Computer Systems – COS10004 – SEMESTER 2 2022

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LAB SESSION – WEDNESDAY 10:30 AM

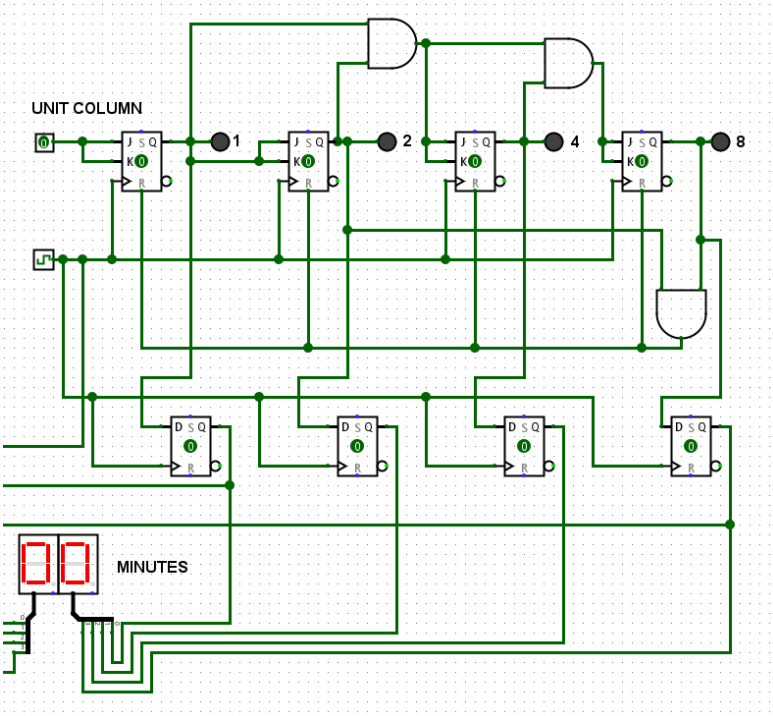
Circuit Description

The circuit design is an implementation of a basic alarm clock that has functions that allow us to set an alarm or change / increment the minutes and hours.

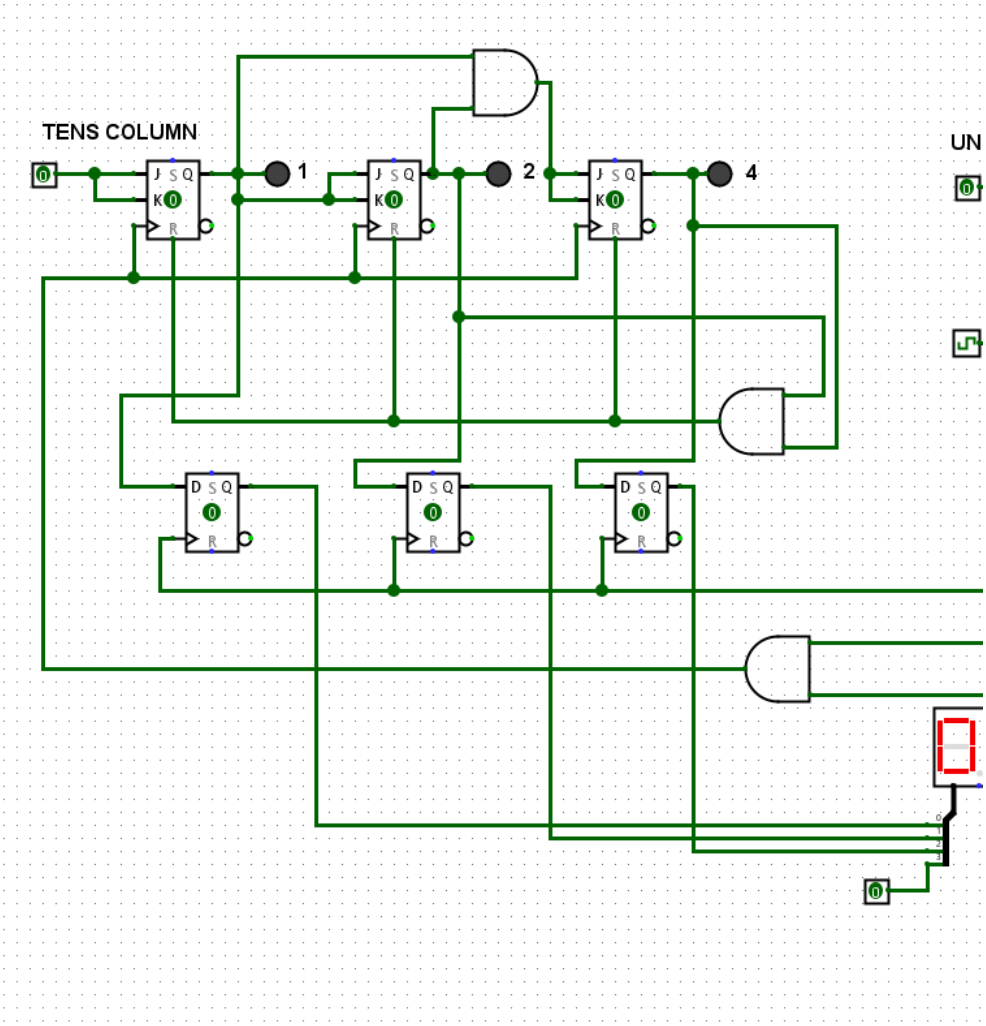
Design Outline

When building my circuit design, I did each stage one by one. I separated the minutes counters and hour counters into 2 parts using components such as JK flip flops and d flip flops.

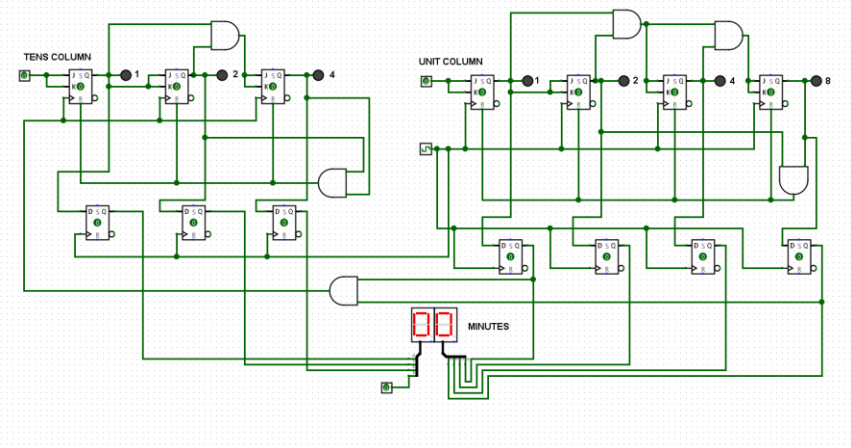
For the **Unit column** in minutes, I used 4 J-K flip flops to MOD until 9 and then rest and 4 D flip flops as buffers to eliminate an illegal state from triggering.



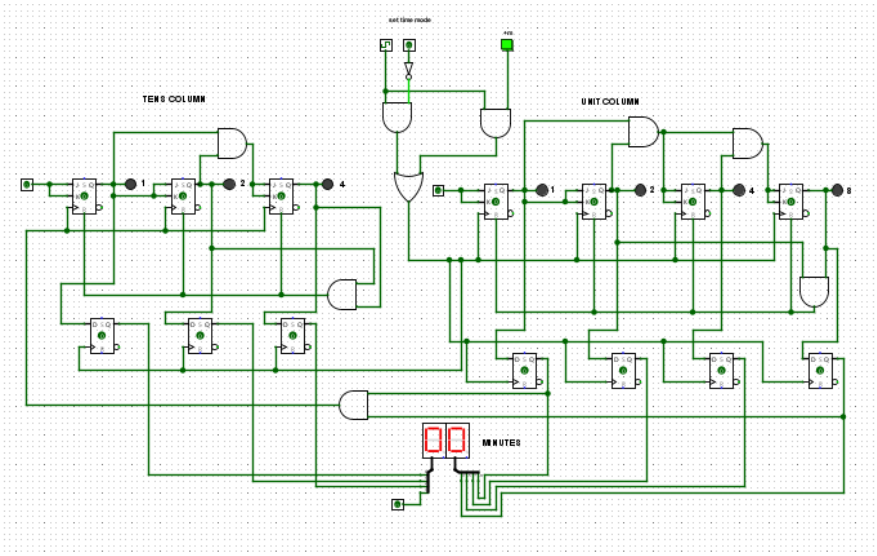
For the **Tens column** in minutes, I used an AND gate that comes from the unit column to trigger the clock pulse to MOD 5 and then reset back to 0 once it hits 5.



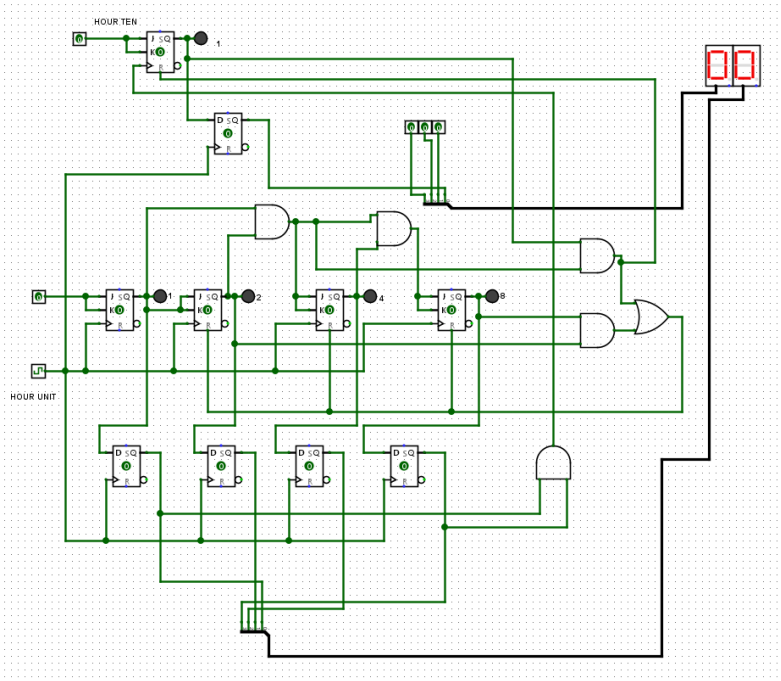
So basically, the entire Minute Circuit is made by a MOD 5 counter and MOD 9 counter to display digits of 00 and 59.



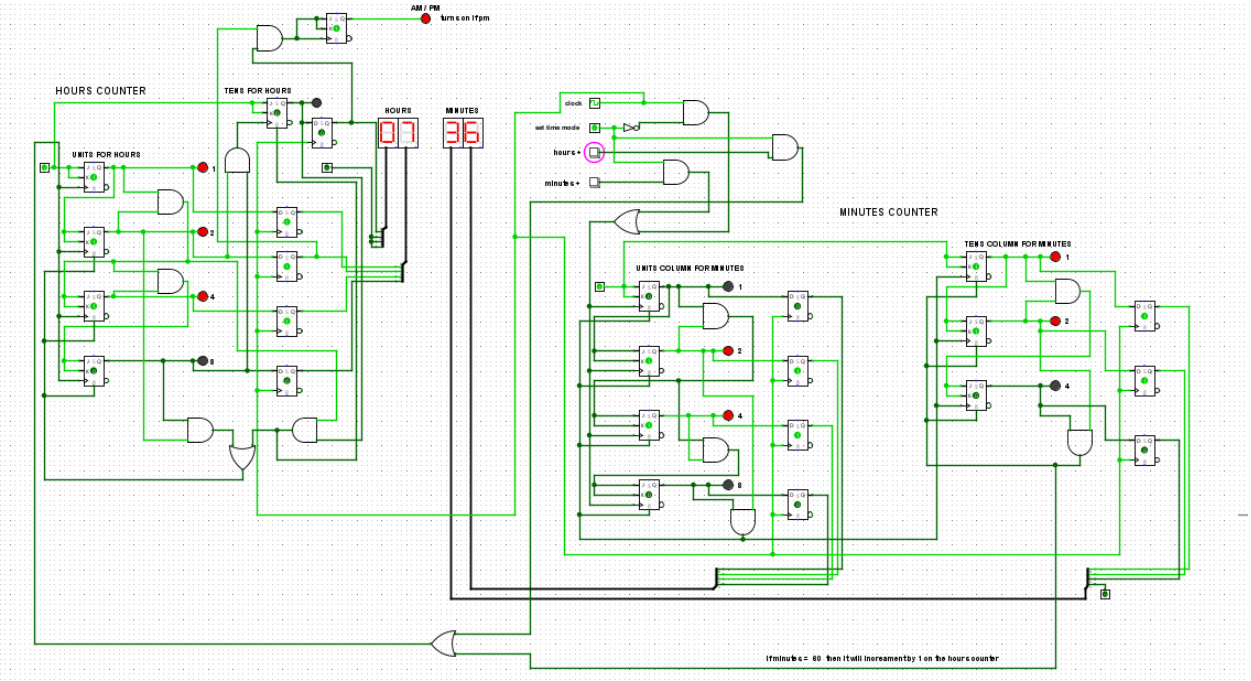
To **extend the functionality of the Minute circuit**, I had to implement away to pause the timer and be able to increment the minutes. To achieve this, I used a NOT gate, 2 AND gates and a OR gate to toggle to **set time mode** where the pulse for the circuit is paused the clock and use a button that acts as minute+ increment to adjust the minute timer.



For the **Hours Circuit**, I copied the same circuit design as minutes but changed the amount of flip flops that count from 0 to 9 in the UNIT column and 0 to 1 on the TEN column where once the timer reaches 12 it resets back to 01 instead of 00.



Once I integrated **the hours and minutes of the clock display**, I implemented the AM / PM LED pin where when 12 is displayed on the hour it will toggle PM to turn on and waits until the clock cycle repeats and hits 12 again to turn off PM and be in AM state.



Unresolved Problems in Design

I was not able to implement the stage 5 Set Alarm and store the time prior displayed before entering Set Alarm mode due to complexity and time constraints.

Final Screenshot of working circuit