

Digital Circuit Design

by Madge Ick Black

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Digital Circuit Design

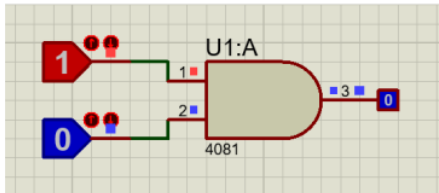
Lecturer: Stalin Jacob

Student Number: 2208511

Madge Ick Black

Task 1

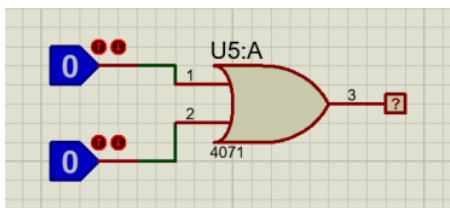
a) AND gate logic symbol:



Truth Table

A	B	Output
0	0	0
0	1	0
1	0	0
1	1	1

b) OR gate logic symbol:

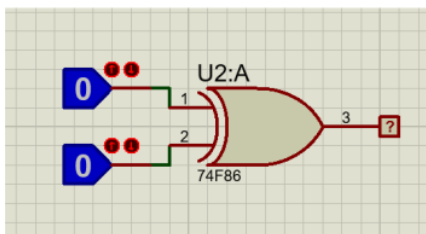


Truth Table

A	B	Output
---	---	--------

0	0	0
0	1	1
1	0	1
1	1	1

c) XOR gate logic symbol:

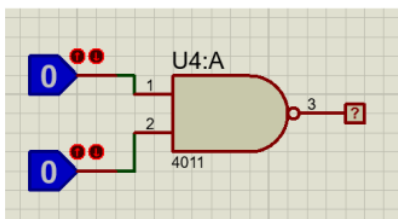


Truth Table

A	B	Output

0	0	0
0	1	1
1	0	1
1	1	0

d) NAND gate logic symbol:



Truth Table

A	B	Output
---	---	--------

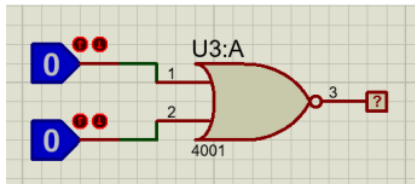
0	0	1
---	---	---

0	1	1
---	---	---

1	0	1
---	---	---

1	1	0
---	---	---

e) NOR gate logic symbol:



Truth Table

A	B	Output
---	---	--------

0	0	1
---	---	---

0	1	0
---	---	---

1	0	0
---	---	---

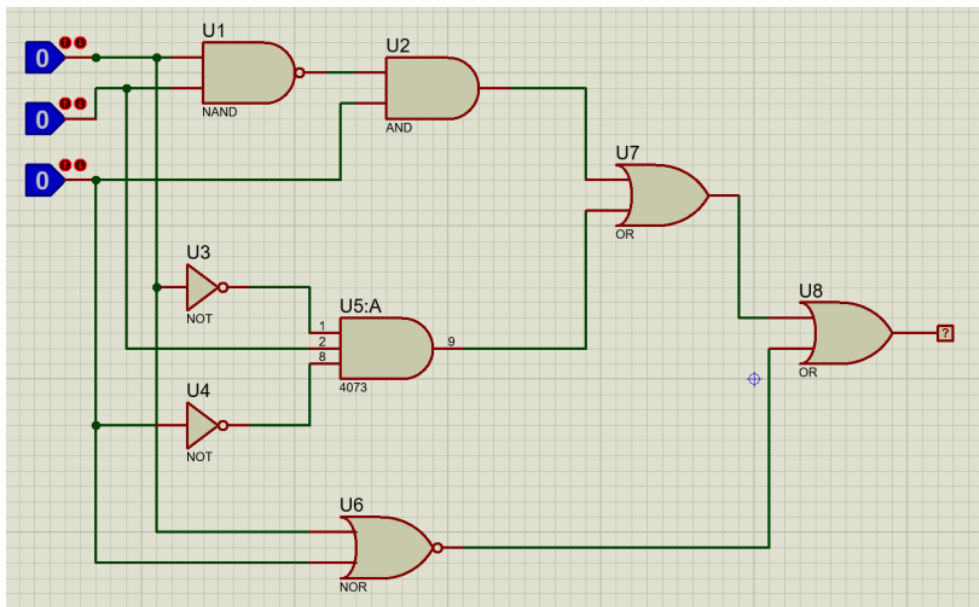
1	1	0
---	---	---

2. Design a logic circuit using a software for the following equations



a) $Y = (\overline{A}B)C + \overline{A}B\overline{C} + \overline{A} + \overline{C}$

Logic circuit for $A + C$:



Truth table:



A	C	Y

0	0	0
0	1	1
1	0	1
1	1	1

2 b). Logic circuit for $m(0,1,5,6,9)$:

Truth table:

A	B	 C	M	Y

0	0	0	1	0
0	0	1	1	0
0	1	0	0	0
0	1	1	0	0
1	0	0	1	0
1	0	1	0	0
1	1	0	0	0
1	1	1	1	1
5	1	0	0	0
5	1	1	0	0
6	0	0	1	0
6	0	1	0	0
9	0	0	1	0
9	0	1	0	0
0	1	0	0	0
0	1	1	0	0
1	0	0	1	0
1	0	1	0	0

5 1 0 0 0

5 1 1 0 0

6 0 0 1 0

6 0 1 0 0

9 0 0 1 0

9 0 1 0 0

3.) $Y = (\overline{A + B})BC$

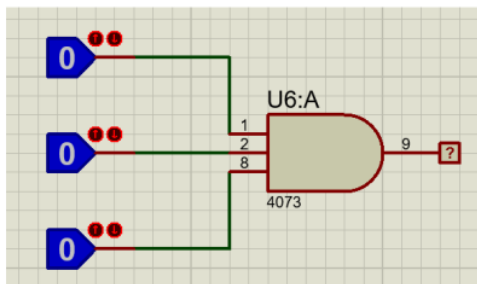
9

$Y = (\overline{AB})BC$

$Y = ABBC$

$Y = ABC$

Logic Diagram



Truth Table

A B C Y

0 0 0 0

0 0 1 0

0 1 0 0

0 1 1 0

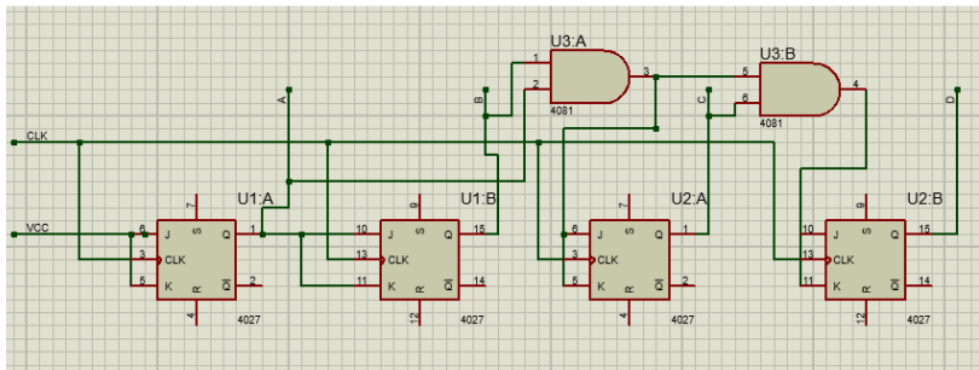
1 0 0 0

1 0 1 0

1 1 0 0
1 1 1 1

4. Design of a 4-bit synchronous counter using Porteous software:

The logic diagram for the 4-bit synchronous counter using J-K flip-flops is shown below:



The truth table for the inputs and outputs of the 4-bit synchronous counter is shown below:

Clock	J3	K3	J2	K2	J1	K1	J0	K0	Q3	Q2	Q1	Q0
-----	----	----	----	----	----	----	----	----	----	----	----	----
0	X	X	X	X	X	X	X	X	Q3	Q2	Q1	Q0
1	0	0	0	0	0	0	0	0	Q3	Q2	Q1	Q0
1	0	0	0	0	0	0	1	1	Q3	Q2	Q1	Q0+1
1	0	0	0	0	0	1	0	0	Q3	Q2	Q1+1	0
1	0	0	0	0	0	1	1	1	Q3	Q2	Q1+1	1

1	0	0	0	0	0	1	0	0	Q3	Q2+1	0	0
1	0	0	0	0	0	1	0	1	Q3	Q2+1	0	1
1	0	0	0	0	0	1	1	0	Q3	Q2+1	1	0
1	0	0	0	0	0	1	1	1	Q3	Q2+1	1	1
1	0	0	0	0	1	0	0	0	Q3+1	0	0	0
1	0	0	0	0	1	0	0	1	Q3+1	0	0	1
1	0	0	0	0	1	0	1	0	Q3+1	0	1	0
1	0	0	0	0	1	0	1	1	Q3+1	0	1	1
1	0	0	0	0	1	1	0	0	Q3+1	1	0	0
1	0	0	0	0	1	1	0	1	Q3+1	1	0	1
1	0	0	0	0	1	1	1	0	Q3+1	1	1	0
1	0	0	0	0	1	1	1	1	Q3+1	1	1	1

5. Types and applications of Sequential Circuits:



Sequential circuits are digital circuits that have memory, which means they remember their previous states and can use them to produce output signals. The types of sequential circuits include:

1. **Synchronous Sequential Circuits:** These circuits use a clock signal to synchronize the timing of all the flip-flops in the circuit. The outputs of the flip-flops change only at the rising or falling edge of the clock signal. Examples of synchronous circuits include counters and registers.

2. Asynchronous Sequential Circuits: These circuits operate without a clock signal and depend entirely on the timing of the inputs. The outputs may change at any time after the input changes. Examples of asynchronous circuits include pulse generators and timing circuits.

3. Mealy and Moore Sequential Circuits: These circuits differ in how they produce output signals. A Mealy circuit's output depends on the current state and the inputs, while a Moore circuit's output depends only on the current state. Examples of Mealy and Moore circuits include state machines and control circuits.

Sequential circuits are used in various applications, such as in digital computers, communication systems, and control systems. They are used to store data, perform arithmetic operations, and control the flow of signals in a system. In digital computers, sequential circuits are used to store program instructions and data. In communication systems, they are used to encode and decode data signals. In control systems, they are used to control the operation of physical systems based on sensor data.

Digital Circuit Design

GRADEMARK REPORT

FINAL GRADE

57 / 100

GENERAL COMMENTS

Instructor

Engagement with Literature Skills: Marks: 0/0

Knowledge and Understanding Skills: Marks: 19/25

It is evident that there is good knowledge and understanding of the basic underlying concepts and principles of the subject. However the truth table provided for task 2 and task 4 is not correct.

Cognitive and Intellectual Skills: Marks: 9/25

Limited attempt at evaluation of the underlying concepts and principles. Weak interpretation of data. Truth table is provided for task 1, and task 3. Brief description about the findings is lagging for all the tasks..

Practical Application Skills: Marks : 27/45

An adequate awareness and mostly appropriate application of basic methods, materials, tools and techniques is evident. Designing logic circuits for a set of equations is evident through Task 2, task 3 and Task 3. However the screen grabs of the outputs for various input combinations are not provided in the assignment.

Transferable Skills for Life and Professional Practice: Marks : 2/5

Mostly ordered presentation and structure in which relevant ideas / concepts are reasonably expressed. It is loosely and at times incoherently structured. Information and ideas provided needs improvement. The title page, table of content, figure numbers, names, table name and numbers were not provided in the report.



Comment 1

Task 1: 16/20

Task 2: 10/30

Task 3: 15/20

Task 4: 10/20

Task 5: 6/10

Total: 57/100



Comment 2

Title page is Good



Comment 3

It is better to have table of content



Comment 4

Good Work, The logic gates and the respective truth tables are correct. It is better to name and number the figures and the tables. A brief description about the gates is missing.

Task 1: 16/20



Comment 5

It is better to have page numbers

PAGE 3

PAGE 4



Comment 6

The designed circuit diagram for Question 2(a) is correct. The truth tables are irrelevant and the circuit has not been designed for Task 2 (b). It is better to have a brief description about the circuits.

Task 2: 10/30

PAGE 5



Comment 7

This truth table is irrelevant to this task

PAGE 6



Comment 8

This table is irrelevant to this task

PAGE 7



Comment 9

The simplified Boolean expression is correct. The truth table for the simplified circuit is correct.

Task 3: 15/20

PAGE 8



Comment 10

Good Attempt, the circuit designed is correct, However it would have been better if input logics and outputs are added in the circuit. The truth table given is not correct.



Comment 11

Good Description, The different types of sequential circuits, and the applications of sequential circuits are mentioned. However, it is better to describe with necessary diagrams and references.