Ryerson University

Department of Electrical & Computer Engineering
Faculty of Engineering & Architectural Science

Course Title:	**Digital Systems**
Course Number:	**BME 328**
Semester/Year (e.g.F2016)	**F2020**

Instructor:	**Nagi Mekhiel**

Assignment/Lab Number:	**1**
Assignment/Lab Title:	**Timer-Counter-7 Seg Display Project**

Submission Date:	**2020-09-18**
Due Date:	**2020-09-25**

Student LAST Name	Student First Name	Student Number	Section	Signature*
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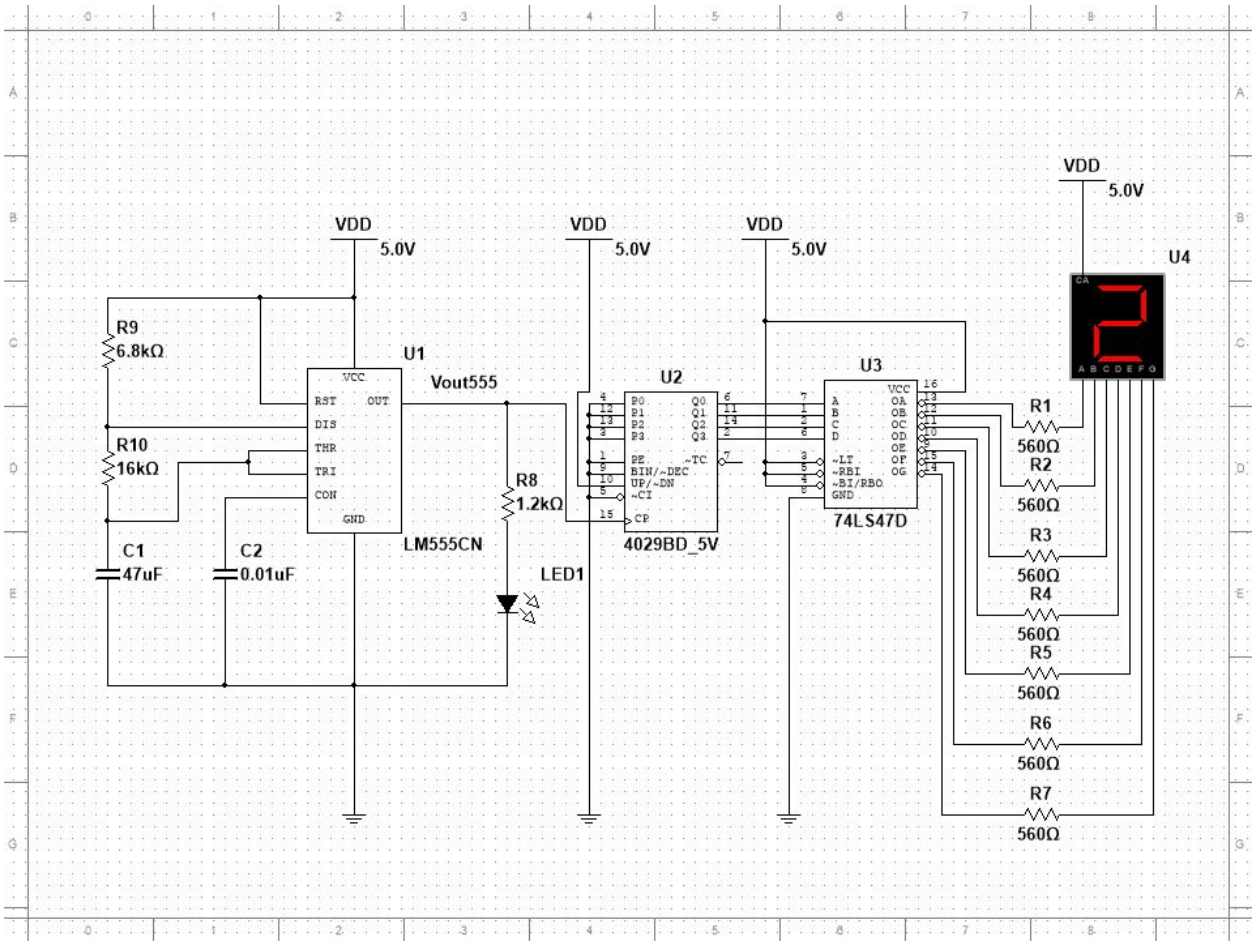
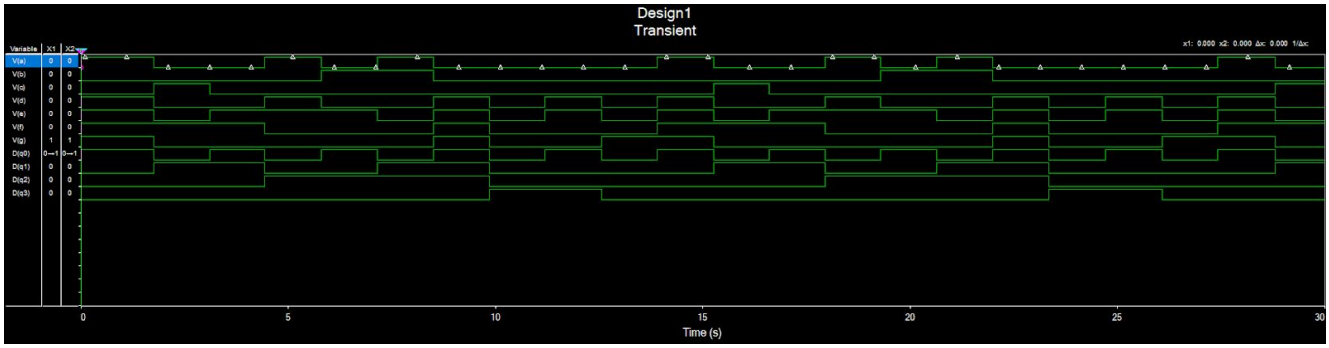
***By signing above you attest that you have contributed to this written lab report and confirm that all work you have contributed to this lab report is your own work. Any suspicion of copying or plagiarism in this work will result in an investigation of Academic Misconduct and may result in a "0" on the work, an "F" in the course, or possibly more severe penalties, as well as a Disciplinary Notice on your academic record under the Student Code of Academic Conduct, which can be found online at: http://www.ryerson.ca/senate/current/pol60.pdf**

SCHEMATIC

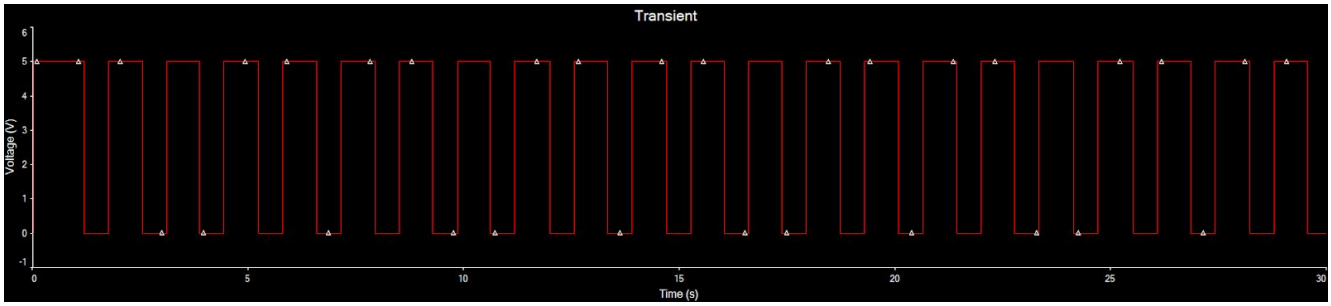


WAVEFORM SIMULATIONS OF OUTPUTS

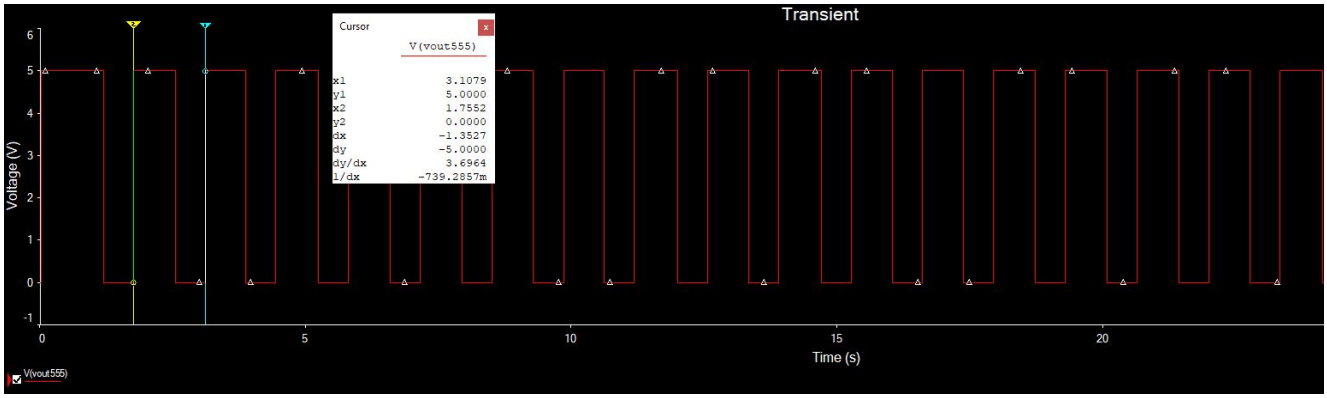
- Timing Diagram showing outputs for A-G and Q0-Q3



- Voltage vs Time graph



MEASUREMENT OF OUTPUT FREQUENCY



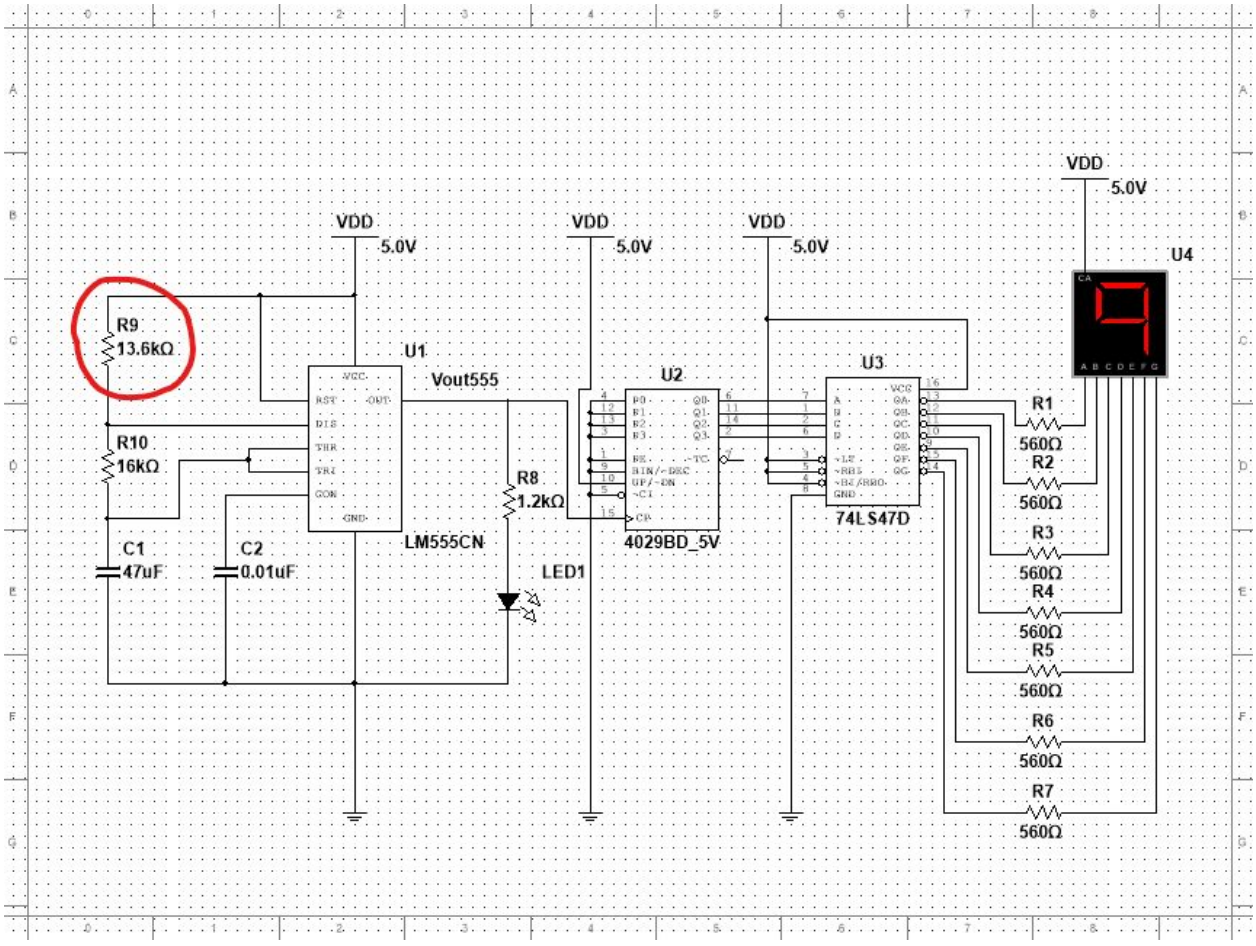
First find the period of the function, (time from peak to peak). From the graph x1 is shown to be at 3.1079 s and x2 is shown to be at 1.7552 s. Taking these values and subtracting them (3.1079-1.7552) gives a period of 1.3527 s. Frequency is the inverse of the period (i.e f = 1/T) so taking the value of the period and inverting it (1/1.3527) gives the output frequency of **0.74 Hz.**

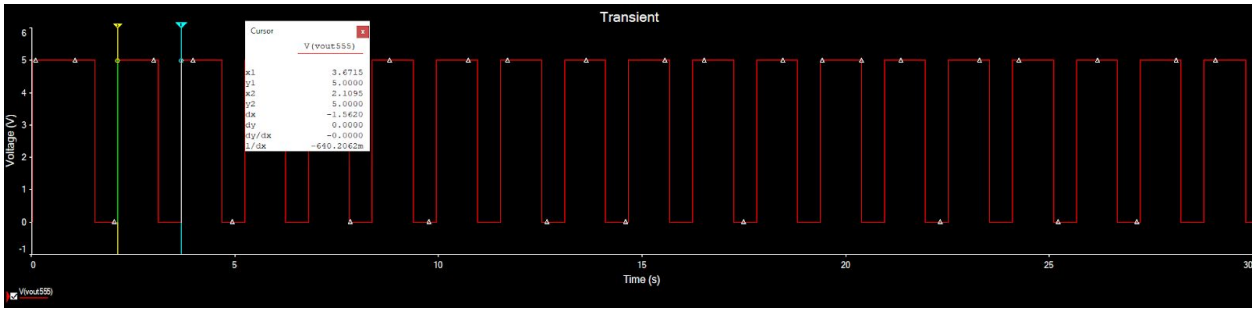
VALUES OF OUTPUTS OF ABCDEFG (when displaying 0-9)

Number being shown	Output on A	Output on B	Output on C	Output on D	Output on E	Output on F	Output on G
0	L	L	L	L	L	L	H
1	H	L	L	H	H	H	H
2	L	L	H	L	L	H	L
3	L	L	L	L	H	H	L
4	H	L	L	H	H	L	L

5	L	H	L	L	H	L	L
6	H	H	L	L	L	L	L
7	L	L	L	H	H	H	H
8	L	L	L	L	L	L	L
9	L	L	L	H	H	L	L

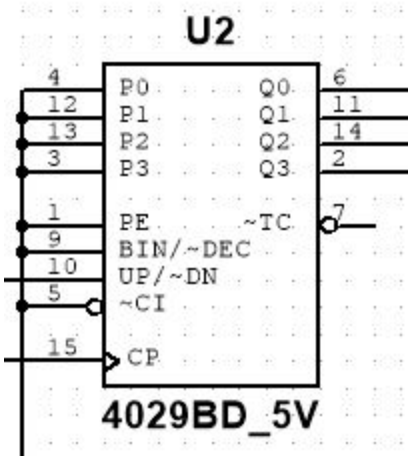
CHANGING THE VALUE OF R9 AND FINDING THE OUTPUT FREQUENCY



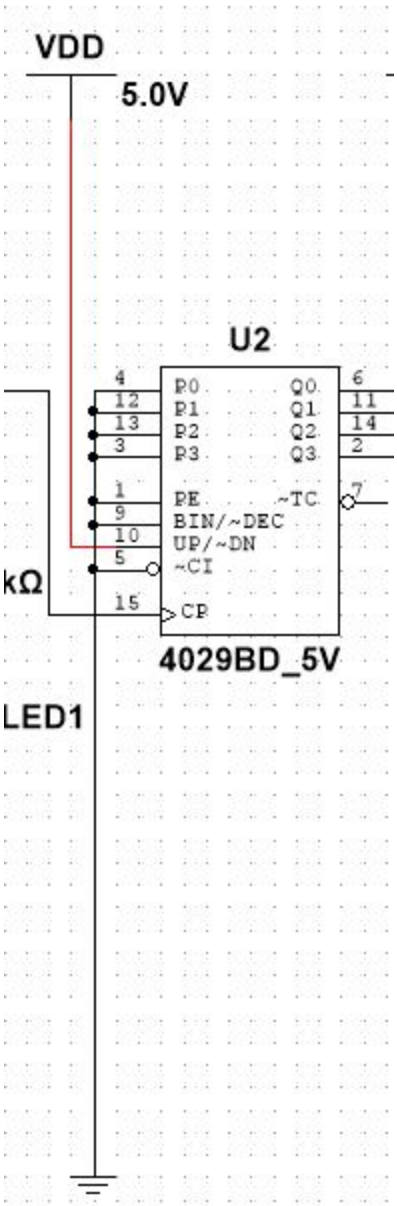


Following the same steps used to calculate frequency before, setup the cursors peak to peak to find the period (in this case it was x1 = 3.6715 and x2 = 2.1095) and subtract the values to find the period of the relation (3.6715-2.1095) by doing this the period is found to be 1.562 s. Taking the inverse of this (1/1.562) gives the output frequency which is found to be **0.64 Hz**.

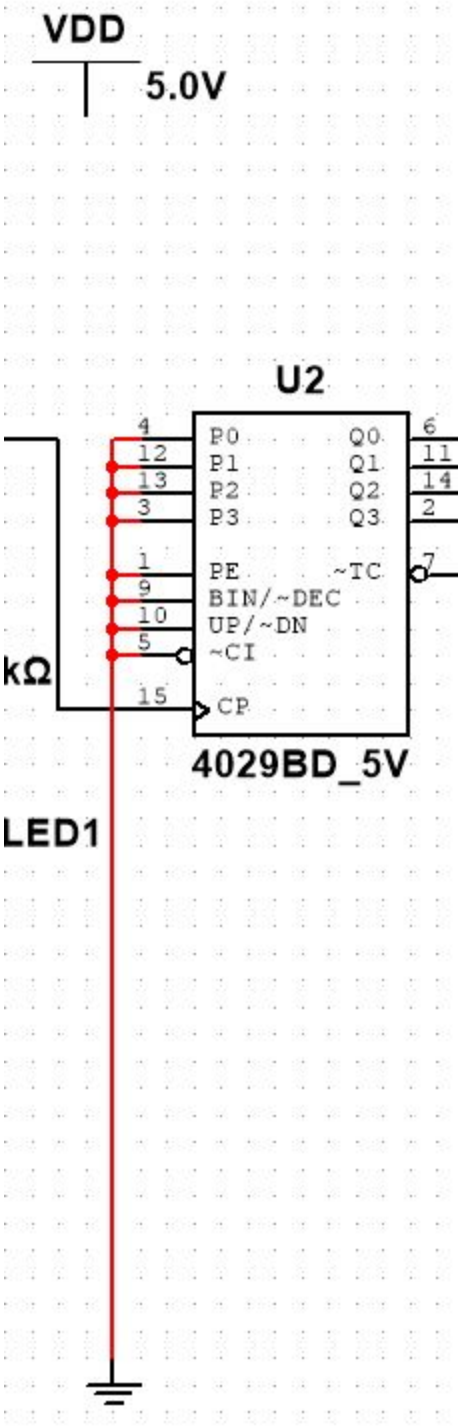
CHANGING THE CONNECTION SO THE COUNTER COUNTS DOWN



The 4029 Counter above is able to either count up or count down depending on the voltage response on pin 10. When a HIGH voltage signal is detected by pin 10 the counter is programmed to count up from 0 to 9 and vice versa when no voltage is detected (i.e LOW voltage signal) the counter is programmed to countdown from 9 until 0. In the current schematic pin 10 is connected to a 5V voltage source which by the above definition, causes the counter to count up from 0-9. Simply changing this so that pin 10 is connected to ground would allow the functionality of the counter to change so that it is counting down.



Counter setup to count up



Counter setup to countdown

REFERENCES

[1] Ryerson University - Department of Electrical & Computer Engineering, "BME 328 Lab 1–Timer-Counter-7 Seg Display Project," Ryerson University, Toronto, 2020.