

# ASSIGNMENT COVER PAGE

Name of Student:	SAHIL ALTAF NAGOO
Batch:	July 2023
Program:	BCA
Subject & Code:	Digital Computers & fundamentals (08CA-112)
Semester:	1st
Learner ID:	2313020640

## NECESSARY INSTRUCTIONS

1. Cover Page must be filled in Capital Letters. All Fields of the Form are compulsory to be filled.
2. The assignment should be written / computer typed on A4 size paper and it should be neat and clearly readable.
3. The cover page should be stapled at the front of each and every assignment.
4. Incomplete Assignments will not be accepted.

You are a Digital Circuit Designer at a tech firm. You are tasked with optimizing a Boolean function represented by a 4-variable Karnaugh map.

The function  $f(A, B, C, D)$  expressed as

$$f(A, B, C, D) = \Sigma(0, 2, 4, 6, 8, 10, 12, 14)?$$

KARNAUGH MAP is a graphical tool for minimizing switching functions of up to four variables. It has 16 cells, each corresponding to a unique combination of the input variables. The function  $f(A, B, C, D)$  can be expressed as a sum of minterms which are the product terms that make the function equal to 1. The given function  $f(A, B, C, D) = \Sigma(0, 2, 4, 6, 8, 10, 12, 14)$  means that the function is 1 when the input variables have the following values.

A	B	C	D
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

To map these minterms to the Karnaugh map, we need to follow the Gray code sequence for the rows & columns. The Gray code sequence is a way of ordering binary numbers such that only one bit changes between adjacent numbers. For example, the Gray code sequence for two bits is 00, 01, 11, 10. The Gray code sequence for four bits is 0000, 0001, 0011, 0010, 0110, 0111, 0101, 0100, 1100, 1101, 1111, 1110, 1010, 1011, 1001, 1000. We can use the first two bits for the rows & last two bits for the columns of the Karnaugh map. The Karnaugh map for the given function is shown below.

	00	01	11	10	
00	1	1	0	0	
01	1	1	0	0	
11	1	1	0	0	
10	1	1	0	0	

To optimize the function, we need to group the adjacent cells that contain 1's in the map. The groups should have a size that is power of two such as 1, 2, 4 & etc. The groups should have a size large as possible & can wrap around the edges of the map. For the given function, there is only one possible group of eight cells as shown below.

	00	01	11	10
00	1	1	0	0
01	1	1	0	0
11	1	1	0	0
10	1	1	0	0

The group of 8 cells has one variable in common:  $D = \bar{B}^2$ . Therefore the simplified expression for the function is  $f(A, B, C, D) = D^2$ . This means that the function is 1 whenever  $D$  is 0, regardless of the values of A, B, & C.