

2221114

by Kai White

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Research

Pelican crossing is a crossing used by pedestrians by pushing a button when wanting to cross to stop traffic. People should only cross when the green figure is showing and made sure all traffic has stopped to ensure safety (Croydon_Gov, 2023)

Puffin crossings are similar to pelican crossings but they use sensors to determine when the road is clear instead of using set timers like the pelican. And if there was a small amount of people on the crossing as soon as everyone has crossed the traffic will continue. (King, 2022)

ASICs (Application-Specific Integrated Circuits) use one chip to combine multiple circuits to complete one big task at the same time. They do this by making lots of functions on the chip which do different things and they communicate with each other through the chip. (SYSTEMS, 2024)

FPGAs (field programmable gate arrays) are logic blocks connected by programmable interconnects. Can be reprogrammed in the future if any changes we needed to be made after manufactured. (AMD, 2024)

Solar panels could be used to replace the power source that are powering the traffic lights because it is eco-friendlier and more sustainable. They are cheaper to run with low maintenance costs. The technology is always developing and getting better. (EnergySaver, 2023)

The benefit of using LEDs over incandescent bulbs are they use up to 80% less energy and last 30x+ more hours than bulbs. When doing installations/maintenance they are a lot safer as they don't get hot. Also, they don't contain mercury like normally bulbs so that will protect the environment using LEDs over bulbs. (Walker, 2023)

Over 19000 pedestrians had slight to major accidents on/from the road in 2022 so having more traffic light located arounds areas would be beneficial for that number of casualties to lower. (GOV.UK, 2023)

5 second timer

Specification

- Count 0 – 5, then stop
- Inputs – B (wait button pressed)
- Outputs – W (count = 5)

State Allocation

S0 – count = 0

S1 – count = 1

S2 – count = 2

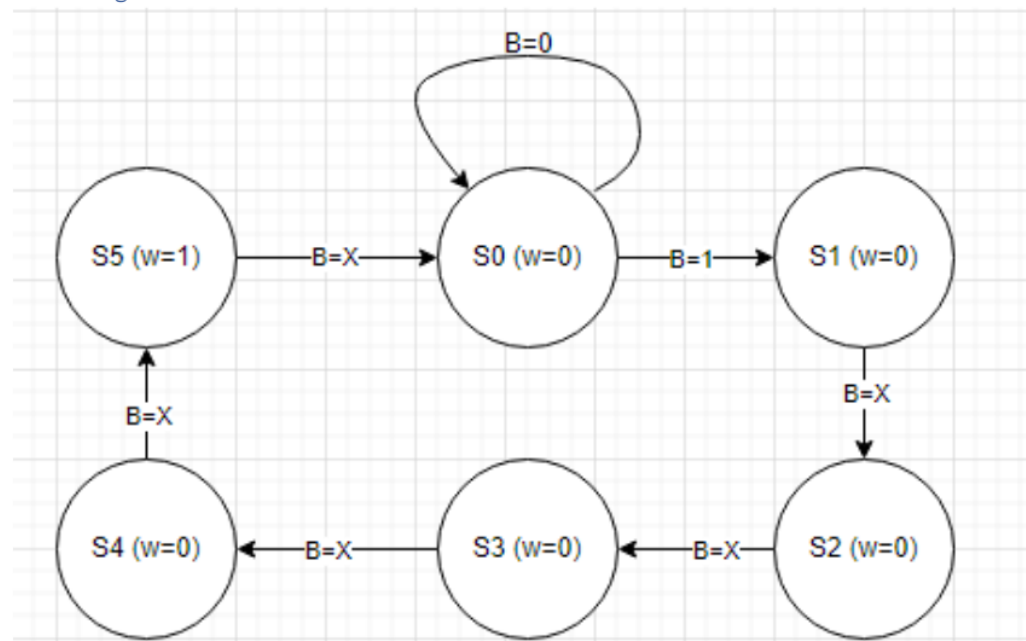
S3 – count = 3

S4 – count = 4

S5 – count = 5

8 STATE FLIP-FLOP

State Diagram



State Table

Present	Next		Present			Next						Output
	B=0	B=1	QA	QB	QC	B=0			B=1			
						QA+	QB+	QC+	QA+	QB+	QC+	
S0	S0	S1	0	0	0	0	0	0	0	0	1	0
S1	S2	S2	0	0	1	0	1	0	0	1	0	0
S2	S3	S3	0	1	0	0	1	1	0	1	1	0
S3	S4	S4	0	1	1	1	0	0	1	0	0	0
S4	S5	S5	1	0	0	1	0	1	1	0	1	0
S5	S6	S6	1	0	1	0	0	0	0	0	0	1
S6	X	X	1	1	0	X	X	X	X	X	X	X
S7	X	X	1	1	1	X	X	X	X	X	X	X

Maps

QB QC BQA	00	01	11	10
00	0	0	1	0
01	1	0	X	X
11	1	0	X	X
10	0	0	1	0

$$QA+ = QB \cdot QC + QA \cdot \text{not}QC$$

QB QC BQA	00	01	11	10
00	0	1	0	1
01	0	0	X	X
11	0	0	X	X
10	0	1	0	1

$$QB+ = QB \cdot \text{not}QC + \text{not}QA \cdot \text{not}QB \cdot QC$$

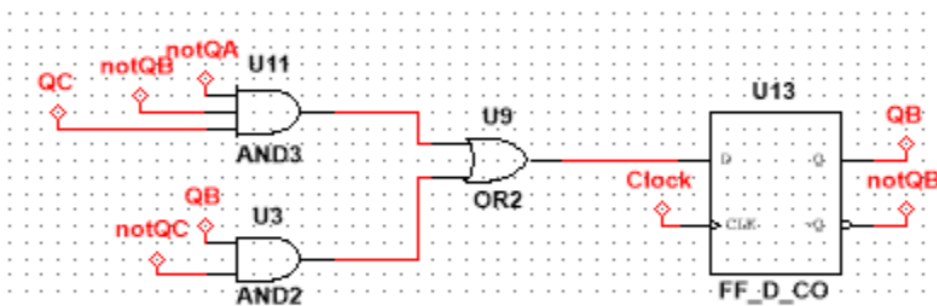
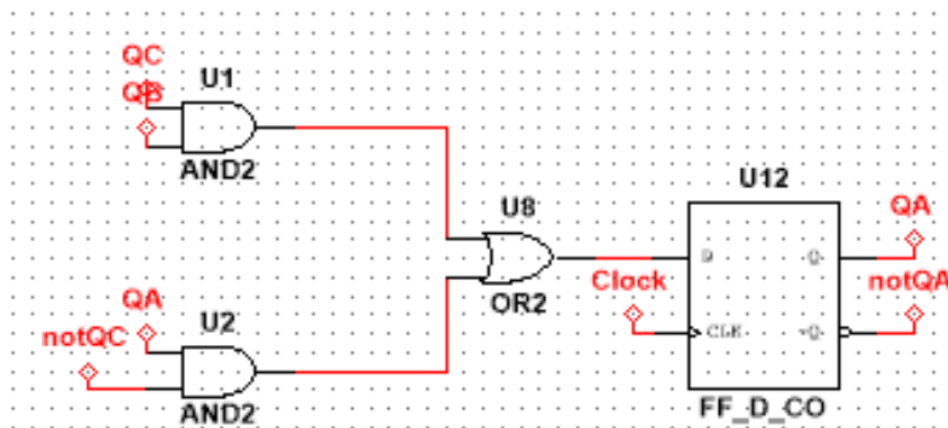
QB QC BQA	00	01	11	10
00	0	0	0	1
01	1	0	X	X
11	1	0	X	X
10	1	0	0	1

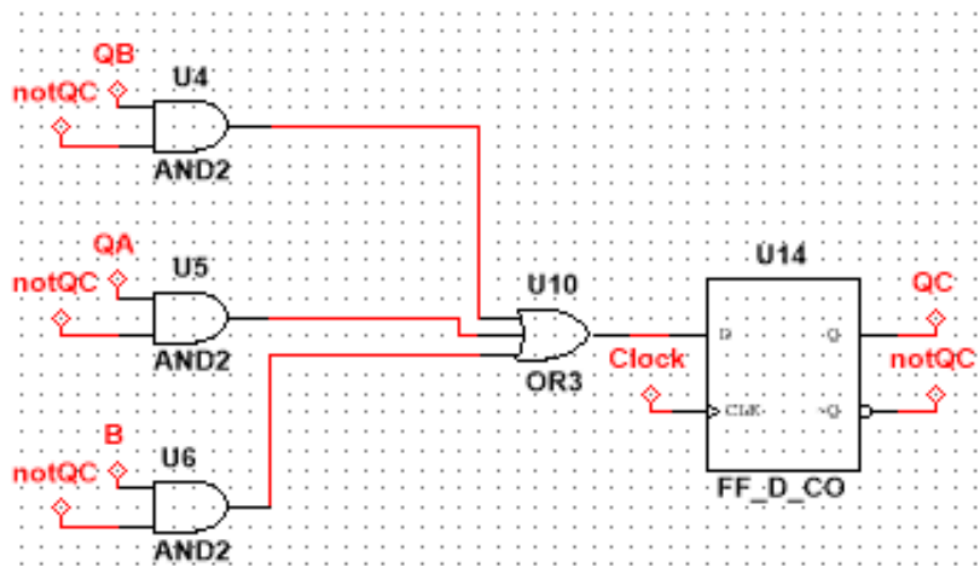
$$QC+ = QB \text{ not} QC + QA \text{ not} QC + B \text{ not} QC$$

QB QC QA	00	01	11	10
00	0	0	0	0
01	0	1	X	X

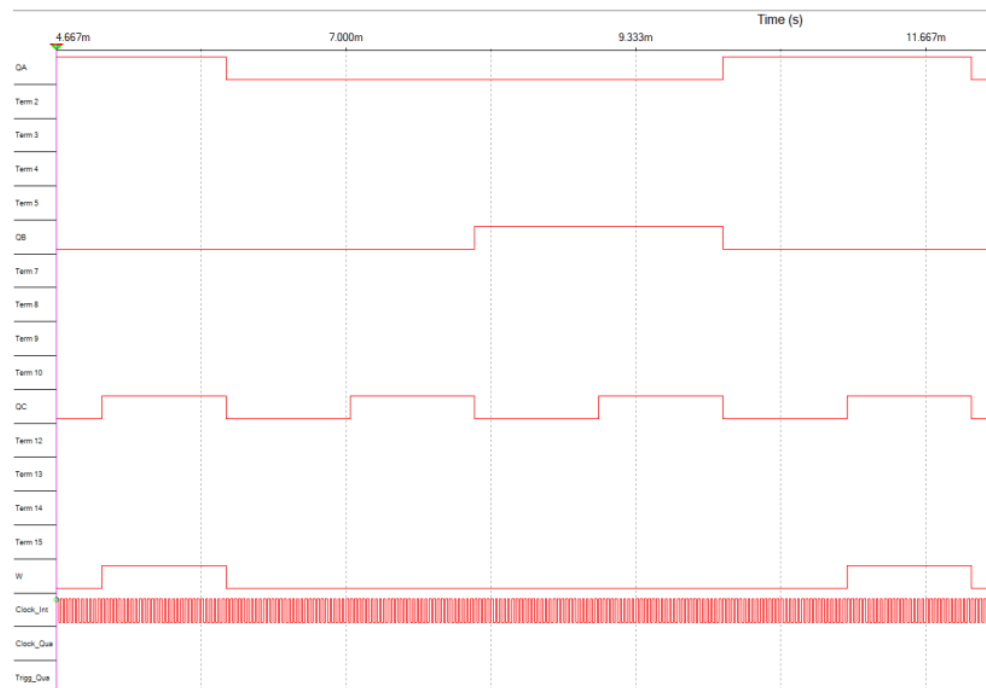
$$W = QA \text{ } QC$$

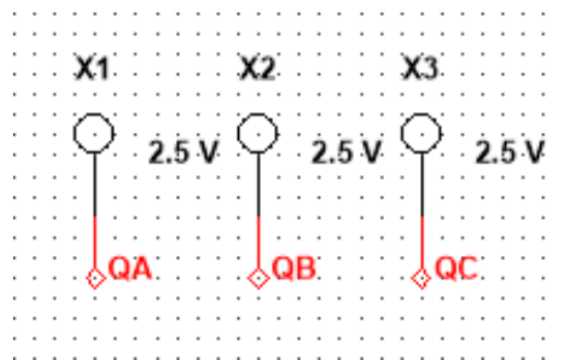
Circuit Diagram





Testing





Tests were carried out on the lamps to see if the sequence is correct by checking if they correspond to counting up in binary.

15 second timer

Specification

- Count 0 – 15, no loop
- Start count when Red = 1
- Output W = 1 when count = 15

State Allocation

S0 – count = 0

S1 – count = 1

S2 – count = 2

S3 – count = 3

S4 – count = 4

S5 – count = 5

S6 – count = 6

S7 – count = 7

S8 – count = 8

S9 – count = 9

S10 – count = 10

S11 – count = 11

S12 – count = 12

S13 – count = 13

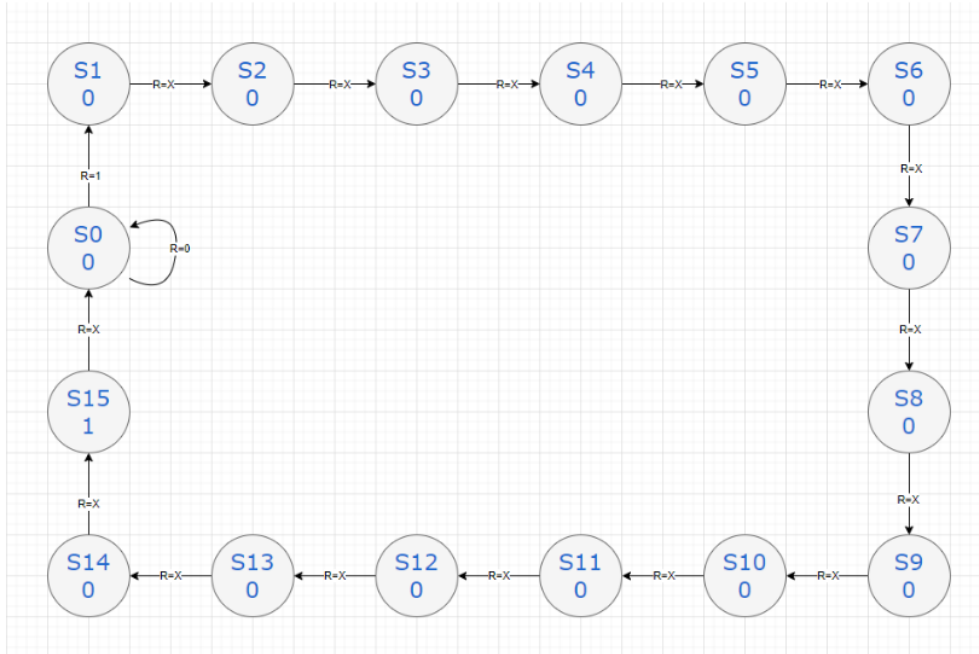
S14 – count = 14

S15 – count = 15

S0 – count = 0

16 STATE FLIP-FLOP

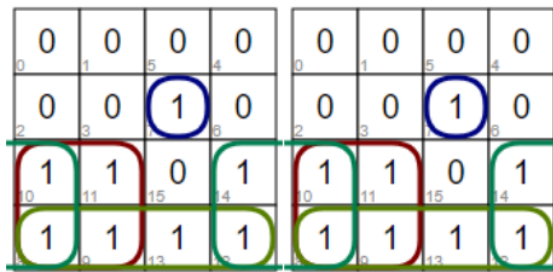
State Diagram



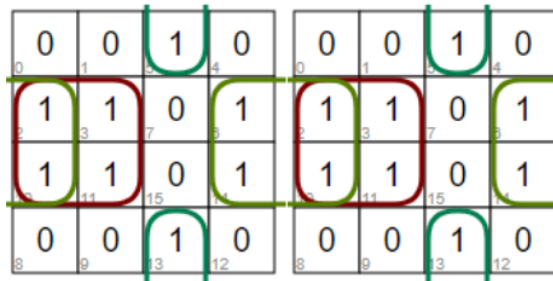
State Table

Present	Next		Present				Next								Output	
							R=0				R=1					
	R=0	R=1	QA	QB	QC	QD	QA+	QB+	QC+	QD+	QA+	QB+	QC+	QD+		w
S0	S0	S1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
S1	S2	S2	0	0	0	1	0	0	1	0	0	0	0	1	0	0
S2	S3	S3	0	0	1	0	0	0	1	1	0	0	1	1	0	0
S3	S4	S4	0	0	1	1	0	1	0	0	0	0	1	0	0	0
S4	S5	S5	0	1	0	0	0	1	0	1	0	1	0	1	0	0
S5	S6	S6	0	1	0	1	0	1	1	0	0	1	1	0	0	0
S6	S7	S7	0	1	1	0	0	1	1	1	0	1	1	1	0	0
S7	S8	S8	0	1	1	1	1	0	0	0	1	0	0	0	0	0
S8	S9	S9	1	0	0	0	1	0	0	1	1	0	0	1	0	0
S9	S10	S10	1	0	0	1	1	0	1	0	1	0	1	0	0	0
S10	S11	S11	1	0	1	0	1	0	1	1	1	0	1	1	0	0
S11	S12	S12	1	0	1	1	1	1	0	0	1	1	0	0	0	0
S12	S13	S13	1	1	0	0	1	1	0	1	1	1	0	1	0	0
S13	S14	S14	1	1	0	1	1	1	1	0	1	1	1	0	0	0
S14	S15	S15	1	1	1	0	1	1	1	1	1	1	1	1	0	0
S15	S0	S0	1	1	1	1	0	0	0	0	0	0	0	0	0	1

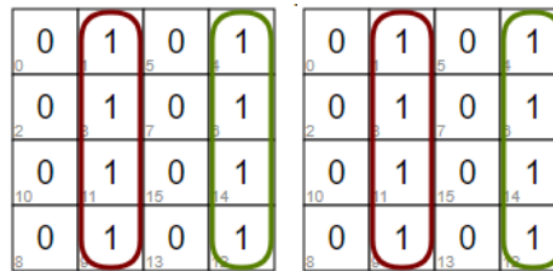
Maps



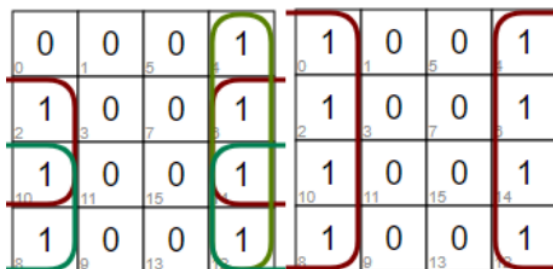
$$QA+ = QA \text{ not } QB + QA \text{ not } QC + QA \text{ not } QD + \text{not } QA \text{ } QB \text{ } QC \text{ } QD$$



$$QB+ = \text{not } QC \text{ } QB + \text{not } QB \text{ } QC \text{ } QD + QB \text{ not } QD$$

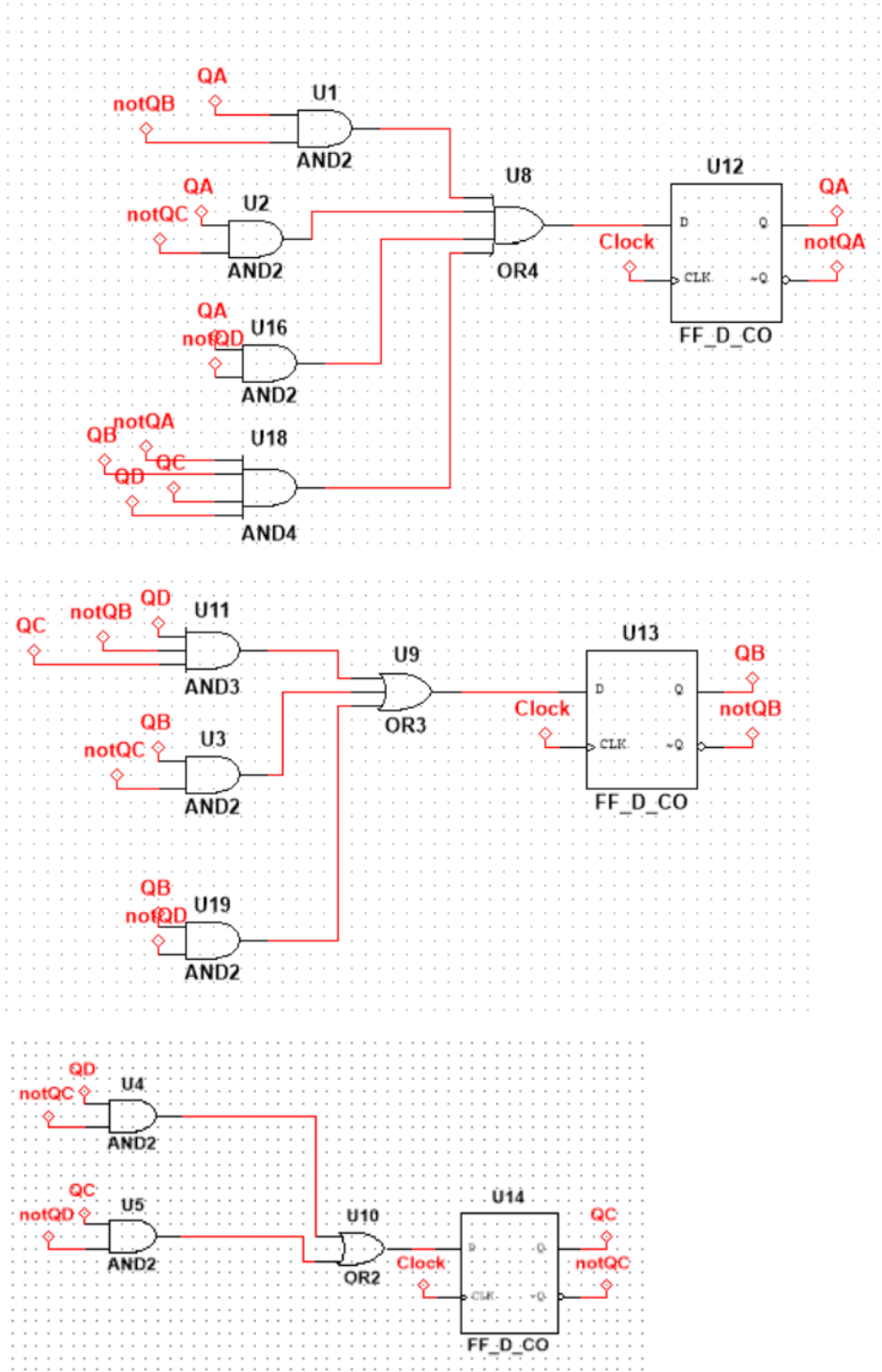


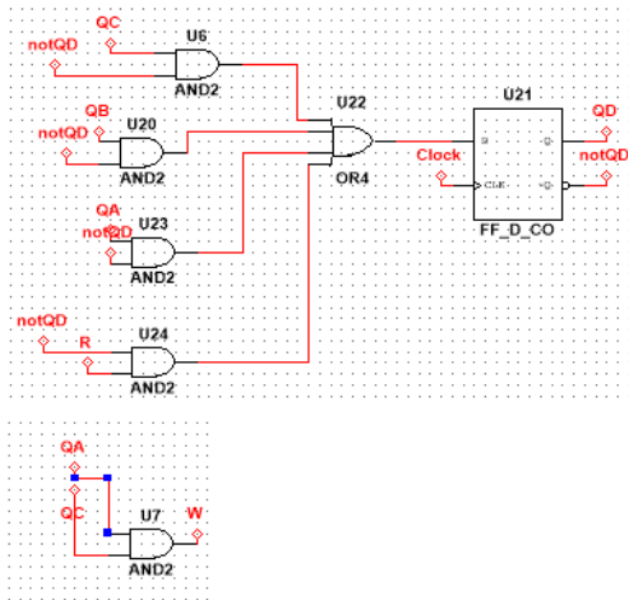
$$QC+ = \text{not } QC \text{ } QD + QC \text{ not } QD$$



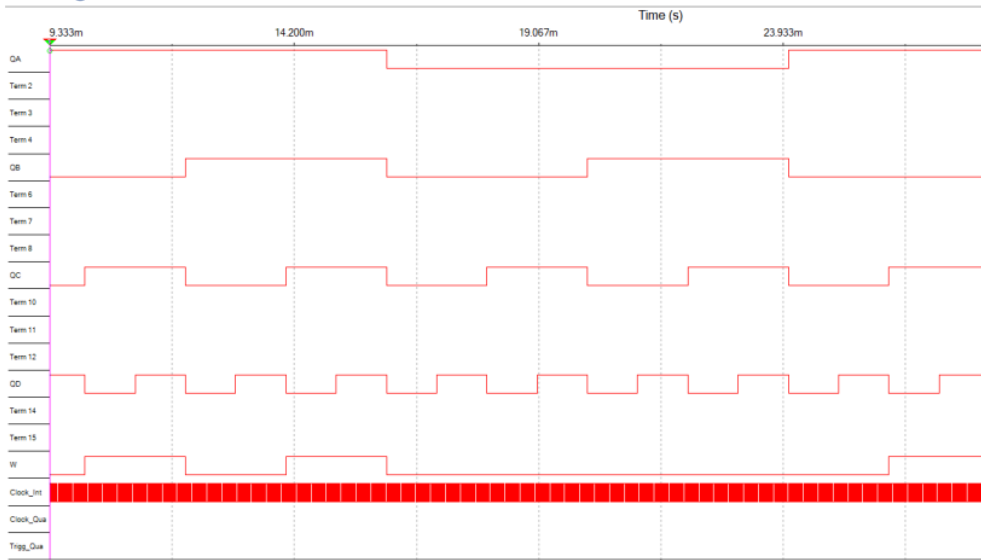
$$QD+ = QC \text{ not } QD + QB \text{ not } QD + QA \text{ not } QD + \text{not } QD \text{ } R$$

Circuit Diagram

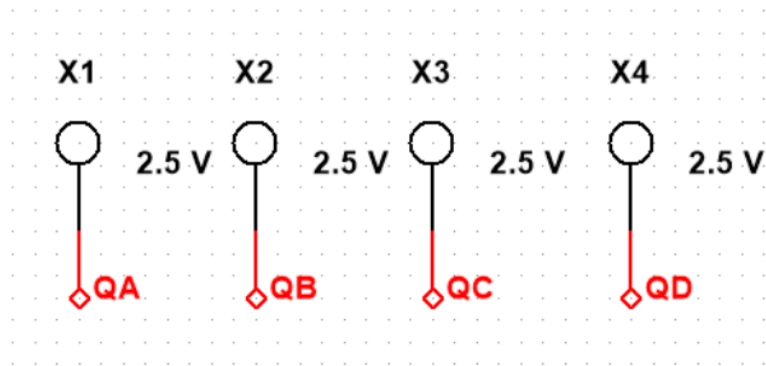




Testing



The logic analyser was used to see if the timer was correctly sequenced by counting to 15.



Tests were carried out on the lamps to see if the sequence is correct by checking if they correspond to counting up in binary.

Traffic Light Sequence

Specification

W = 1 -> Change green light to red

T = 1 -> Change red light to green

Outputs

R – red light

A – amber light

G – green light

State Allocation

S0 – Green light on

S1 – Amber light on

S2 – Amber light on

S3 – Red light on

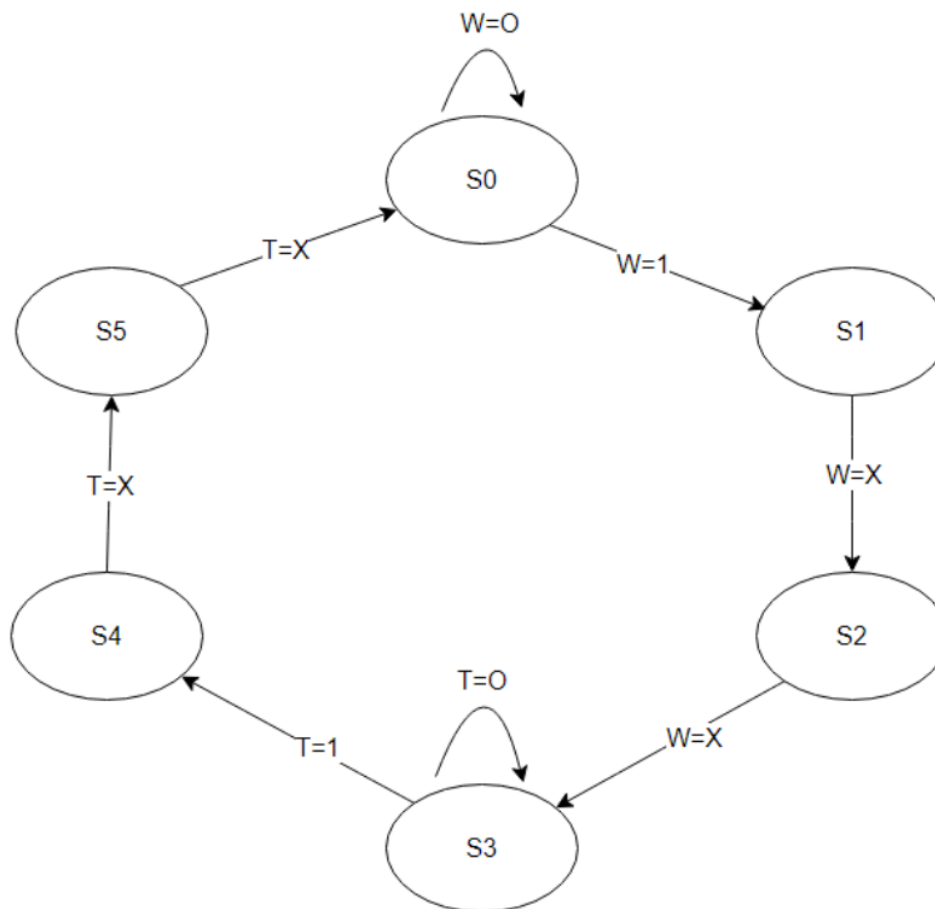
S4 – Red / Amber light on

S5 – Red / Amber light on

If $W = 1$

If $t = 1$

State Diagram



State Table

Current	Next				Current			Next												Output		
	W = 0		W = 1		QA	QB	QC	W = 0						W = 1						R	A	G
	T = 0	T = 1	T = 0	T = 1				T = 0			T = 1			T = 0			T = 1					
								QA+	QB+	QC+	QA+	QB+	QC+	QA+	QB+	QC+	QA+	QB+	QC+			
S0	S0	S0	S1	S1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1
S1	S2	S2	S2	S2	0	0	1	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0
S2	S3	S3	S3	S3	0	1	0	0	1	1	0	1	1	0	1	1	0	1	1	0	1	0
S3	S3	S4	S3	S4	0	1	1	0	1	1	1	0	0	0	1	1	1	0	0	1	0	0
S4	S5	S5	S5	S5	1	0	0	1	0	1	1	0	1	1	0	1	1	0	1	1	1	0
S5	S0	S0	S0	S0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
S6	X	X	X	X	1	1	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
S7	X	X	X	X	1	1	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Maps

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	X	X	1	1	0	X	X	1	0	X	X	1	0	X	X	1	0	X	X	1	0
1	0	X	X	1	1	0	X	X	1	0	X	X	1	0	X	X	1	0	X	X	1	0
0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0

$$QA+ = QA \text{ not } QC + T \text{ } QB \text{ } QC$$

0	1	1	1	0	0	1	1	0	1	1	1	0	0	1	1	0	0	1	1	0	0	0
0	0	X	X	0	0	X	X	0	0	X	X	0	0	X	X	0	0	X	X	0	0	0
0	0	X	X	0	0	X	X	0	0	X	X	0	0	X	X	0	0	X	X	0	0	0
0	1	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0

$$QB+ = QB \text{ not } QC + \text{not } T \text{ } QB + \text{not } QA \text{ not } QB \text{ } QC$$

0	0	1	1	1	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0	0
1	0	X	X	1	1	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	1	0
1	0	X	X	1	1	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	1	0
0	0	0	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0

$$\text{not } QC \text{ } W + \text{not } T \text{ } QB + QA \text{ not } QC + QB \text{ not } QC$$

0	0	1	0
1	1	X	X

$$R = R + A G$$

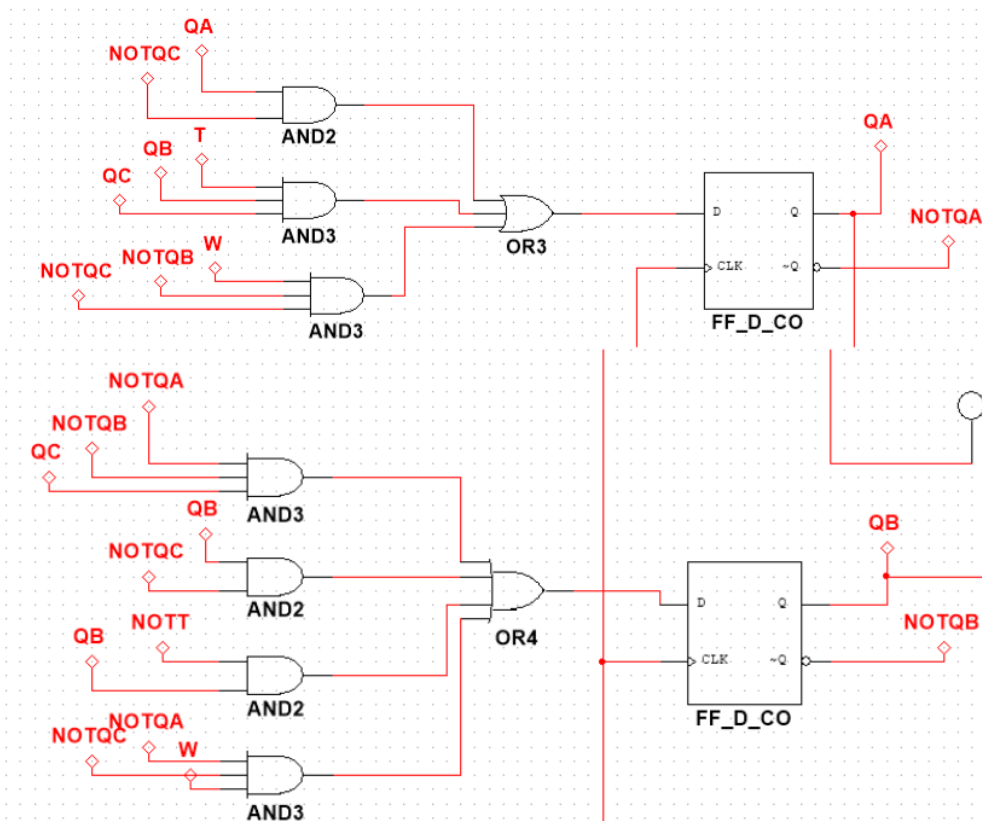
0	1	0	1
1	1	X	X

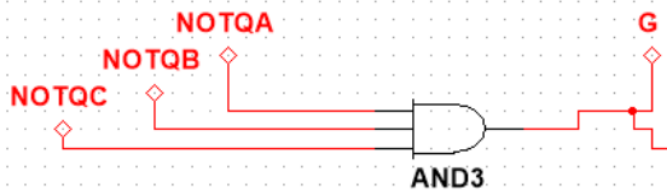
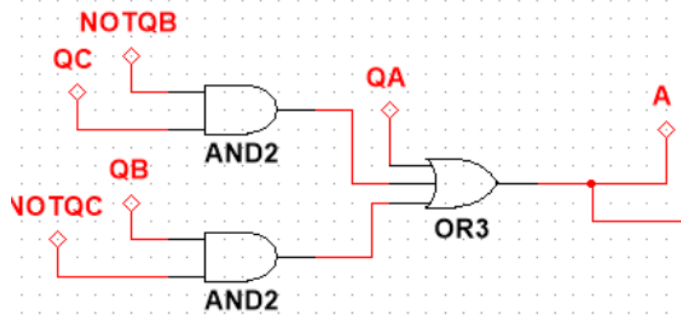
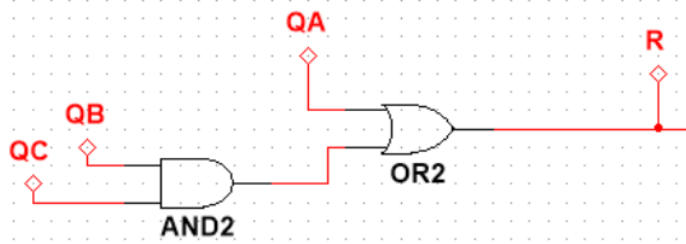
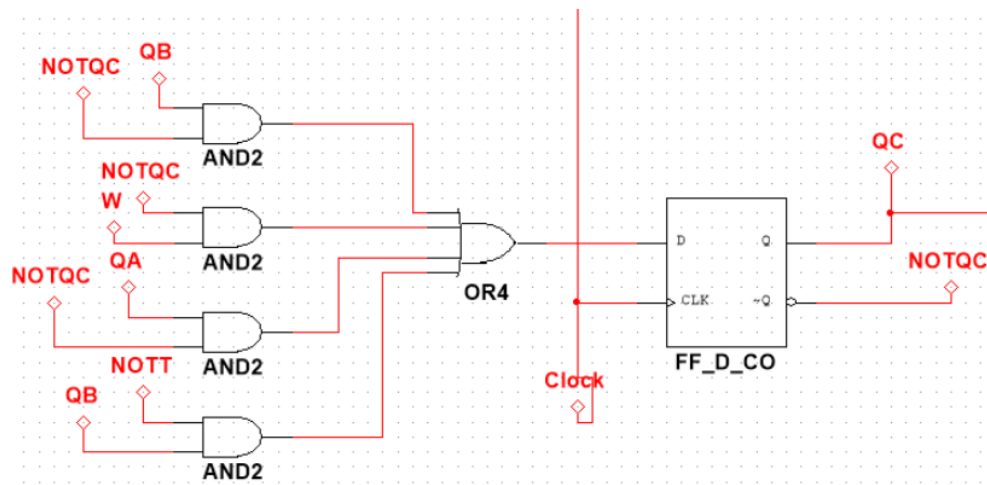
$$A = R + \text{not} A G + A \text{ not} G$$

1	0	0	0
0	0	X	X

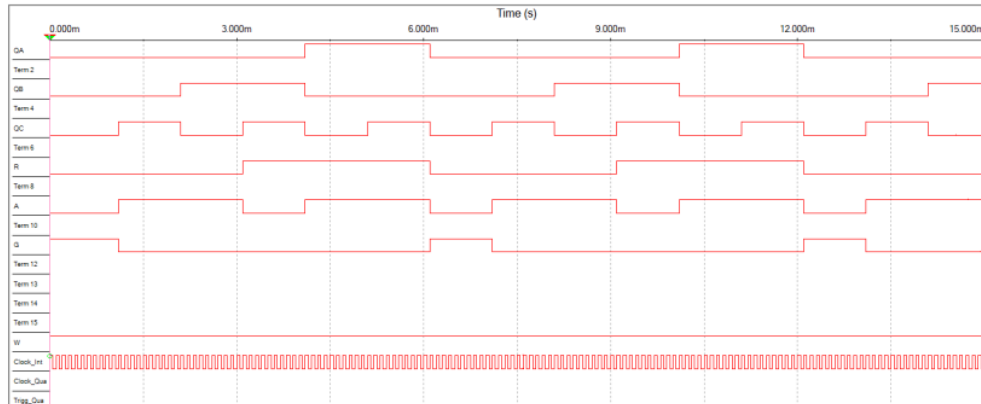
$$G = \text{not} R \text{ not} A \text{ not} G$$

Circuit Diagram

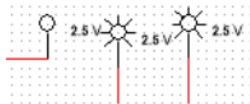




Testing

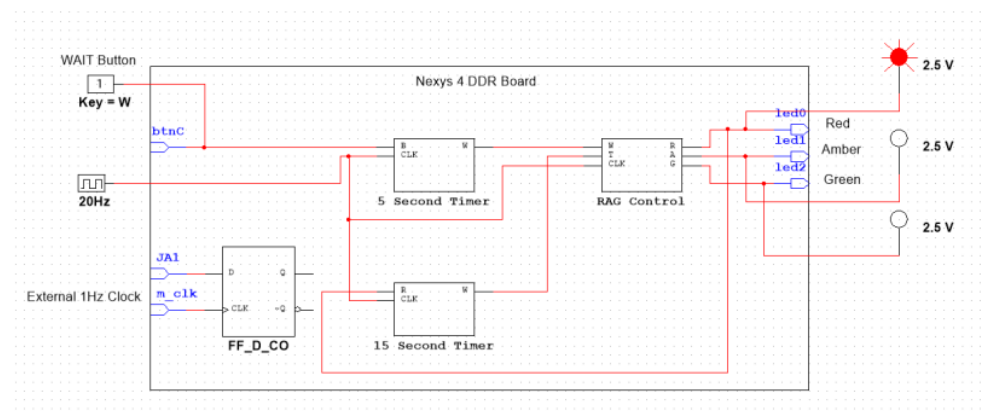


This test shows that all the lights come on in the right order. For example, red is never on the same time as green. And all the other colours have the correct sequence.



Tests were carried out on these lamps checking to see if they show the traffic sequence correctly, toggling T and W to check if it was fully functional.

Final Result



All timers are connected and correctly sequenced.

Analysis

All individual circuits were tested by using the logic analyser and bulbs to simulate the process. So if any of the gates were missing or incorrect the sequence would not work correctly and this would be seen either on the bulbs on the analyser. When testing make sure that the Hz of the clock matching the PC so that tests are accurate and visible.

Evaluation

From the design sections you can see there is a lot more states to be used in the flip flops this means that more stages can be implemented in the future with a few changes to the gates depending on the Karnaugh maps.

Conclusion

To conclude starting off a five second time was built and tested for waiting when a pedestrian has pressed the button. Then a fifteen second timer was made giving the pedestrians time to cross the road then the lights should go green letting traffic continue. The final traffic light sequence was made so when the button isn't pressed the traffic lights will continue in their order, until the button is pressed.

Testing was done by using a logic analyser in multisim which showed the order of each variable for the sequences. Therefore, you could see if any were overlapping and if the timing on the variables were correct. Also, lamps were installed on multisim to test each timer to see if they have the correct sequence.

Recommendations could be installing a pressure plate so to press the button you have to be standing on the pressure plate for it to activate, this will stop people from pressing the button and walking away.

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FINAL GRADE

GENERAL COMMENTS

60/100

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GRADING FORM: CSG-RUBIC

KAI WHITE

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RESEARCH-INFORMED LITERATURE



There was evidence of further reading and research with the inclusion of a reference list and appropriate in text referencing. Your interpretation and understanding of the additional research was good. Your references were appropriate to the task and your reference list was of an appropriate length for this assignment.

6

KNOWLEDGE AND UNDERSTANDING



The knowledge and understanding of the subject demonstrated by this assignment was reasonably detailed and mainly accurate. There were very few gaps in your knowledge of the basic concepts and your understanding of the higher level concepts was demonstrated to a limited degree - you could

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have explained in more detail how the circuit evolved. Further work – Your explanations need to be more detailed and written with a greater emphasis on critical evaluation rather than description.

ANALYSIS



Your analysis of the task was generally satisfactory, both in class and as shown in this assignment, however it did tend more towards descriptive rather than analytical. You have demonstrated some analytical skills and your approach to the task was logical. You wrote a short conclusion that demonstrated some skills in analysing quantitative and qualitative data, however this was generally basic in nature. Further work – in your conclusion, you should relate the results to the original specification and to accepted theory and provide a detailed critical analysis of this.

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PRACTICAL APPLICATION AND DEP.



Your application of practical skills for this task was generally good. You used the resources available appropriately when designing the circuit and you used appropriate options for testing and evaluating the circuit performance. You managed to design an efficient circuit that functioned within the specification and achieved this by only asking for assistance when appropriate. Your results were comprehensive and allowed for a good conclusion to be attempted.

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SKILLS FOR PROFESSIONAL PRAC.



Your application of practical skills for this task was generally good. You used the resources appropriately when designing the circuit and you used appropriate options for testing and evaluating the circuit performance. You managed to design an effective circuit that functioned within the specification and achieved this by only asking for assistance when appropriate thus demonstrating some advanced problem solving skills. Your results were comprehensive and allowed for a detailed conclusion to be attempted.

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