:

(a) $f(a,b,c,d) = \Pi\, M(0,1,6,8,11,12) \cdot \Pi\, D(3,7,14,15)$

(b) $f(a,b,c,d) = \Sigma m(1,3,4,11) + \Sigma d(2,7,8,12,14,15)$

5.22 Find all prime implicants and all minimum sum-of-products expressions for each of the following functions.

(a) $f(A, B, C, D) = \Sigma m(4, 11, 12, 13, 14) + \Sigma d(5, 6, 7, 8, 9, 10)$

(b) $f(A, B, C, D) = \Sigma m(3, 11, 12, 13, 14) + \Sigma d(5, 6, 7, 8, 9, 10)$

(c) $f(A, B, C, D) = \Sigma m(1, 2, 4, 13, 14) + \Sigma d(5, 6, 7, 8, 9, 10)$

(d) $f(A, B, C, D) = \Sigma m(4, 15) + \Sigma d(5, 6, 7, 8, 9, 10)$

(e) $f(A, B, C, D) = \Sigma m(3, 4, 11, 15) + \Sigma d(5, 6, 7, 8, 9, 10)$

(f) $f(A, B, C, D) = \Sigma m(4) + \Sigma d(5, 6, 7, 8, 9, 10, 11, 12, 13, 14)$

(g) $f(A, B, C, D) = \Sigma m(4, 15) + \Sigma d(0, 1, 2, 5, 6, 7, 8, 9, 10)$

5.38 $F(a, b, c, d, e) = \Sigma m(0, 1, 4, 5, 9, 10, 11, 12, 14, 18, 20, 21, 22, 25, 26, 28)$

(a) Find the essential prime implicants using a Karnaugh map, and indicate why each one of the chosen prime implicants is essential (there are four essential prime implicants).

(b) Find all of the prime implicants by using the Karnaugh map (there are 13 in all).