Implementation of 2-Bit Magnitude Comparator in FPGA

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Contents

Introduction

Implementation details of the project for FPGA Lab: 2-Bit Magnitude Comparator

- Hardware Used: Vaman LC
- Programming Language: Verilog

Magnitude Comparator Circuit

An N-bit magnitude comparator is a logical circuit that takes in two N-bit binary inputs A and B, and outputs one of the following three:

- $A > B$
- $A < B$
- $A = B$

This presentation goes over the implementation details of the 2-bit magnitude comparator.

Applications of Magnitude Comparator

- Circuits in control applications
- Inputs: binary equivalent of the values of physical quantities like temperature, humidity, pressure, etc.
- Output of the comparator: often triggers a specific sequence of actions
- Analog-to-Digital Converter circuits, ALUs, and more

2-Bit Magnitude Comparator: Truth Table

The truth table for the 2-bit magnitude comparator is shown in the table below:

A_1	A_0	B_1	B_0	A > B	A < B	A = B
0	0	0	0	0	0	1
0	0	0	1	0	1	0
0	0	1	0	0	1	0
0	0	1	1	0	1	0
0	1	0	0	1	0	0
0	1	0	1	0	0	1
0	1	1	0	0	1	0
0	1	1	1	0	1	0
1	0	0	0	1	0	0
1	0	0	1	1	0	0
1	0	1	0	0	0	1
1	0	1	1	0	1	0
1	1	0	0	1	0	0
1	1	0	1	1	0	0
1	1	1	0	1	0	0
1	1	1	1	0	0	1

Boolean Expression for A > B

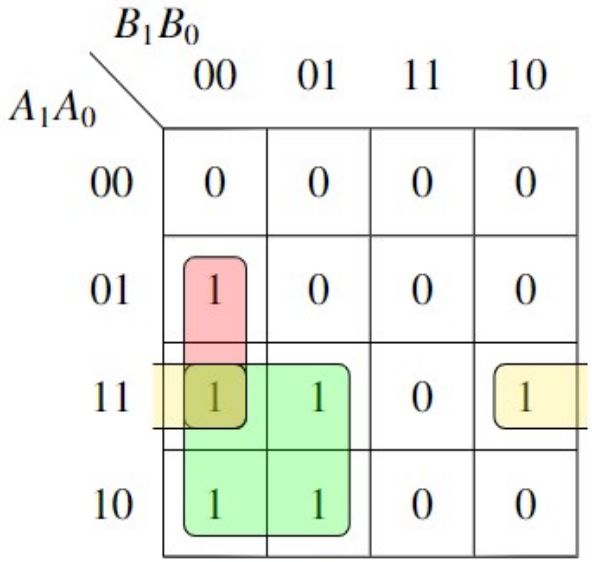

Fig. 1: K-Map for $A > B$

$$(A > B) = A_1B_1' + A_0B_1'B_0' + A_1A_0B_0'$$

Boolean Expression for A < B

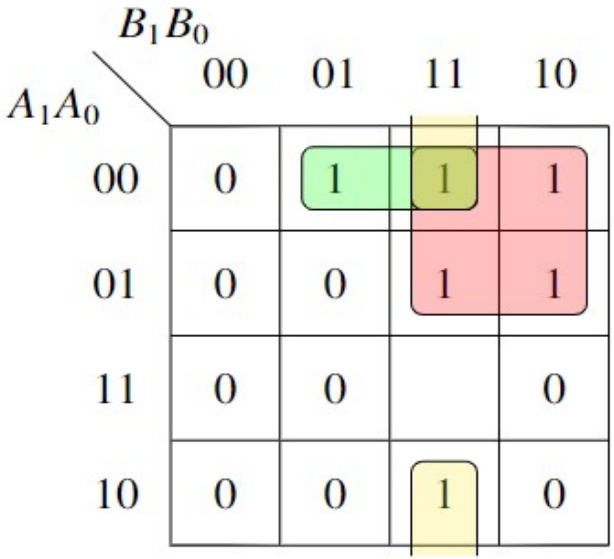

Fig. 2: K-Map for $A < B$

$$(A < B) = A_1'B_1 + A_0'B_1B_0 + A_1'A_0'B_0$$

Boolean Expression for A = B

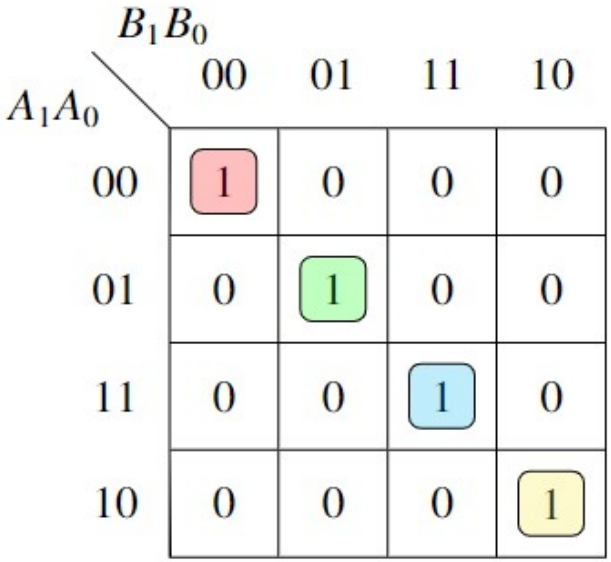

Fig. 3: K-Map for $A = B$

$$A = B = A_1'A_0'B_1'B_0' + A_1'A_0B_1'B_0 + A_1A_0'B_1B_0' + A_1B_1A_0B_0$$

$$(A = B) = (A_1 \odot B_1).(A_0 \odot B_0)$$

Implementation

- The file `twobitcomparator.v` contains the definition of the Verilog module for the 2-bit comparator circuit.
- The file `quickfeather.pcf` contains the pin configurations
- Provide inputs as needed to the Vaman LC board, compile and run the source code files in the `code` folder in the above-mentioned GitHub repository.

Thank You!