

**SWINBURNE VIETNAM
HO CHI MINH CAMPUS**



Alliance with  Education

Assignment 1 Report

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COS10004 Computer Science

Overview

1. Description

This circuit will implement a basic clock system, with several functions, it allows us to change hours, minutes, increase hours and minutes.

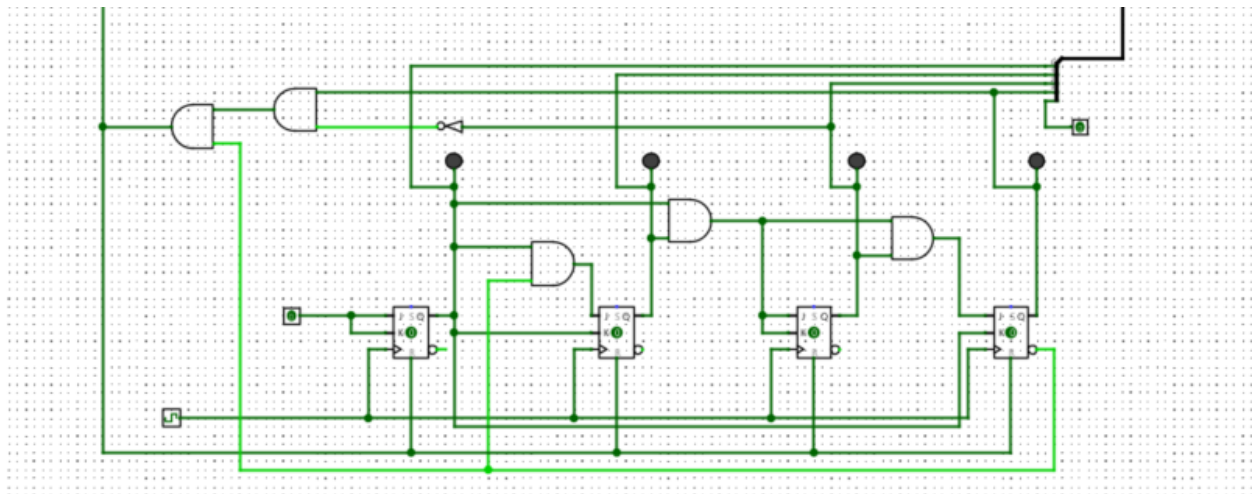
2. Outline

My circuit include:

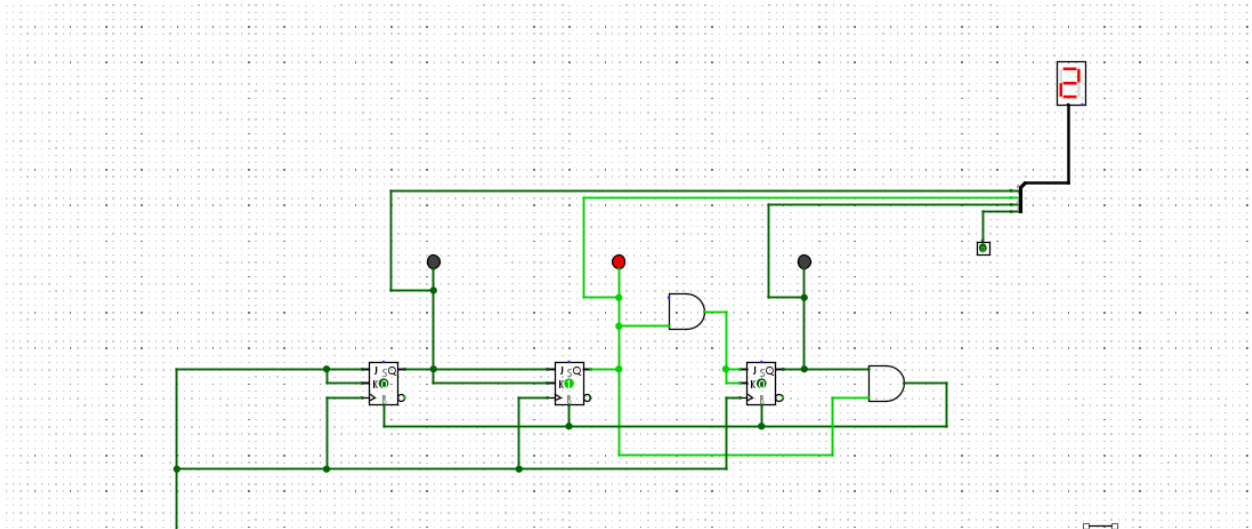
- 13 LEDs (which 12 of them use to decorate for module of hour and minute , 1 led is used for AM/PM)
- 12 JK flip flops
- 12 D flip flops
- 1 T flip flops used in display AM/PM
- 4 x Logisim Hex Digit displays
- 2 buttons (1 for increase minute and 1 for increase hour).
- Some other components like : gates, wires

Stage 1 : Implement minutes counter and display

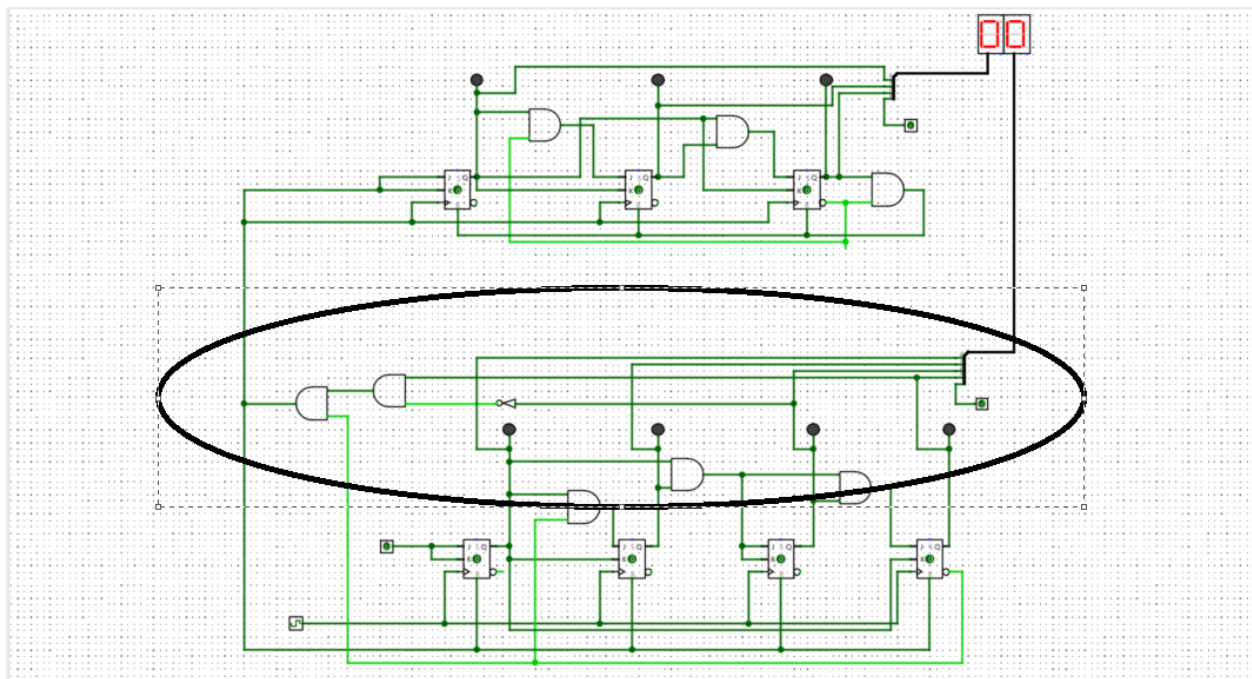
- I use MOD-10 to display values from 0 to 9 and return to 0 when it reaches 9. It includes 4 J-K flip flops and 4 LEDs to display each value as it reaches it. I use it as the "units" column of the minute circuit.



-Then I use MOD-6 to display values from 0 to 5 and return to 0 when it reaches 5. It includes 3 J-K flip flops and 3 LEDs to display each value as it reaches it. I use it as the "ten" column of the minute circuit.



- Finally, I use an 2 AND gates to connect the two modules together. When the unit part of the minute reaches 9, the ten column of the minute increases by 1 until the minute circuit reaches 59, at which point it wraps back to 00.



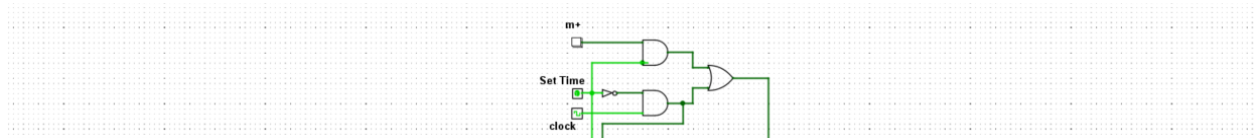
Stage 2 : Create SetTime and m+ button for minute circuit.

I use AND , NOT and OR gate to create the Set Time , when the Set Time time button enable the time display will pause.

First, I connect the Set Time pin to a NOT gate, so that when I activate the Set Time pin and it passes through the NOT gate, it will change the Set Time from 0 to 1. To demonstrate this, I will use the truth table of the NOT gate.

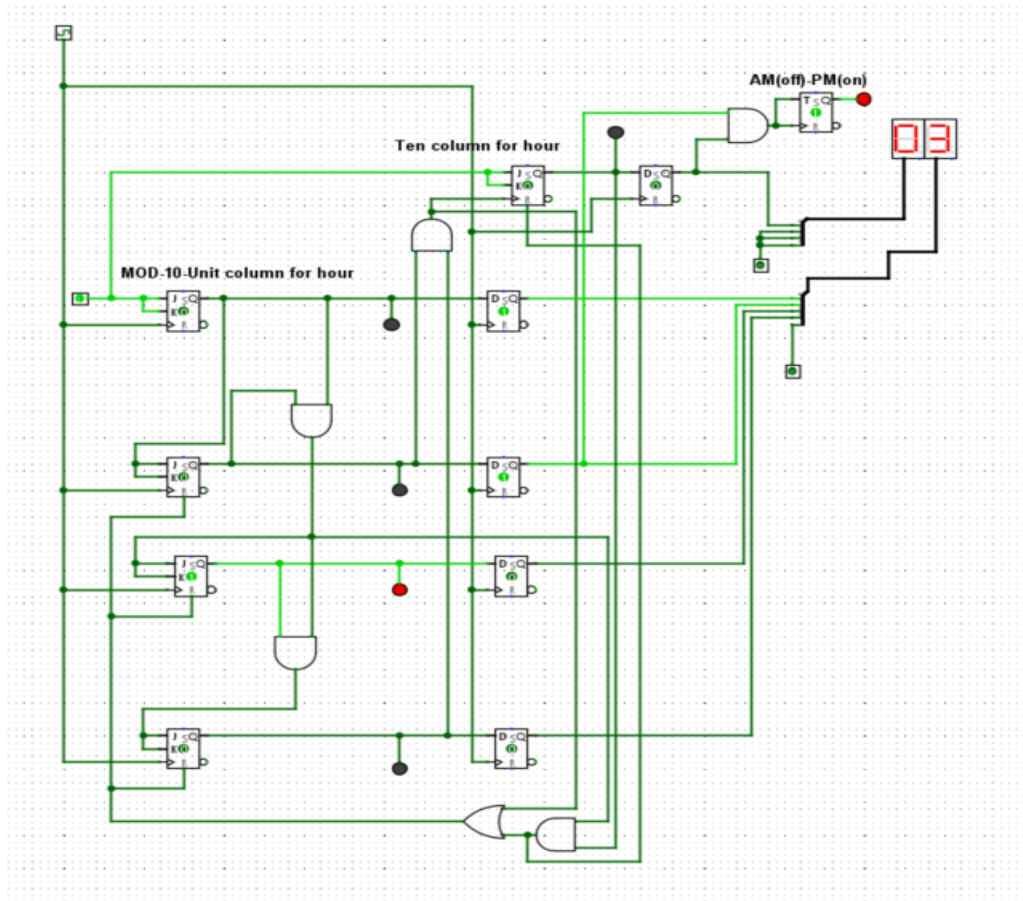
Input	Output
1	0
0	1

Next, I will use an AND gate to control the output. Its input will be connected to both the clock and the Set Time button, meaning that when Set Time is not activated, the clock will not be allowed to control the minute circuit. Finally, I will create an m+ button that will also pass through an AND gate along with the remaining wire of the Set Time. When I press the m+ button, it will add 1 to the Minute circuit and after passing through the two AND Gates, output of 2 AND Gates will connect to the OR Gate.



Stage 3 : Implement hour counter and display

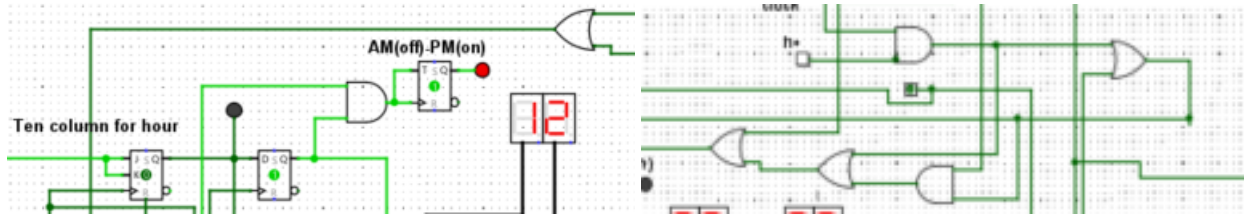
For the Hours Circuit, I also use module 10 to display unit column of the hour circuit , it count form 0 to 9 and wrap back to 0 when it reaches 9 and then I connect it with a JK flip flop. It used to display ten column of the hour circuit. To be specific, in the Hour circuit, when the hour reaches 12, it will roll over to 01 instead of 00.



For the AM/PM , I will use an AND gate and a T flip flop to create it. The two inputs of the AND gate will be connected to the output of the D flip flop used for the Unit column of the hour circuit and the remaining output will be connected to the output of the second D flip flop in the MOD-10 module of the Ten column in the Hour circuit. The output of the AND gate will become the input and clock of the T flip flop. This will allow the LED connected to the output of the T flip flop to turn on and off when the Hour circuit reaches 12. I use T flip flop because it allows to switch between their 2 states (increase by one and decrease by one) by applying a simple pulse to input T. To demonstrate that I will use a truth table of the T flipflop

Clock	T	Q_{n+1}
0	X	Q_n
1	0	Q_n
1	1	Q'_n

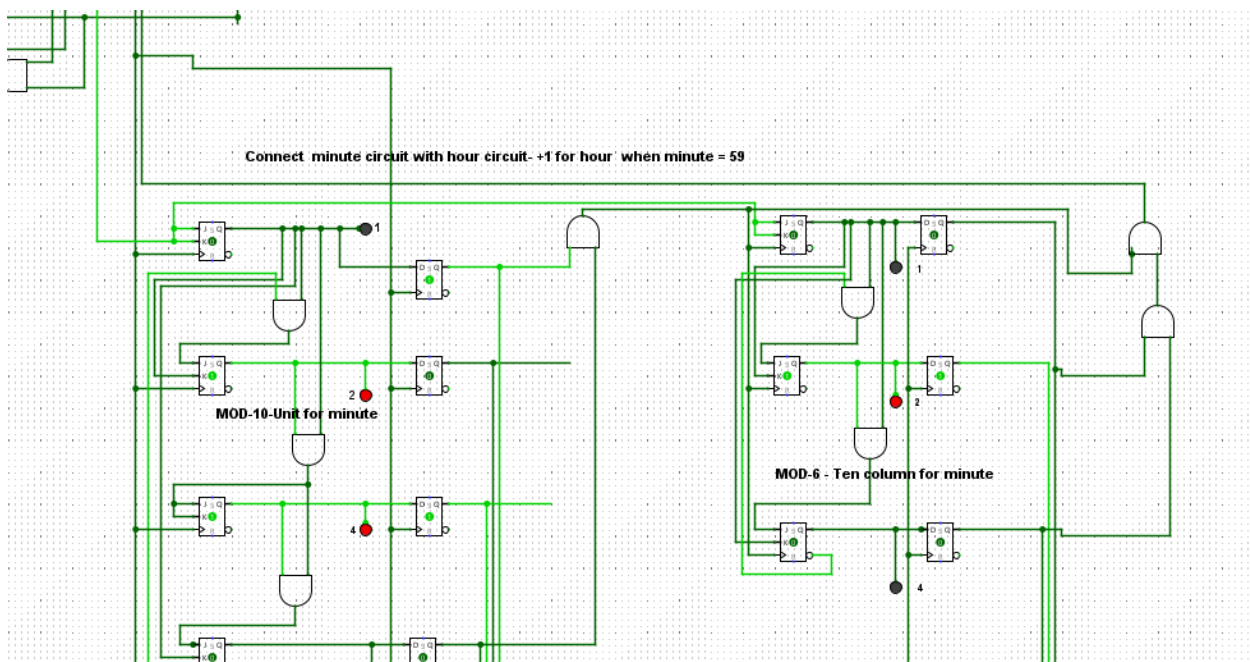
- I also put h+ in stage 3 it same as m+ in stage 3



Stage 4 : Connect minutes counter to hours counter

To connect the minute counter to the hour counter, I use 2 AND gates and 1 OR, 1 AND gate. The first AND gate takes as input the output of the first D flip flop and the output of the third D flip flop in the tens column of the Minute circuit. The output of the first AND Gate is then used as the input for the second AND Gate, along with the outputs of the first and second flip flops in the unit column of the Minute circuit, which means the output when the unit column reaches to 9 . This means that when the Minute cycle reaches 59 minutes, it will increase the Hour circuit by 1.

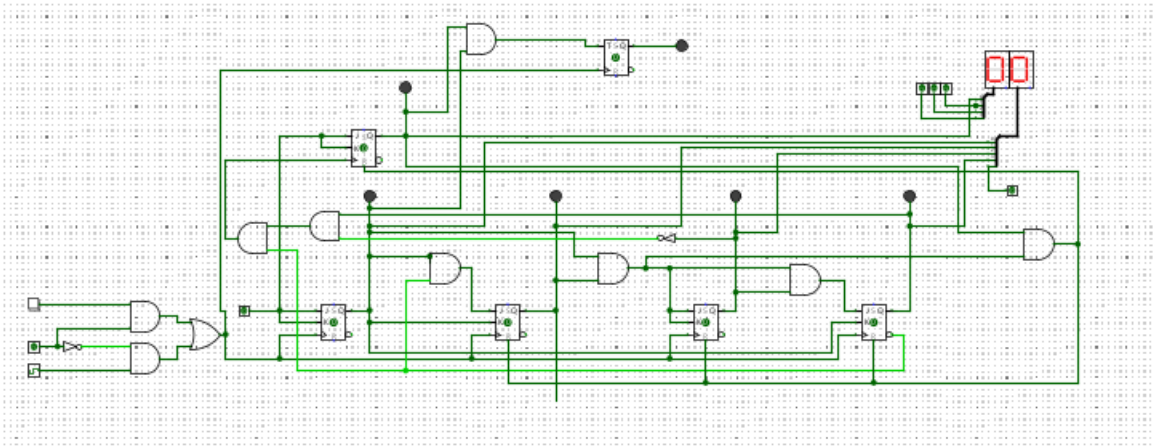
In addition, I connect the output of each J-K flip flop to each D flip flop to avoid the occurrence of illegal values.



3. Assumption I have made :

**Note : The assumption is made when I am developing my circuit, it can be a draft to test many components even though it is working or not.*

For this circuit ,In hour circuit I did not use a reset to reset the module 10 part of the Hour circuit to 0 when it reaches 9. Instead, I only used the complement output (Q') to reset the module 10 to 0 when it reaches 9. However, when I connected the Hour circuit to the Minute circuit, I noticed a delay of one clock cycle when the Hour and Minute values jumped from 9:59 to 10:00. This delay caused synchronization issues between the Hour and Minute circuits. To address this issue, I used a reset instead of relying solely on the complement output. This ensured that the Hour circuit would properly reset to 0 when it reached 9, and the synchronization issue was resolved. Here is your initial Hour circuit design:



4. Unresolved problems

I cannot implement stage 5 Set Alarm functionality because it is quite difficult and complex for me, I think it will take me amount of time to implement , and I am also time-constrained to accomplish it.

5. Screenshots of my working circuit

