Name: ..... Student ID: .....

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Laboratory 6

Karnaugh Map

1. **W**rite the output logic equation according to the following given truth table;

A	B	C	X
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

1.1 In m-notation of minterm expansion form:

1.2 In m-notation of maxterm expansion form:

1.3 In algebraic from:

Instructor's signature

2. Draw a Karnaugh map from the truth table shown in 1. Demonstrate looping the 1's in the map in order to obtain the minimum solution.

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3. Draw a corresponding logic circuit diagram from the logic equation obtained from 2. Connect the circuit and record the results:

A	B	C	X
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

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4. **W**rite the output logic equation according to the following given truth table;

A	B	C	D	Y
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	X
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	X

4.1 In m-notation of minterm expansion form:

4.2 In m-notation of maxterm expansion form:

4.3 In algebraic from:

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5. Draw a Karnaugh map from the truth table shown in 4. Demonstrate looping the 1's in the map in order to obtain the minimum solution.

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6. Draw a corresponding logic circuit diagram from the logic equation obtained from 5. Connect the circuit and record the results:

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

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7. Give conclusion about the advantages of using Karnaough map to find the minimum solution.

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8. Assignments:

8.1 The product package machine is built such that it loads the products into the package in the predefined number. If the desired number to be loaded is set to *n,* the machine is expected to load the products into the package in the range of *[n-3,n+3]*. From the detailed study, an engineer finds that, the machine will only load the products in the range of *[n-8,n+7]*. Design a logic circuit for this machine such that it outputs the alarm if the number of loaded products to the package is out of range.

a) Construct a truth table
b) Construct a Karnaugh map
c) Give the corresponding logic equation
d) Build the corresponding circuit to show the result

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8.2 A simple floodgate has a sensor to measure incoming water level, which can be classified into 10 levels, (0-9). The opening height of the floodgate depends on this incoming water level. For water level of 0-3, the floodgate will be at its upper level. For water level 0f 4-6, the floodgate will be at its middle level, otherwise it will be at its lower level. Construct a logic circuit, which give the alarm signal when the floodgate is at its lower level.

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8.3 Construct a minimum circuit which receives BCD inputs indicating the number of month in a year (for example, January is 1, February is 2, and so on). The circuit shall have the following functions:

- If the input month has 31 days, only D0 is ON
- If the month input has 30 days, only D1 is ON
- Otherwise, both D0 and D1 are ON.

(Credit: Applied from Mr. Kornkitt P. SE06)

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Logic Diagram of frequently used gates