

EHB 205E: Introduction to Logic Design

Quiz 2

Duration: 90 Minutes

Grading: 1) 30%, 2) 70%

Quiz is in closed-notes and closed-books format

For your answers please use the space provided in the exam sheet

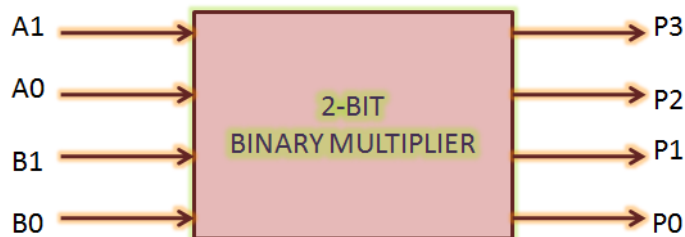
GOOD LUCK!

1. SIMPLIFICATION WITH KARNAUGH MAP

Consider a 4-variable Boolean function $f(x_1, x_2, x_3, x_4) = \sum(1,3,4,5,9,11,12,13,14,15)$; x_1 is the most significant bit. Obtain a minimal sum-of-products (SOP) expression for f using a **Karnaugh** map. Show all prime and essential prime implicants.

2. DESIGNING A 2-BIT BY 2-BIT MULTIPLIER

Consider a 2-bit by 2-bit multiplier with its circuit symbol shown below; $(A_1A_0)_2 \times (B_1B_0)_2 = (P_3P_2 P_1P_0)_2$.



- Derive a truth table (with 16 rows) for the outputs P_0, P_1, P_2, P_3 in terms of the inputs A_0, A_1, B_0, B_1 . Each row of the table represents a different input assignment. For example, if input binary numbers 11 and 10 are multiplied then the output binary number should be 0110 meaning that $A_0=1, A_1=1, B_0=0, B_1=1, P_0=0, P_1=1, P_2=1, P_3=0$ for the corresponding row.
- Using Karnaugh Maps, derive minimum SOP forms of P_0, P_1, P_2, P_3 having minimum literal counts.