CS 3101 Computer Organization

Homework 3

**Due Date: Monday, October 1, 2018 at class time**

You can use Equations in Word to write the Boolean expressions, use Visio or Insert Shapes in Word to draw the circuits, and use Insert Tables in Word to draw the Kmaps.

If you write formulas and draw charts by hand, make sure your writing and drawings are legible.

***Show your steps to receive partial credit.***

1. Simplify the following functional expression using Boolean algebra and its identities. List the identity used at each step.

Factor out y

Factor out x

Inverse Law

Inverse Law

1. Use any method to prove the following either True for False.

**FALSE**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *x* | *y* | *z* |  |  |  |  |  |  |  |
| 0 | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | **0** |
| 0 | 0 | 1 | 0 | 0 | 1 | **1** | 0 | 1 | **1** |
| 0 | 1 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | **0** |
| 0 | 1 | 1 | 0 | 0 | 0 | **0** | 0 | 1 | **1** |
| 1 | 0 | 0 | 0 | 0 | 0 | **0** | 0 | 0 | **0** |
| 1 | 0 | 1 | 0 | 0 | 0 | **0** | 0 | 0 | **0** |
| 1 | 1 | 0 | 0 | 1 | 1 | **1** | 1 | 0 | **1** |
| 1 | 1 | 1 | 1 | 0 | 0 | **1** | 1 | 0 | **1** |

1. Given the function:
   1. List the truth table for .

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *x* | *y* | *z* |  |  |  |  |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | 0 | 1 |
| 1 | 0 | 1 | 1 | 0 | 0 | 1 |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 0 | 1 | 1 | 1 |

* 1. Draw the logic circuit using the original Boolean expression

*x*

*y*

*z*

*x*

*y*

*z*

*z*

*y*

*z*

* 1. Simplify the expression using Boolean algebra and identities.

Factor out x

Factor out

Inverse Law

Redundancy Law

* 1. List the truth table for your answer in Part c.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *x* | *y* | *z* |  |  |  |
| 0 | 0 | 0 | 1 | 1 | 0 |
| 0 | 0 | 1 | 1 | 1 | 0 |
| 0 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 1 | 0 |
| 1 | 0 | 0 | 1 | 1 | 1 |
| 1 | 0 | 1 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 0 | 1 | 1 |

* 1. Draw the logic diagram for the simplified expression in Part c.

*x*

*y*

*z*

1. Write a simplified expression for the Boolean function defined by the following Kmap.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| yz  wx | 00 | 01 | 11 | 10 |
| 00 | 1 |  |  | 1 |
| 01 | 1 |  |  | 1 |
| 11 |  |  |  |  |
| 10 | 1 |  | 1 | 1 |

1. Write a simplified expression for the Boolean function defined by the following K-maps:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| yz  x | 00 | 01 | 11 | 10 |
| 0 | 1 | 0 | 0 | X |
| 1 | 1 | 1 | 1 | 1 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| yz  wx | 00 | 01 | 11 | 10 |
| 00 | 1 | 1 | 1 | 1 |
| 01 |  | X | 1 | X |
| 11 |  |  | X |  |
| 10 | 1 |  | X | 1 |