

LAB 4

Objectives:

- Writing a **function in terms of Min & Max Terms from logic diagram and Statement**
- To learn how to do **Minimization of Boolean function using K-Map**
- To obtain the simplest implementation for given function by circuit optimization that require **cost criterion (Literal & Gate input cost)**

EQUIPMENT: Logic trainer, Logic probe

COMPONENTS: ICs 74LS08, 74LS32, 74LS04

Theory:

Minterm

Each of the product terms in the canonical SOP form is called a minterm. Minterm are represented as binary numbers in terms of 0s and 1s. The binary words are formed by representing each non-complemented variable by 1 and each complemented variable by 0, and the decimal equivalent of this binary word is represented as a subscript of m as m_0 , m_1 , m_2 , etc. We generally use the Σ (**sigma**) notation to represent minterms.

Maxterm

Each of the sum terms in the canonical POS form is called a maxterm. Maxterm can also be represented using binary numbers where each non-complemented variable is represented using 0 and complemented variable using 1, and the decimal equivalent of this binary word is represented as a subscript of M as M_0 , M_2 , M_2 , etc. We generally use Π (**pi**) notation to represent the max terms.

Karnaugh map

(K-map) is a method used to simplify Boolean expressions. K-Map is a grid-like representation of a truth table that gives more insight. . Optimal groups of 1s or 0s are identified, which represent the terms of a canonical form of the logic in the original truth table. The minimization will result in reduction of the number of gates (resulting from less number of terms) and the number of inputs per gate (resulting from less number of variables per term). The minimization will reduce cost and power consumption of the logic circuit.

Literal Cost

Literal means **variable or its complement**. Literal cost is no of Literal appearances in Boolean expression corresponding to logic circuit diagram. Expressed as L

Gate Input Cost

“Is the no of inputs to gate in implementation corresponding exactly to given equation”

G= No of Excluding terms consisting only of single literal (Invertors not counted)

GN=No of distinct complemented single Literals (Invertors counted)

Q1. The light bulb is ON, if switch A is OFF and switch B is ON and either switch B is OFF or switch C is ON, or if switch A is ON and switch D is ON and either switch D is OFF or switch C is OFF

- a) Find truth table for the light bulb
- b) Write Boolean function for the light bulb in canonical form using minterms & maxterms
- c) Find POS standard form. Minimize expression for the light bulb using ALGEBRIC manipulation. Implement on trainer.

IC type	Required No. of Gates	Gates per IC	Required No. of ICs
Total no. of ICs			

Q2. (a)Use a k-map to drive the minimum cost SOP expression for

F =x' (y XNOR z') + x. y **(b)**Draw truth table. **(c)**Write Literal Cost and Gate Input Cost for this expression. **(d)**Implement Original equation on trainer.

