

Computer Systems Assignment 1

Answer the questions and submit a PDF to Moodle with your answers. We advise you use the tools covered in the module as far as possible and paste images into a Word document or similar. Then convert to PDF, and upload.

For Boolean expressions you can either write these by hand and add photos, or use Word's mathematical equation input in the Insert menu.

1. Design a simple logic circuit using the following building blocks of logic design.

(a) $(\neg A \wedge B) \vee (A \wedge \neg B \wedge C)$

[4]

(b) $\neg(A \wedge (B \vee C)) \wedge B$

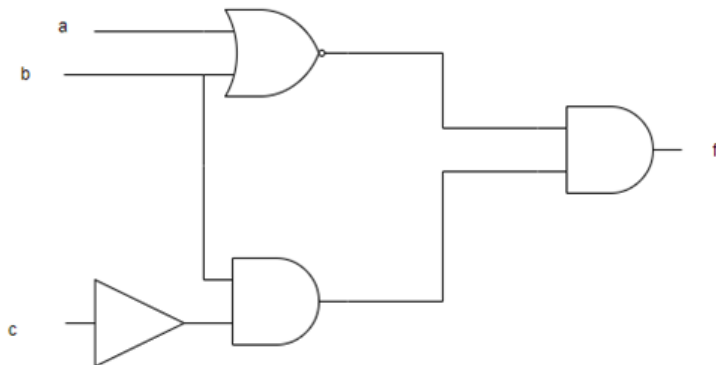
[4]

(c) $\neg(A \wedge B) \vee \neg(\neg A \vee C)$

[4]

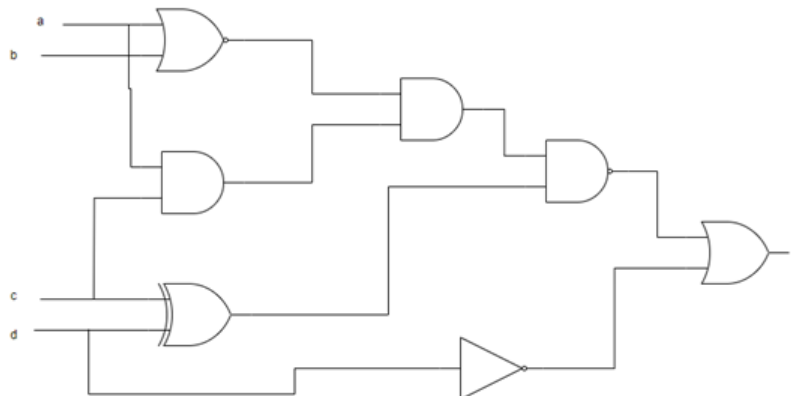
12 points

2. Write the following logic circuits as Boolean expressions.



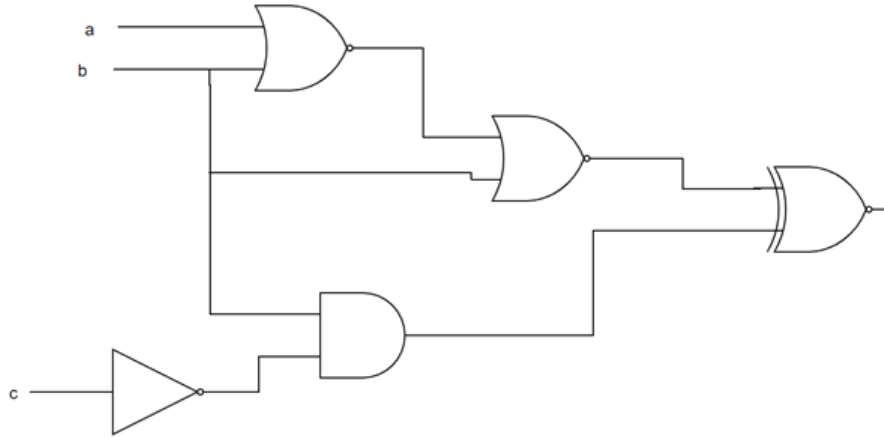
(a)

[3]



(b)

[3]



(c)

[5]

11 points

3. For the logic circuits in Question 2 define the truth tables.

(a)

[2]

(b)

[2]

(c)

[3]

7 points

4. Construct the finite state machines given the state transition tables provided.

(a)

Start State	Input	End State
-	Initial	q_0
q_0	1	q_0
q_0	0	q_1
q_1	1	q_2
q_1	0	q_1
q_2	0	q_2
q_2	1	q_3
q_3	0	q_3
q_3	1	q_3

[2]

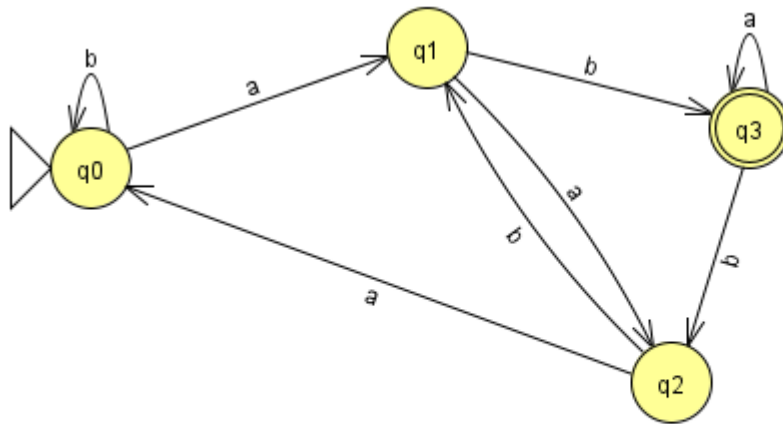
(b)

Start State	Input	End State
-	Initial	q_0
q_0	b	q_1
q_0	a	q_0
q_0	c	q_4
q_1	b	q_1
q_1	a	q_2
q_1	c	q_0
q_2	b	q_1
q_2	a	q_2
q_2	c	q_3
q_3	c	q_4
q_3	b	q_2
q_3	a	q_3
q_4	c	q_4
q_4	b	q_1
q_4	a	q_3

[4]

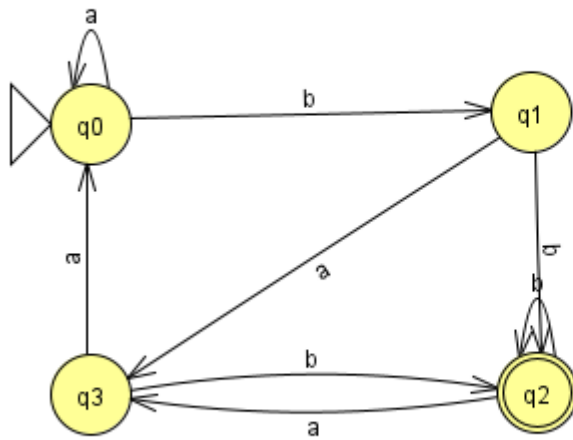
6 points

5. Provide the state transition table for the following state machines.



(a)

[3]



(b)

[3]

6 points

6. For the two state machines provided in Question 5, determine if the following strings will be accepted by the state machine.

(a) *abbaa*

[2]

(b) *bbaaba*

[2]

(c) *abba*

[2]

- (d) *baba* [2]
 (e) *babbbaba* [2]

10 points

7. Design state machines that will accept the following string definitions.

- (a) A string of 0s and 1s such that any string with at least 101 is accepted. [2]
 (b) A string of 0s and 1s such that any string is a multiple of four digits in length, ignoring any leading zeros. For example, [4]
 • 1100 is acceptable (length of string is four).
 • 0110 is not acceptable (length without leading 0s is three).
 • 001000 is acceptable (length of string without leading 0s is four).
 • 10000000 is acceptable (length of string is eight, which is a multiple of four).
 (c) A string of 0s and 1s such that three 1s appear in a row anywhere in the string. [2]

8 points

Question	Points	Score
1	12	
2	11	
3	7	
4	6	
5	6	
6	10	
7	8	
Total:	60	