**Discrete Structures**

**University at Albany**

**Department of Computer Science**

**ICSI 210 – Spring 2023**

**Concept Assignment-2**

**Assigned: Monday, February 13th, 2023.**

**Due: Monday, February 20th through your Blackboard account by 11:59 PM. Submissions with**

**20% penalty will be accepted by Wednesday, February 22nd, by 11:59 PM.**

**Unlimited number of submissions is allowed.**

**Student Name:**

**WHAT TO DO**

1. [30 marks total] Consider the Boolean expression *(X+Y)(+Z)(Y+Z).*
   1. [5 marks] Obtain the sum-of-products.

Work:

(X+Y)(X’+Z)(Y+Z)

(X’X+XZ+X’Y+YZ)(Y+Z

X’XY+X’XZ+XYZ+XZZ+XYY+X’YZ+YYZ+YZZ

* 1. [10 marks] Use a K-map to obtain its minimal sum-of-products. Use the table below to supply your answer.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
| *X* | XY’Z’=0 | XY’Z =0 | **XYZ=1** | XYZ’=0 |
|  | X’Y’Z’ =0 | X’Y’Z=0 | **X’YZ=1** | X’YZ’=0 |

* 1. [10 marks] Use the Boolean identities to show that your result from item a. and b. are equivalent.
  2. [5 marks] Implement your minimized solution using only NOT, 2-input AND, and 2-input OR gates.

1. [25 marks] For the following Boolean expression provide the following:

*XYZW + XZW + XZ + YZW + XYW + YW*

* 1. [10 marks] Minimize it using the Boolean identities.
  2. [10 marks] Use K-map to verify the correctness of your solution to item a. Use the table below to supply your answer.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| *XY* |  |  |  |  |
| *X* |  |  |  |  |

* 1. [5 marks] Implement your minimized solution using only NOT, 2-input AND, and 2-input OR gates.

1. [30 marks] You have been asked to implement a digital circuit.  This circuit consists of three inputs (X, Y, and M) and one output (OUT).  When M equals 1, OUT will equal the Boolean OR of X and Y.  If M equals 0, OUT will equal the Boolean AND of X and Y.
2. [5 marks] Construct a truth table to describe the behavior of the circuit.
3. [5 marks] Write the sum-of-products for OUT.
4. [5 marks] Minimize t using the Boolean identities.
5. [10 marks] Use a K-map to obtain the minimal sum-of-products for your OUT result. Use the table below to supply your answer.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
| *M* |  |  |  |  |
|  |  |  |  |  |

1. [5 marks] Implement your minimized solution. You are to use only NOT, 2-input AND, and 2-input OR gates.
2. [15 marks] Consider the proposition (). Show that it is a contradiction by using both:
   1. [5 marks] the truth table, and
   2. [10 marks] the logical equivalencies provided by Table 6 below.

Table

Description automatically generated

**WHAT TO SUBMIT**

Your answers must be typeset in **MS Word** and submitted through **Blackboard**. Marks will be deducted if you do not follow this requirement. Note that handwritten pictures of answers included in the submitted document will be subject to penalties. The name of your MS Word file must follow the format: *210 Assignment2 Your Name*.