Computer Science

10. Boolean Logic

Marking Scheme

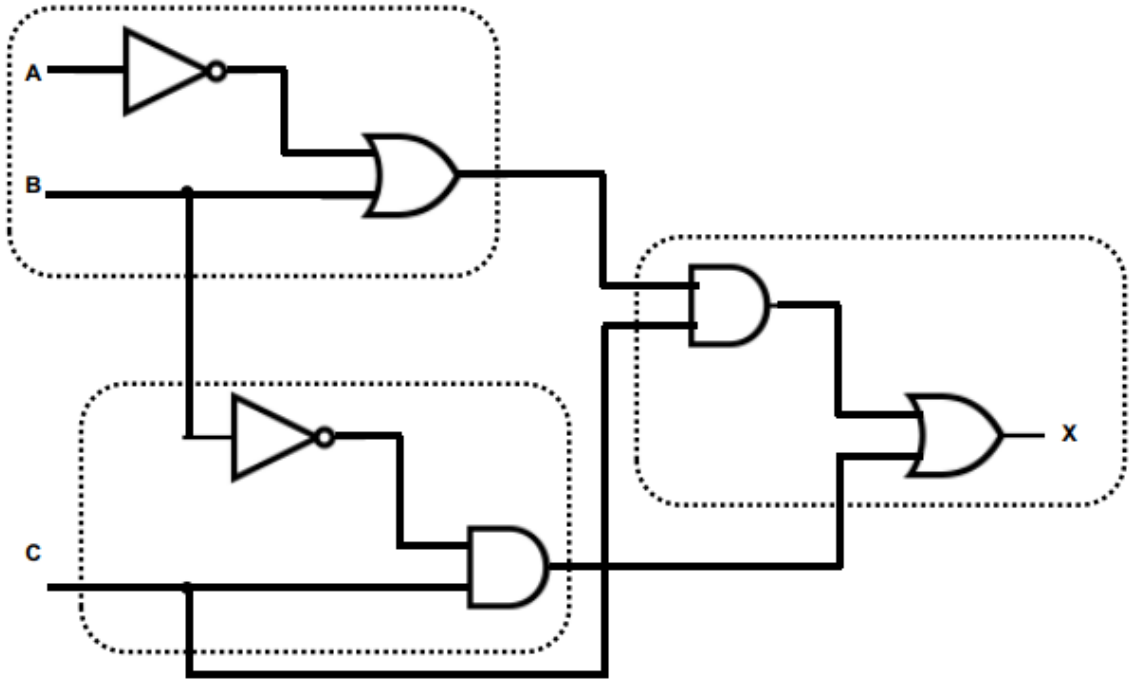
Q1)

(a)

A	B	C	Working	X	
0	0	0		1	] 1 mark
0	0	1		0	
0	1	0		0	] 1 mark
0	1	1		0	
1	0	0		0	] 1 mark
1	0	1		1	
1	1	0		1	] 1 mark
1	1	1		1	

[4]

(b) 1 mark per dotted section



[3]

(c) X is 1 if:

(A is 1 OR B is 1) (1 mark)

AND (1 mark)

(B is 1 OR C is NOT 1) (1 mark)

accept equivalent ways of writing this:

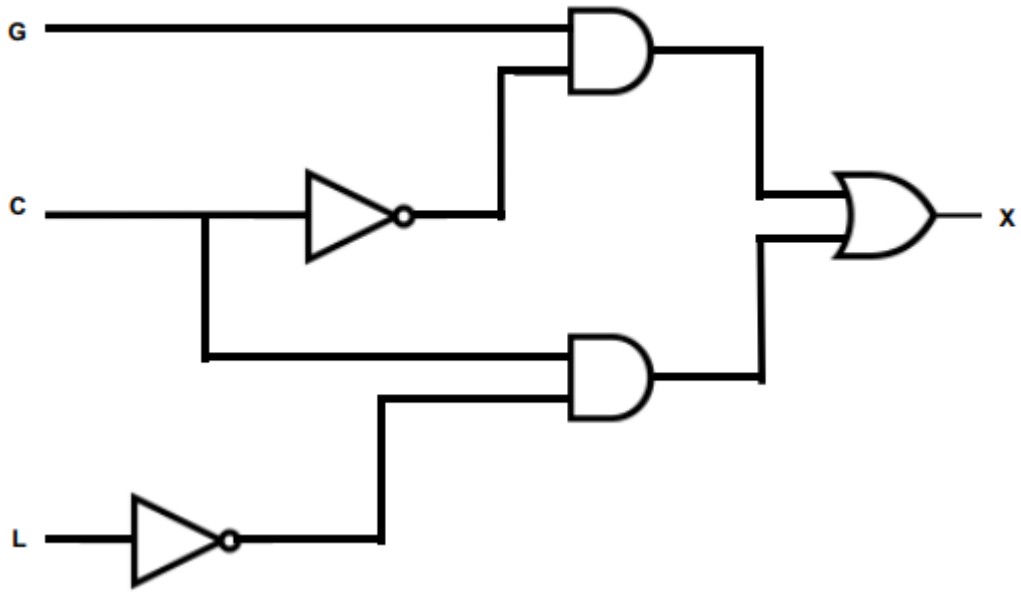
e.g. (A OR B = 1) AND (B OR NOT C = 1)

e.g. (A OR B) AND (B OR NOT C)

e.g. $(A + B)\ (B + \overline{C})$ [3]

Q2)

(a) 1 mark per correct logic gate, correctly connected



[5]

(b)

G	C	L	Workspace	X	
0	0	0		0	] 1 mark
0	0	1		0	
0	1	0		1	] 1 mark
0	1	1		0	
1	0	0		1	] 1 mark
1	0	1		1	
1	1	0		1	] 1 mark
1	1	1		0	

[4]

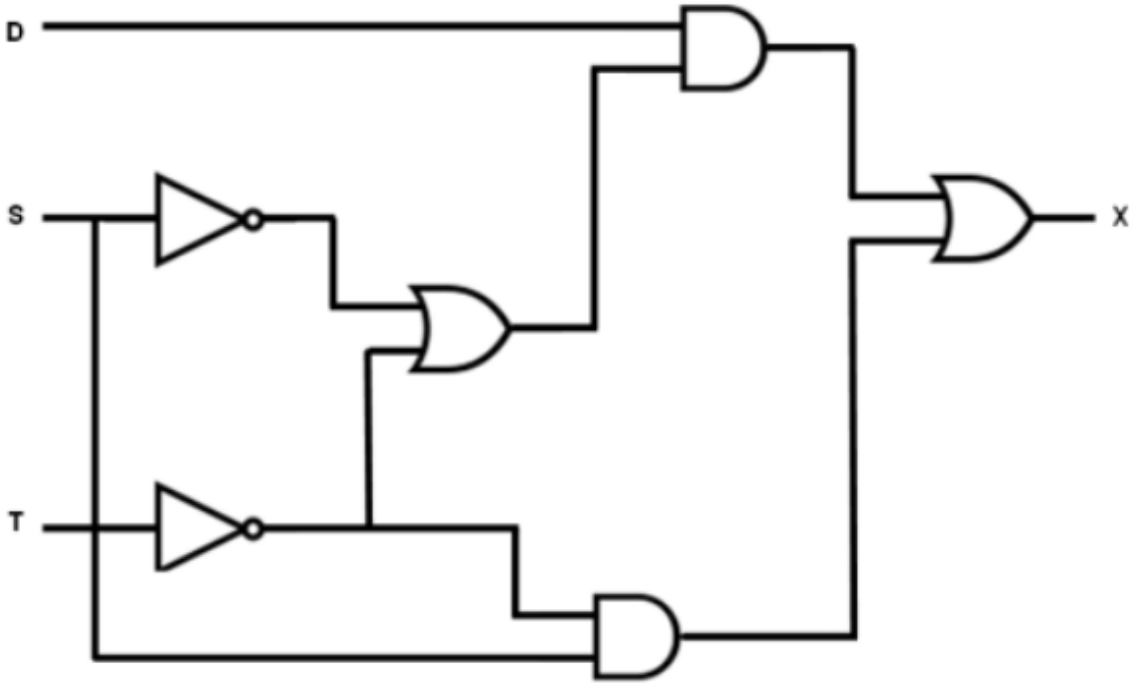
(c) 1 mark for correctly completed truth table

A	*B*	*C*
0	*0*	**0**
0	*1*	**1**
1	*0*	**1**
1	*1*	**0**

[1]

Q3)

(a) **1** mark for each correct gate, with correct source of input(s)



[6]

(b)

D	S	T	Working Space	X
0	*0*	*0*		**0**
0	*0*	*1*		**0**
0	*1*	*0*		**1**
0	*1*	*1*		**0**
1	*0*	*0*		**1**
1	*0*	*1*		**1**
1	*1*	*0*		**1**
1	*1*	*1*		**0**

4 marks for 8 correct X bits
3 marks for 6 correct X bits
2 marks for 4 correct X bits
1 mark for 2 correct X bits

[4]

Q4)

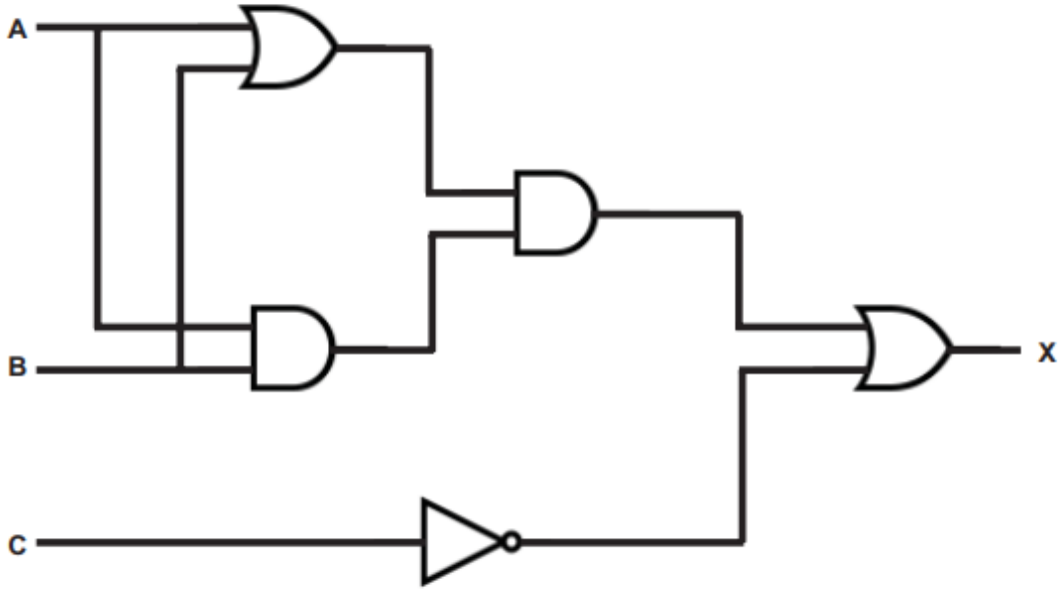
(a)

A	B	C	Working space	X
0	*0*	*0*		**0**
0	*0*	*1*		**1**
0	*1*	*0*		**0**
0	*1*	*1*		**1**
1	*0*	*0*		**0**
1	*0*	*1*		**1**
1	*1*	*0*		**1**
1	*1*	*1*		**0**

4 marks for 8 correct X bits
3 marks for 6 correct X bits
2 marks for 4 correct X bits
1 mark for 2 correct X bits

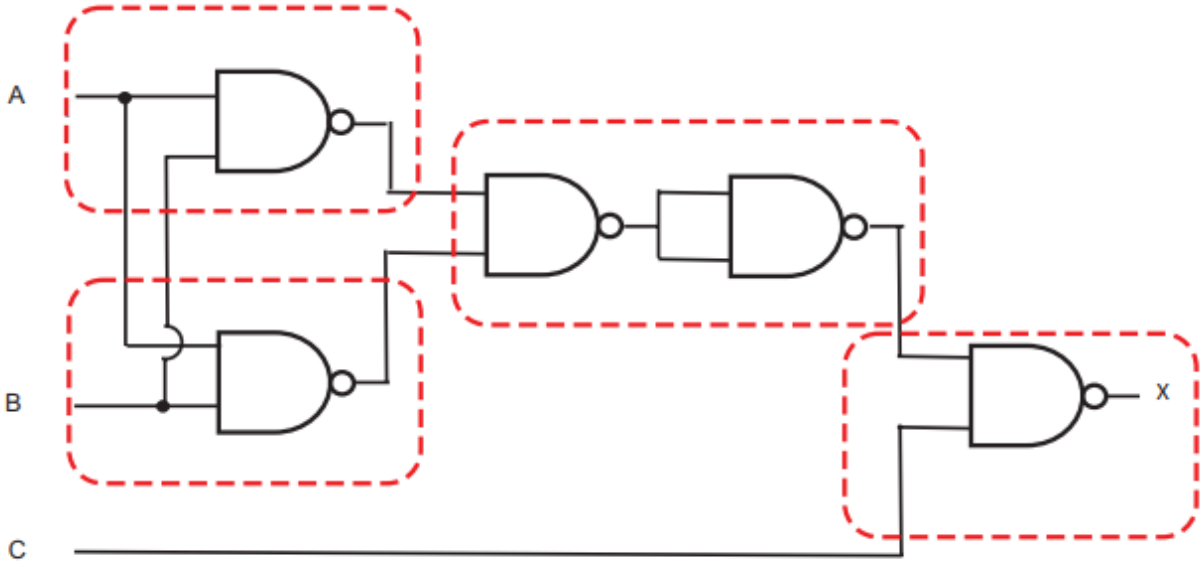
[4]

(b) **1** mark for each correct gate with correct source of input



[5]

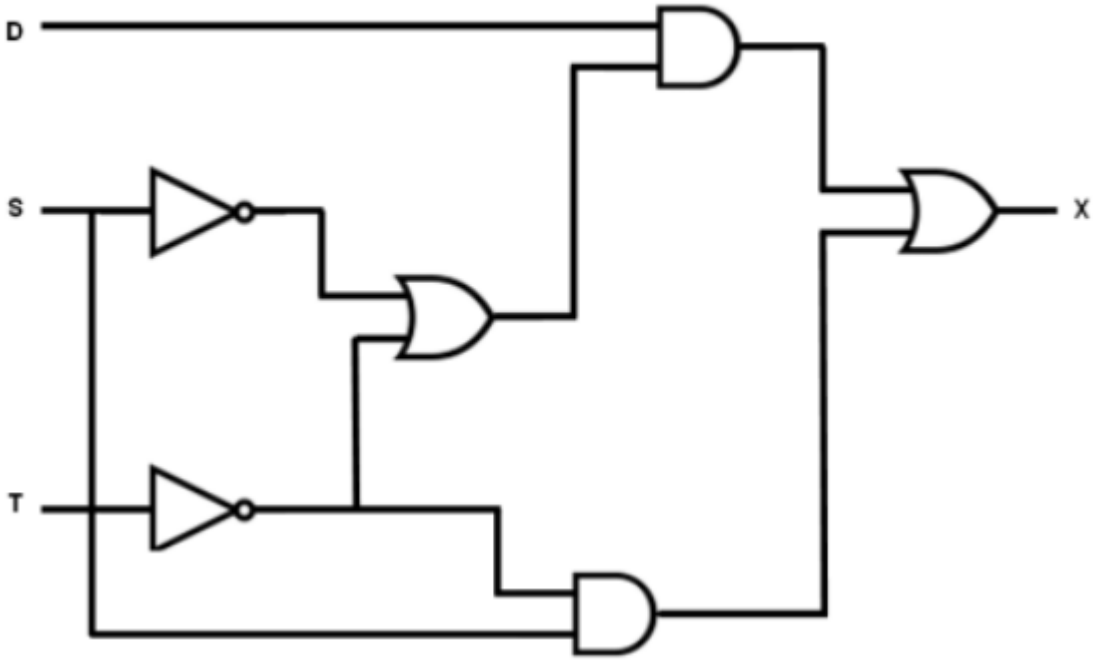
(c) Each dotted area is **1** mark



[4]

Q5)

(a) **1** mark for each correct gate, with correct source of input(s)



[6]

(b)

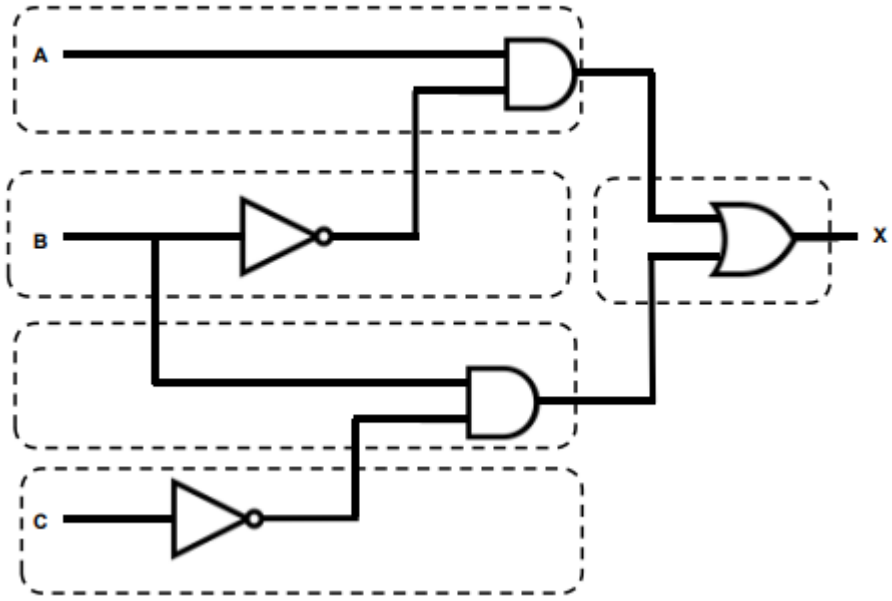
D	S	T	Working Space	X
0	*0*	*0*		**0**
0	*0*	*1*		**0**
0	*1*	*0*		**1**
0	*1*	*1*		**0**
1	*0*	*0*		**1**
1	*0*	*1*		**1**
1	*1*	*0*		**1**
1	*1*	*1*		**0**

4 marks for 8 correct X bits
3 marks for 6 correct X bits
2 marks for 4 correct X bits
1 mark for 2 correct X bits

[4]

Q6)

(a) 1 mark per correct section.



[5]

(b) 4 marks for 8 correct values
3 marks for 6 correct values
2 marks for 4 correct values
1 mark for 2 correct values

A	B	C	Working space	X
0	0	0		0
0	0	1		0
0	1	0		1
0	1	1		0
1	0	0		1
1	0	1		1
1	1	0		1
1	1	1		0

[4]

Q7)

(a) (i) 2 marks for 4 correct outputs,
1 mark for 2 correct outputs

1 mark for correct gate

A	B	Working space	X
0	*0*		0
0	*1*		0
1	*0*		0
1	*1*		1

AND gate

[3]

(ii) 2 marks for 4 correct outputs
1 mark for 2 correct outputs

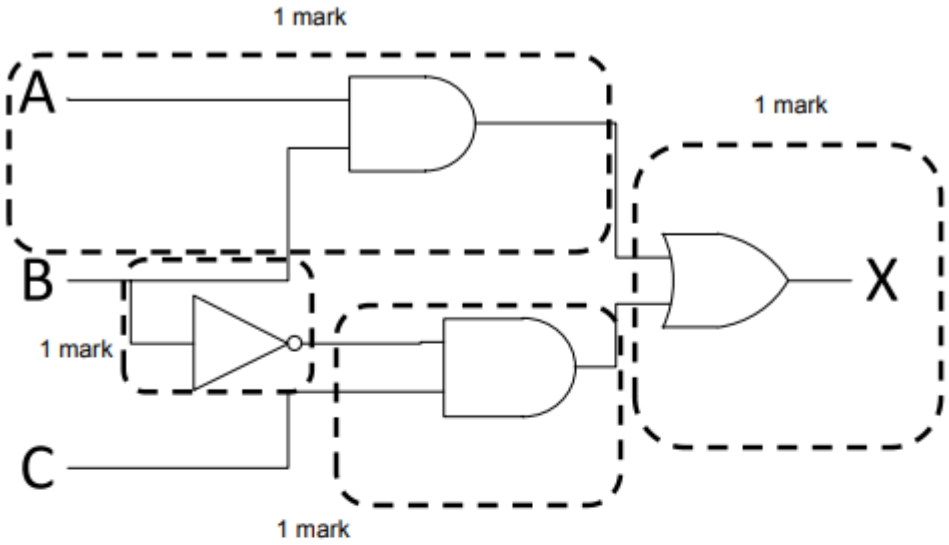
1 mark for correct gate

A	B	Working space	X
0	*0*		0
0	*1*		1
1	*0*		1
1	*1*		1

OR gate

[3]

(b)(i) 1 mark per correct section.



[4]

(ii) 4 marks for 8 correct outputs
3 marks for 6 correct outputs
2 marks for 4 correct outputs
1 mark for 2 correct outputs

A	B	C	Working space	X
0	*0*	*0*		0
0	*0*	*1*		1
0	*1*	*0*		0
0	*1*	*1*		0
1	*0*	*0*		0
1	*0*	*1*		1
1	*1*	*0*		1
1	*1*	*1*		1

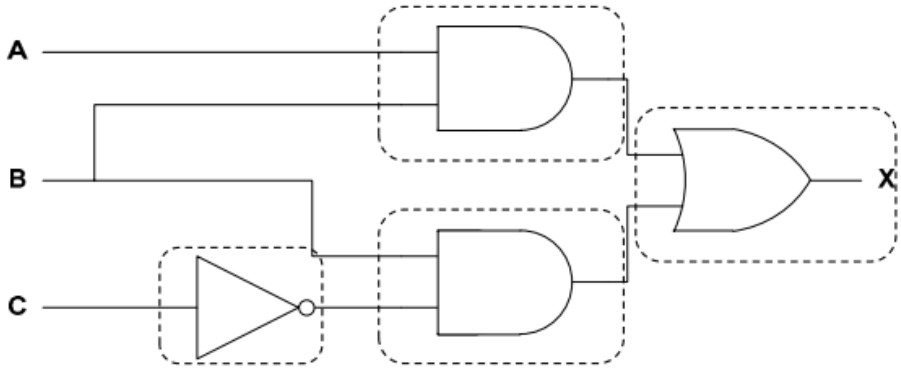
[4]

Q8)

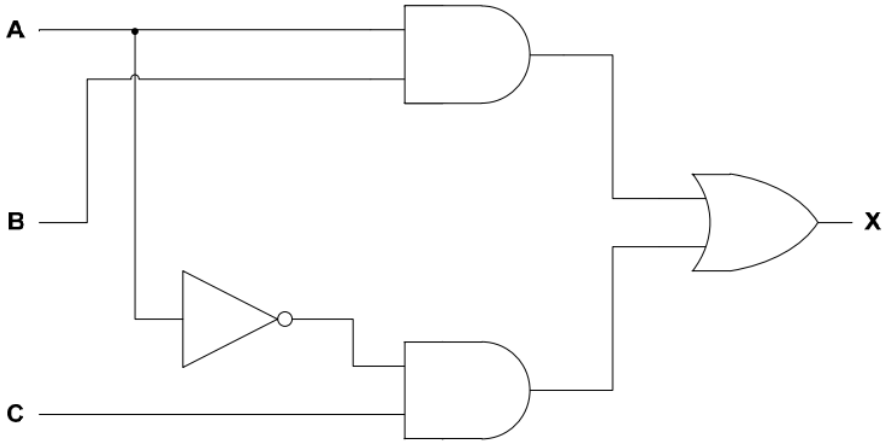
<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>(a)</td><td>1 mark for four correct outputs only
<table><tr><th>A</th><th>B</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table></td><td>1</td></tr>
<tr><td>(b)</td><td>1 mark for each correct section of the statement

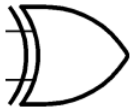
∞ (A AND B)
∞ AND
∞ (C OR NOT B)</td><td>3</td></tr>
</table>

Q9)

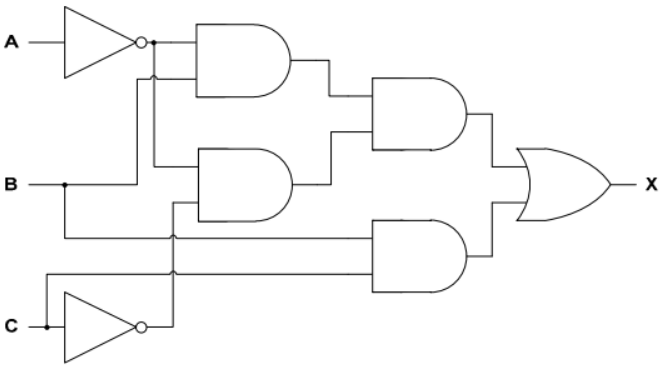
<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>(a)</td><td>1 mark for each correct gate, with the correct input(s)
 
</td><td>4</td></tr>
<tr><td>(b)</td><td>
<table>
<tr><th>A</th><th>B</th><th>C</th><th>X</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td></tr>
</table>
4 marks for 8 correct outputs
3 marks for 6 or 7 correct outputs
2 marks for 4 or 5 correct outputs
1 mark for 2 or 3 correct outputs</td><td>4</td></tr>
</table>

Q10)

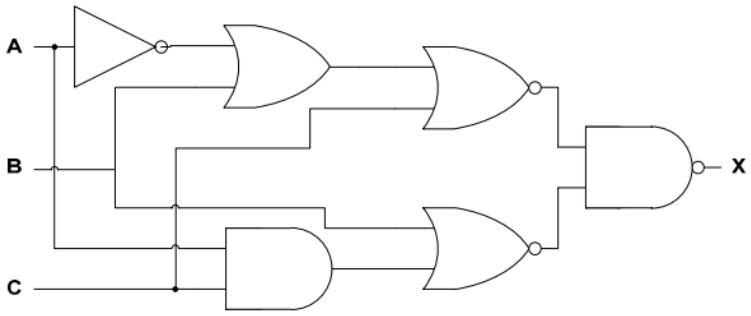
Question	Answer	Marks
(a)	1 mark for each correct logic gate 	4

Question	Answer	Marks
(b)	1 mark for correct logic gate symbol:  Any **four** from: – similar to an OR gate – It has (at least) two inputs – Output will be high/1 if both inputs are different – Output will be high/1 if either input is high – Output will be low/0 if both inputs are high – Output will be low/0 if both inputs are low	5

Q11)

Question	Answer	Marks
	1 mark for each correct logic gate with the correct input(s) 	7

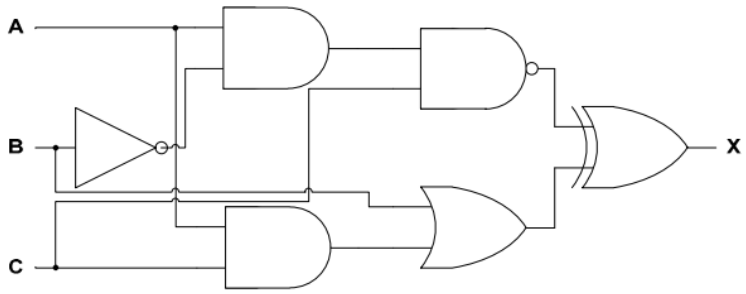
Q12)

Question	Answer	Marks
(a)	1 mark for each correct logic gate (with the correct direction of input(s)) 	6

Question	Answer	Marks
(b)	4 marks for 8 correct outputs 3 marks for 6 or 7 correct outputs 2 marks for 4 or 5 correct outputs 1 mark for 2 or 3 correct outputs	4

A	B	C	Working space	X
0	0	0		**1**
0	0	1		**1**
0	1	0		**1**
0	1	1		**1**
1	0	0		**0**
1	0	1		**1**
1	1	0		**1**
1	1	1		**1**

Q13)

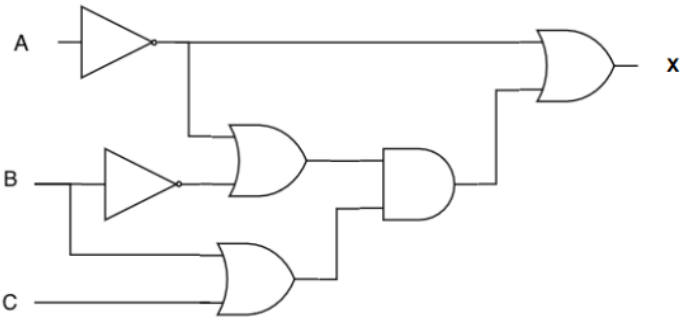
<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>(a)</td><td>1 mark for each correct logic gate with correct direct of input(s):
 
</td><td>6</td></tr>
<tr><td>(b)</td><td>4 marks for 8 correct outputs
3 marks for 6 or 7 correct outputs
2 marks for 4 or 5 correct outputs
1 mark for 2 or 3 correct outputs
<table>
<tr><th>A</th><th>B</th><th>C</th><th>Working space</th><th>X</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td></td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td></td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td></td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td></td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td></td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td></td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td></td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td></td><td>0</td></tr>
</table></td><td>4</td></tr>
</table>

Q14)

Question	Answer	Marks
(a)		4

A	B	C	X
0	0	0	**1**
0	0	1	**1**
0	1	0	**0**
0	1	1	**1**
1	0	0	**0**
1	0	1	**1**
1	1	0	**1**
1	1	1	**1**

All 8 for 4 marks
6 or 7 for 3 marks
4 or 5 for 2 marks
2 or 3 for 1 mark

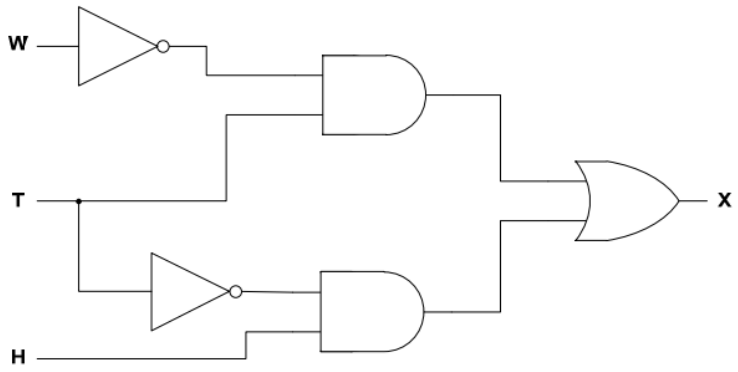
Question	Answer	Marks
(b)		6

1 mark per gate with correct inputs

Q15)

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>(a)</td><td>
∝ 4 marks for 8 correct outputs
∞ 3 marks for 6 or 7 correct outputs
∞ 2 marks for 4 or 5 correct outputs
∞ 1 mark for 2 or 3 correct outputs
<table>
<tr><th>A</th><th>B</th><th>C</th><th>Working space</th><th>X</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td></td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td></td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td></td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td></td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td></td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td></td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td></td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td></td><td>1</td></tr>
</table>
</td><td>4</td></tr>
<tr><td>(b)</td><td>
Three from:
∞ output of AND is 1 if both inputs are 1
∞ output of AND is 0 if either or both inputs are 0
∞ output of OR is 1 if either input is 1
∞ output of OR is 0 if both inputs are 0
∞ correct example of AND truth table
∞ correct example of OR truth table
</td><td>3</td></tr>
</table>

Q16)

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td></td><td>
1 mark for each correct logic gate, with correct inputs.


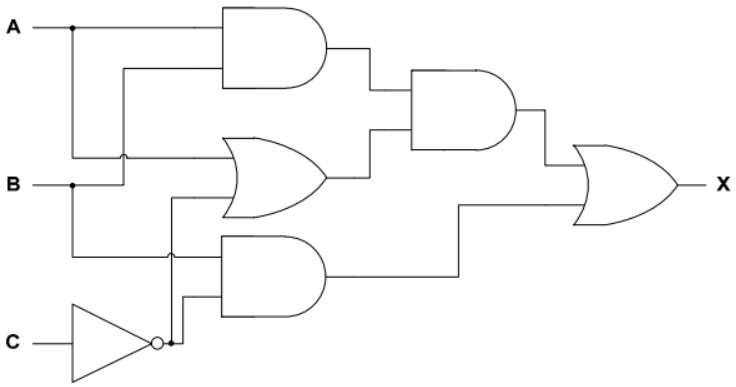
</td><td>5</td></tr>
</table>

Q17)

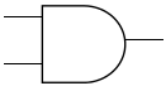
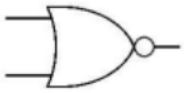
Question	Answer	Marks
(a)	4 marks for 8 correct outputs 3 marks for 6 or 7 correct outputs 2 marks for 4 or 5 correct outputs 1 mark for 2 or 3 correct outputs	4

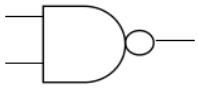
A	B	C	X
0	*0*	*0*	**0**
0	*0*	*1*	**0**
0	*1*	*0*	**1**
0	*1*	*1*	**1**
1	*0*	*0*	**0**
1	*0*	*1*	**1**
1	*1*	*0*	**0**
1	*1*	*1*	**0**

Question	Answer	Marks
(b)	1 mark per correct gate with correct inputs.	6

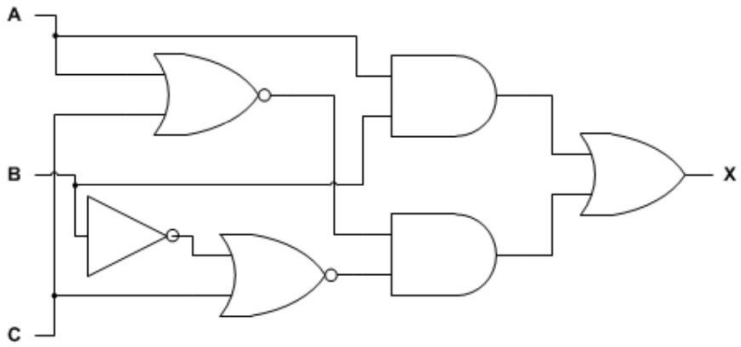


Q18)

Question	Answer	Marks
(a)	1 mark for correct name, 1 mark for correct gate symbol – AND 	2
(b)	1 mark for correct name, 1 mark for correct gate symbol – NOR 	2

Question	Answer	Marks
(c)	1 mark for correct name, 1 mark for correct gate symbol – NAND 	2

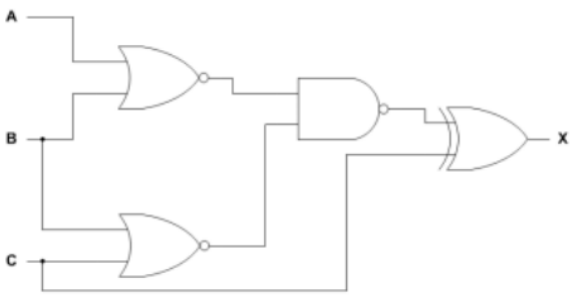
Q19)

Question	Answer	Marks
(a)	1 mark per each correct logic gate, with correct input(s) 	6

Question	Answer	Marks
(b)	4 marks for 8 correct outputs 3 marks for 6/7 correct outputs 2 marks for 4/5 correct outputs 1 mark for 2/3 correct outputs	4

A	B	C	Working space	X
0	0	0		**0**
0	0	1		**0**
0	1	0		**1**
0	1	1		**0**
1	0	0		**0**
1	0	1		**0**
1	1	0		**1**
1	1	1		**1**

Q20)

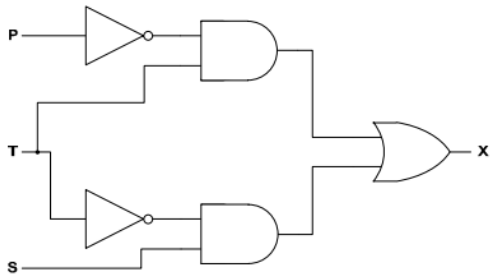
Question	Answer	Marks
(a)	1 mark for each correct logic gate, with correct inputs:  	4

Question	Answer	Marks
(b)	4 marks for 8 correct outputs 3 marks for 6/7 correct outputs 2 marks for 4/5 correct outputs 1 mark for 2/3 correct outputs	4

A	B	C	Working space	X
0	0	0		**0**
0	0	1		**0**
0	1	0		**1**
0	1	1		**0**
1	0	0		**1**
1	0	1		**0**
1	1	0		**1**
1	1	1		**0**

(c)	**Two** from: – To carry out a logical operation – To control the flow of electricity through a logic circuit – An input is given and the logic of the gate is applied to give an output // to alter the output from given inputs	2

Q21)

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>(a)</td><td>
<table>
<tr><th>Input A</th><th>Input B</th><th>Output</th></tr>
<tr><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>1</td></tr>
</table>
</td><td>1</td></tr>
<tr><td>(b)</td><td>∝ Exclusive OR / XOR / EOR</td><td>1</td></tr>
<tr><td>(c)</td><td>One mark for each correct logic gate with correct inputs
 
</td><td>5</td></tr>
<tr><td>(d)</td><td>Two from:
∞ Can work continuously
∞ Avoids human error
∞ It could be a dangerous environment and will avoid human risk
∞ Detect errors instantly
∞ Maintain consistent and correct conditions</td><td>2</td></tr>
</table>

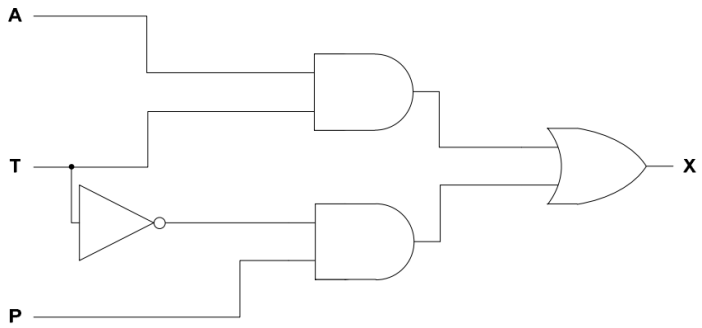
Q22)

Question	Answer	Marks
(a)	∞ X = 1 if (A is 1 XOR C is 1) OR (B is 1 NAND C is NOT 1) ∞ X = (A XOR C) OR (B NAND NOTC) **One** mark for each bullet: ∞ (A XOR C) ∞ OR ∞ (B NAND NOTC)	**3**

Question	Answer	Marks
(b)	**Four** marks for 8 correct outputs **Three** marks for 6 or 7 correct outputs **Two** marks for 4 or 5 correct outputs **One** mark for 2 or 3 correct outputs	**4**

A	B	C	Working space	X
0	0	0		**1**
0	0	1		**1**
0	1	0		**0**
0	1	1		**1**
1	0	0		**1**
1	0	1		**1**
1	1	0		**1**
1	1	1		**1**

Q23)

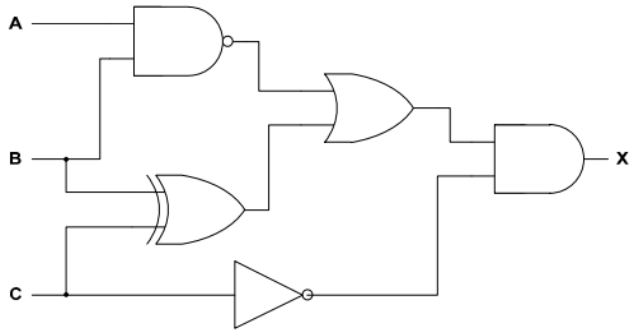
Question	Answer	Marks
(a)	**One** mark for each correct logic gate with correct input(s) 	**4**

Question	Answer	Marks
(b)	**Four** mark for 8 correct outputs **Three** marks for 6 or 7 correct outputs **Two** mark for 4 or 5 correct outputs **One** mark for 2 or 3 correct outputs	**4**

A	T	P	Working space	X
0	0	0		**0**
0	0	1		**1**
0	1	0		**0**
0	1	1		**0**
1	0	0		**0**
1	0	1		**1**
1	1	0		**1**
1	1	1		**1**

(c)	**Six** from: ∞ Sensor sends a signal/reading/data to the microprocessor ∞ Signal/reading/data is analogue and is converted to digital using ADC ∞ Reading/data is stored in the system ∞ Microprocessor compares data/reading to the pre-set value of 7 ∞ If value is greater than 7 … ∞ … a signal/data is sent by the microprocessor to display a warning message on a monitor ∞ The process is continuous	**6**

Q24)

Question	Answer	Marks
(a)	 1 mark for each correct gate.	5

Question	Answer	Marks
(b)		4

A	B	C	Working space	X
0	0	0		**1**
0	0	1		**0**
0	1	0		**1**
0	1	1		**0**
1	0	0		**1**
1	0	1		**0**
1	1	0		**1**
1	1	1		**0**

4 marks for 8 correct outputs
3 marks for 6 or 7 correct outputs
2 marks for 4 or 5 correct outputs
1 mark for 2 or 3 correct outputs

Q25)

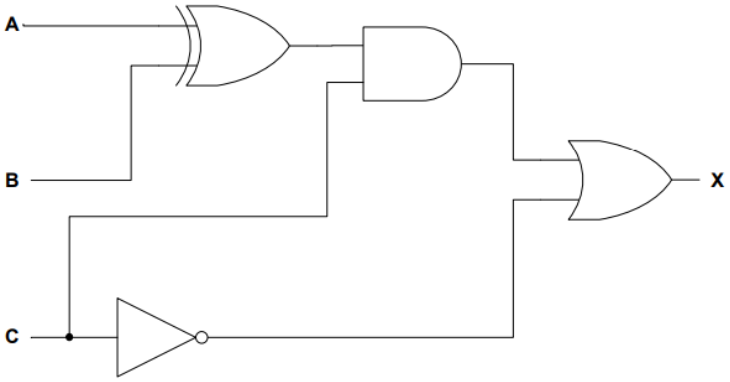
Question	Answer	Marks
(a)(i)	– NAND 	2
(a)(ii)	– NOR 	2

Question	Answer	Marks
(b)		4

A	B	C	Working space	X
0	0	0		**0**
0	0	1		**0**
0	1	0		**1**
0	1	1		**1**
1	0	0		**0**
1	0	1		**0**
1	1	0		**1**
1	1	1		**1**

4 marks for 8 correct outputs
3 marks for 6 or 7 correct outputs
2 marks for 4 or 5 correct outputs
1 mark for 2 or 3 correct outputs

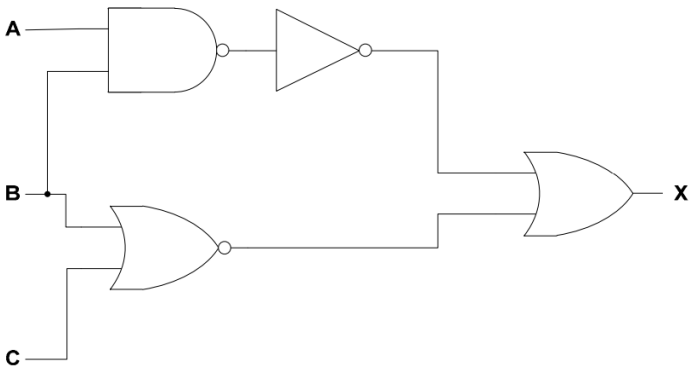
Q26)

Question	Answer	Marks
(a)	 One mark for each correct gate.	4

Question	Answer	Marks
(b)		4

A	B	C	Working space	X
0	0	0		**1**
0	0	1		**0**
0	1	0		**1**
0	1	1		**1**
1	0	0		**1**
1	0	1		**1**
1	1	0		**1**
1	1	1		**0**

Q27)

Question	Answer	Marks
(a)	 **One** mark for each correct gate with correct input	**4**

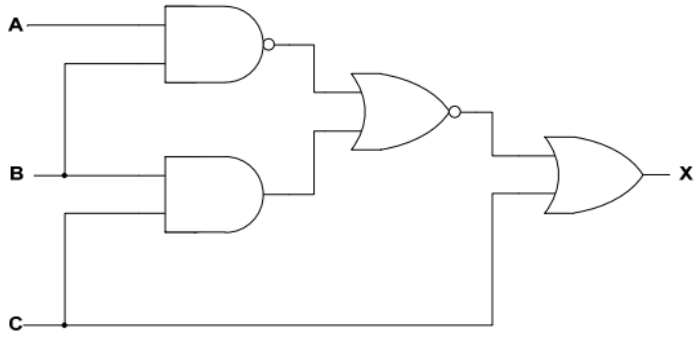
Question	Answer	Marks
(b)	**Four** marks for 8 correct outputs **Three** marks for 6/7 correct outputs **Two** marks for 4/5 correct outputs **One** mark for 2/3 correct outputs	**4**

A	B	C	Working space	X
0	0	0		**1**
0	0	1		**0**
0	1	0		**0**
0	1	1		**0**
1	0	0		**1**
1	0	1		**0**
1	1	0		**1**
1	1	1		**1**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>(c)</td><td>One mark for the correct gate and one mark for the correct truth table

– AND
<table><tr><td>A</td><td>B</td><td>X</td></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table>– XOR
<table><tr><td>A</td><td>B</td><td>X</td></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table></td><td>4</td></tr>
</table>

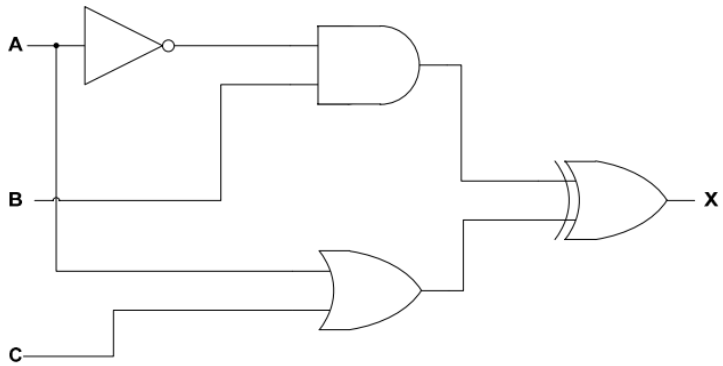
Q28)

Question	Answer	Marks
(a)	**One** mark for each correct logic gate with correct input: 	4

Question	Answer	Marks
(b)	**Four** marks for 8 correct outputs **Three** marks for 6/7 correct outputs **Two** marks for 4/5 correct outputs **One** mark for 2/3 correct outputs	4

A	B	C	Working space	X
0	0	0		**0**
0	0	1		**1**
0	1	0		**0**
0	1	1		**1**
1	0	0		**0**
1	0	1		**1**
1	1	0		**1**
1	1	1		**1**

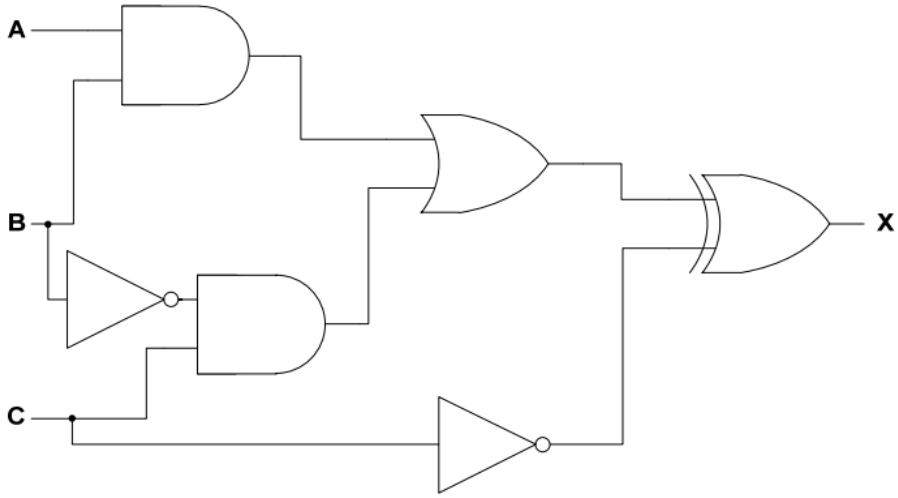
Q29)

Question	Answer	Marks
(a)	**One** mark for each correct logic gate with the correct input: 	4

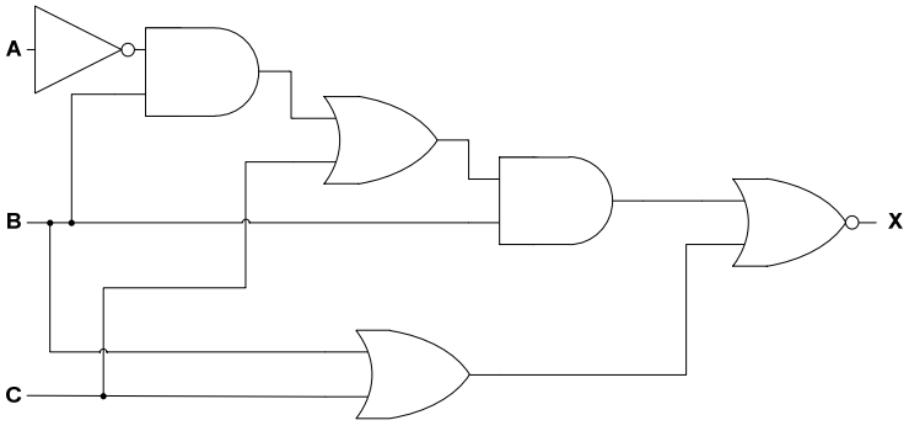
Question	Answer	Marks
(b)	**Four** marks for 8 correct outputs **Three** marks for 6/7 correct outputs **Two** marks for 4/5 correct outputs **One** mark for 2/3 correct outputs	4

A	B	C	Working space	X
0	0	0		**0**
0	0	1		**1**
0	1	0		**1**
0	1	1		**0**
1	0	0		**1**
1	0	1		**1**
1	1	0		**1**
1	1	1		**1**

Q30)

Question	Answer	Marks
(a)	One mark per each correct logic gate, with correct input:  	6
(b)	– Row 1 – Row 3 – Row 4 – Row 5	4

Q31)

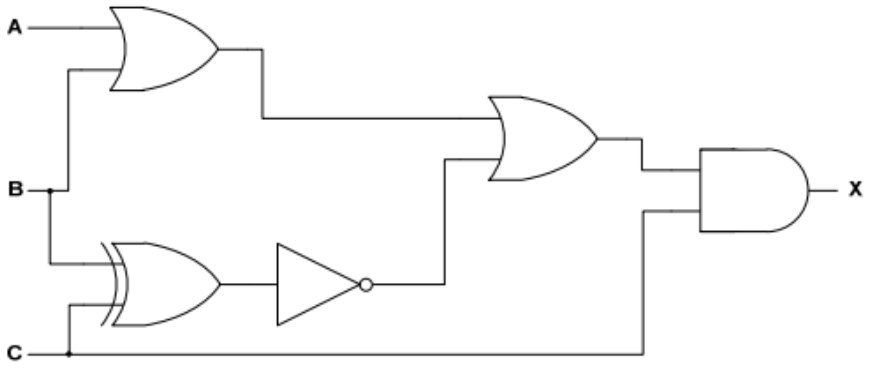
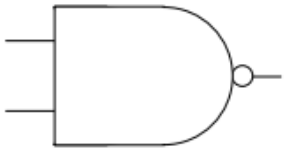
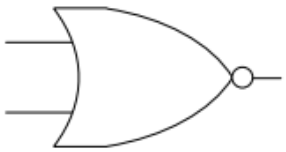
(a)	One mark for each correct logic gate with correct input. 	6

Question	Answer	Marks
(b)	One mark per each correct row. – Row 2 – Row 3 – Row 7 – Row 8	4

Q32)

Question	Answer	Marks
(a)	– AND – NOR – XOR	3
(b)	– Row 1 – Row 4 – Row 7 – Row 8	4

Q33)

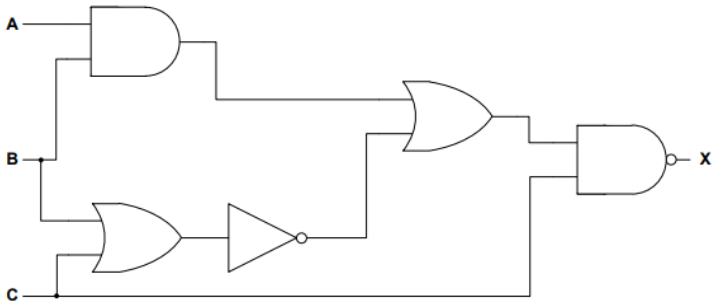
Question	Answer	Marks
(a)	**One** mark per each correct logic gate with the correct input(s). 	**5**
(b)	**One** mark per logic gate name and **one** mark per correct drawing. – NAND  – NOR 	**2**

Question	Answer	Marks
(c)		4

A	B	C	Working space	X
0	0	0		**0**
0	0	1		**0**
0	1	0		**0**
0	1	1		**1**
1	0	0		**0**
1	0	1		**1**
1	1	0		**0**
1	1	1		**1**

4 marks per 8 correct outputs
3 marks per 6/7 correct outputs
2 marks per 4/5 correct outputs
1 mark per 2/3 correct outputs

Q34)

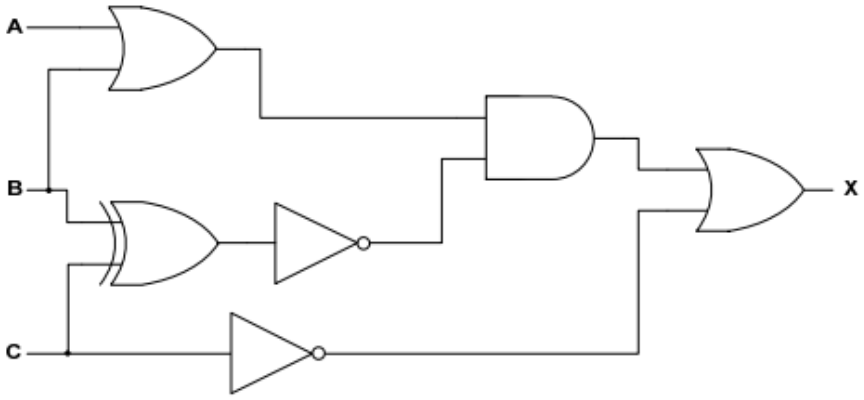
Question	Answer	Marks
(a)	**One** mark per each correct logic gate with correct input(s) 	**5**

Question	Answer	Marks
(b)	4 marks for 8 correct outputs 3 marks for 6/7 correct outputs 2 marks for 4/5 correct outputs 1 mark for 2/3 correct outputs	**4**

A	B	C	Working space	X
0	0	0		**1**
0	0	1		**1**
0	1	0		**1**
0	1	1		**1**
1	0	0		**1**
1	0	1		**1**
1	1	0		**1**
1	1	1		**0**

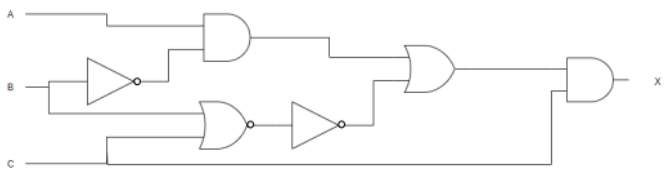
(c)	– NOR – XOR / EOR	**2**

Q35)

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>(a)</td><td>One mark per each correct logic gate with correct inputs
.
 
</td><td>6</td></tr>
<tr><td>(b)</td><td>4 marks for 8 correct outputs
3 marks for 6/7 correct outputs
2 marks for 4/5 correct outputs
1 mark for 2/3 correct outputs

<table>
<tr><th>A</th><th>B</th><th>C</th><th>Working space</th><th>X</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td></td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td></td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td></td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td></td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td></td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td></td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td></td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td></td><td>1</td></tr>
</table></td><td>4</td></tr>
</table>

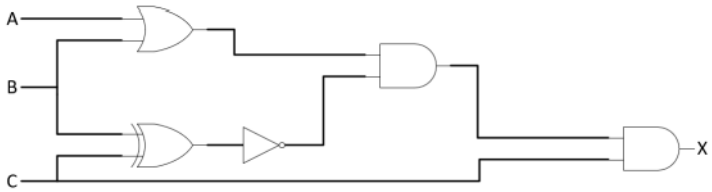
Q36)

Question	Answer	Marks
(a)	**One** mark for each correct logic gate with correct input(s) 	**6**

Question	Answer	Marks
(b)	**Four** marks for 8 correct outputs **Three** marks for 6/7 correct outputs **Two** marks for 4/5 correct outputs **One** mark for 2/3 correct outputs	**4**

A	B	C	Working space	X
0	0	0		**0**
0	0	1		**1**
0	1	0		**0**
0	1	1		**1**
1	0	0		**0**
1	0	1		**1**
1	1	0		**0**
1	1	1		**1**

Q37)

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>(a)</td><td>One mark for each correct logic gate with correct input(s)
 
</td><td>5</td></tr>
<tr><td>(b)</td><td>Four marks for 8 correct outputs
Three marks for 6/7 correct outputs
Two marks for 4/5 correct outputs
One mark for 2/3 correct outputs
<table>
<tr><th>A</th><th>B</th><th>C</th><th>Working space</th><th>X</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td></td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td></td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td></td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td></td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td></td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td></td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td></td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td></td><td>1</td></tr>
</table></td><td>4</td></tr>
</table>

Q38)

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>(a)</td><td>One mark for each correct row
<table>
<tr><th>Statement</th><th>AND (✓)</th><th>OR (✓)</th><th>XOR (✓)</th></tr>
<tr><td>if both inputs are 0, the output is 0</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>if both inputs are different, the output is 1</td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>if both inputs are 1, the output is 1</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>if both inputs are the same, the output is always 0</td><td></td><td></td><td>✓</td></tr>
</table></td><td>4</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>(b)</td><td>One mark for the correct name and one mark for the correct truth table

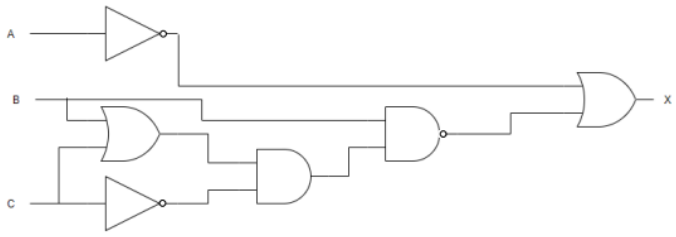
NOR

<table>
<tr><th>A</th><th>B</th><th>Output</th></tr>
<tr><td>0</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>0</td></tr>
</table>

NAND

<table>
<tr><th>A</th><th>B</th><th>Output</th></tr>
<tr><td>0</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>0</td></tr>
</table></td><td>4</td></tr>
</table>

Q39)

Question	Answer	Marks
(a)	**One** mark for each correct logic gate with correct input(s) 	**6**
(b)	Any **one** from: • NOR • XOR // EOR	**1**

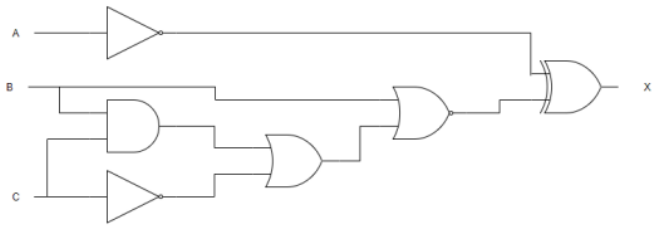
Question	Answer	Marks
(c)	**Four** marks for 8 correct outputs **Three** marks for 6/7 correct outputs **Two** marks for 4/5 correct outputs **One** mark for 2/3 correct outputs	**4**

A	B	C	Working space	X
0	0	0		**1**
0	0	1		**1**
0	1	0		**1**
0	1	1		**1**
1	0	0		**1**
1	0	1		**1**
1	1	0		**0**
1	1	1		**1**

Q40)

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>(a)</td><td>One mark for each correct row
<table>
<tr><th>Statement</th><th>NAND (✓)</th><th>OR (✓)</th><th>XOR (✓)</th></tr>
<tr><td>if both inputs are 1, the output is 1</td><td></td><td>✓</td><td></td></tr>
<tr><td>if both inputs are different from each other, the output is 1</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>if both inputs are 0, the output is 0</td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>if both inputs are the same as each other, the output is always 0</td><td></td><td></td><td>✓</td></tr>
</table></td><td>4</td></tr>
<tr><td>(b)</td><td>One mark for a correct logic gate, one mark for a corresponding truth table
AND
<table>
<tr><th>A</th><th>B</th><th>Output</th></tr>
<tr><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td></tr>
</table></td><td>2</td></tr>
</table>

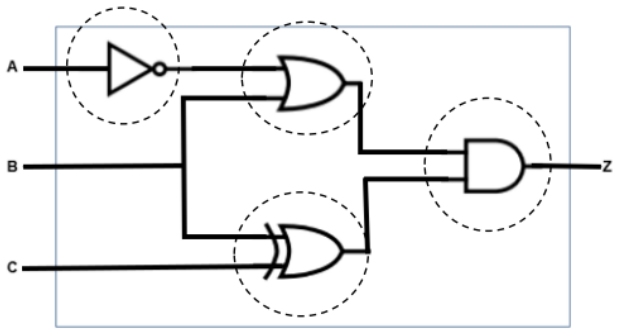
Q41)

Question	Answer	Marks
(a)	**One** mark for each correct logic gate with the correct inputs 	**6**

Question	Answer	Marks
(b)	**Four** marks for 8 correct outputs **Three** marks for 6/7 correct outputs **Two** marks for 4/5 correct outputs **One** mark for 2/3 correct outputs	**4**

A	B	C	Working space	X
0	0	0		**1**
0	0	1		**0**
0	1	0		**1**
0	1	1		**1**
1	0	0		**0**
1	0	1		**1**
1	1	0		**0**
1	1	1		**0**

Q42)

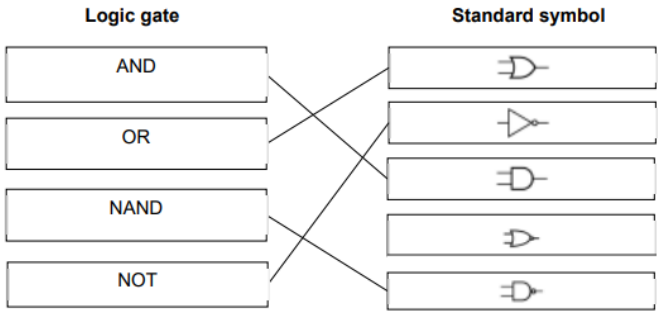
Question	Answer	Marks
(a)	**One** mark for each correct gate, with the correct input(s) as shown. 	4

Question	Answer	Marks
(b)	**Four** marks for eight correct outputs. **Three** marks for six or seven correct outputs. **Two** marks for four or five correct outputs. **One** mark for two or three correct outputs	4

A	B	C	Z
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

Q43)

Question	Answer	Marks
	One mark for each correct line	4

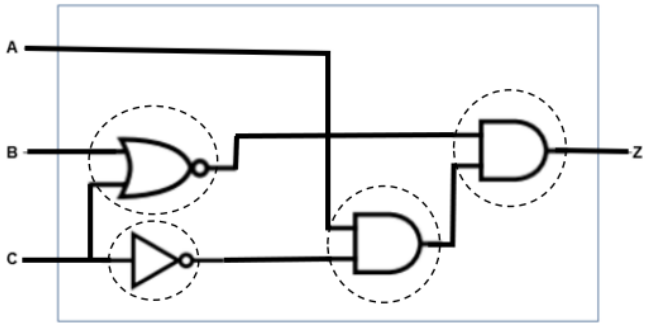


Q44)

Question	Answer	Marks
	4 marks for 8 correct outputs 3 marks for 6/7 correct outputs 2 marks for 4/5 correct outputs 1 mark for 2/3 correct outputs	4

A	B	C	X
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	0

Q45)

Question	Answer	Marks
(a)	**One** mark for each correct gate, with the correct input(s) as shown. 	4

Question	Answer	Marks
(b)	**Four** marks for eight correct outputs. **Three** marks for six or seven correct outputs. **Two** marks for four or five correct outputs. **One** mark for two or three correct outputs	4

A	B	C	Z
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

Q46)

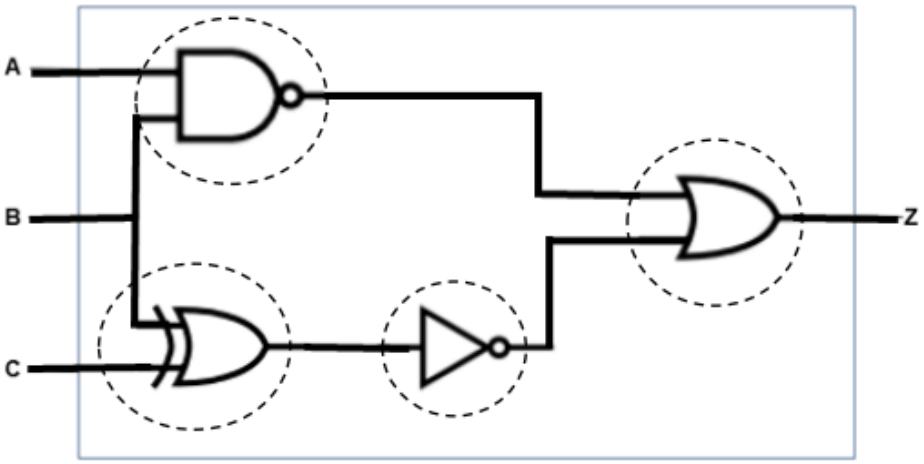
Question	Answer	Marks
(a)	One mark for each point • NOT A • AND B • OR NOT C • expression correct (NOT A AND B) OR NOT C	4

Question	Answer	Marks
(b)		4

A	B	C	X
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

4 marks for 8 correct outputs
3 marks for 6/7 correct outputs
2 marks for 4/5 correct outputs
1 mark for 2/3 correct outputs

Q47)

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>(a)</td><td>One mark for each correct gate, with the correct input(s) as shown.
 
</td><td>4</td></tr>
<tr><td>(b)</td><td>Four marks for eight correct outputs.
Three marks for six or seven correct outputs.
Two marks for four or five correct outputs.
One mark for two or three correct outputs
<table>
<tr><th>A</th><th>B</th><th>C</th><th>Z</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td></tr>
</table></td><td>4</td></tr>
</table>

Q48)

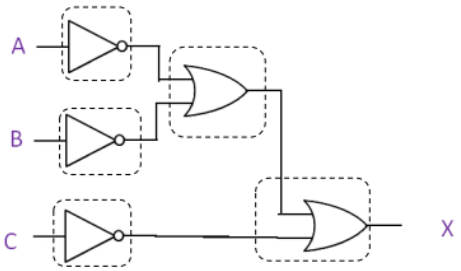
<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>(a)</td><td>One mark for correct gate and one mark for correct truth table

AND
<table><tr><th>A</th><th>B</th><th>X</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table></td><td>2</td></tr>
<tr><td>(b)</td><td>One mark for correct gate and one mark for correct truth table

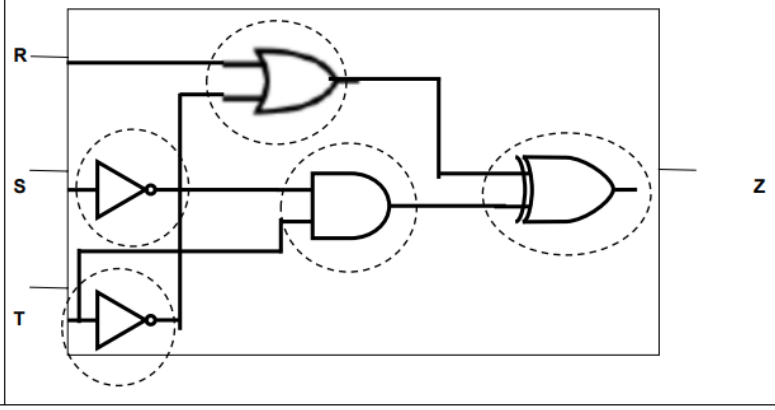
XOR // EOR
<table><tr><th>A</th><th>B</th><th>X</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table></td><td>2</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>`(c)</td><td>One mark for correct gate and one mark for correct truth table

NOR
<table><tr><th>A</th><th>B</th><th>X</th></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table></td><td>2</td></tr>
<tr><td>(d)</td><td>One mark for each correct gate, with the correct input(s) as shown.

 
</td><td>5</td></tr>
</table>

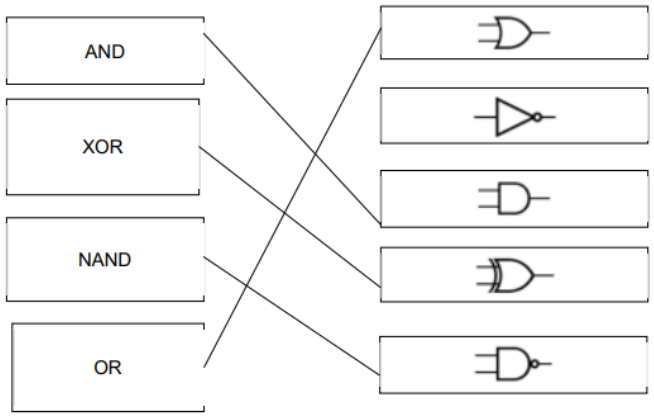
Q49)

Question	Answer	Marks
(a)	**One** mark for each correct gate, with the correct input(s) as shown. 	5

Question	Answer	Marks
(b)	**Four** marks for eight correct outputs. **Three** marks for six or seven correct outputs. **Two** marks for four or five correct outputs. **One** mark for two or three correct outputs	4

R	S	T	Z
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

Q50)

Question	Answer	Marks
	One mark for each correct line **Logic function** **Standard symbol** 	4

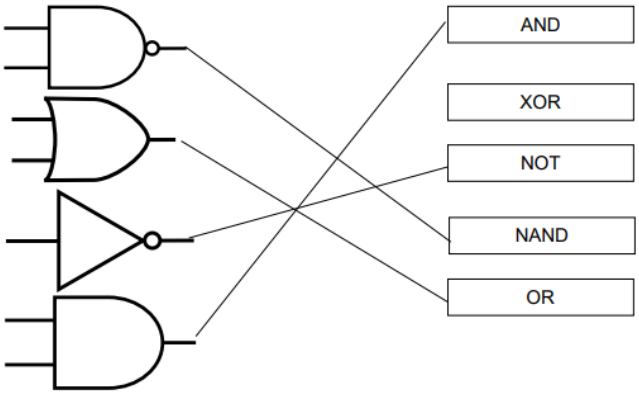
Q51)

Question	Answer	Marks
(a)	X = 1 **mark** (A AND B) // A AND B 1 **mark** AND NOT C 1 **mark** X = (A AND B) AND NOT C	3

Question	Answer	Marks
(b)	**Four** marks for 8 correct outputs **Three** marks for 6/7 correct outputs **Two** marks for 4/5 correct outputs **One** mark for 2/3 correct outputs	4

A	B	C	X
0	0	0	**0**
0	0	1	**0**
0	1	0	**0**
0	1	1	**0**
1	0	0	**0**
1	0	1	**0**
1	1	0	**1**
1	1	1	**0**

Q52)

Question	Answer	Marks
(a)	**One** mark for each correct line **Logic gate symbol** **Logic function**  	4

Question	Answer	Marks
(b)	<table><tr><th>A</th><th>B</th><th>C</th><th>Z</th></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td><td>0</td></tr></table> **Four** marks for eight correct outputs. **Three** marks for six or seven correct outputs. **Two** marks for four or five correct outputs. **One** mark for two or three correct outputs	4

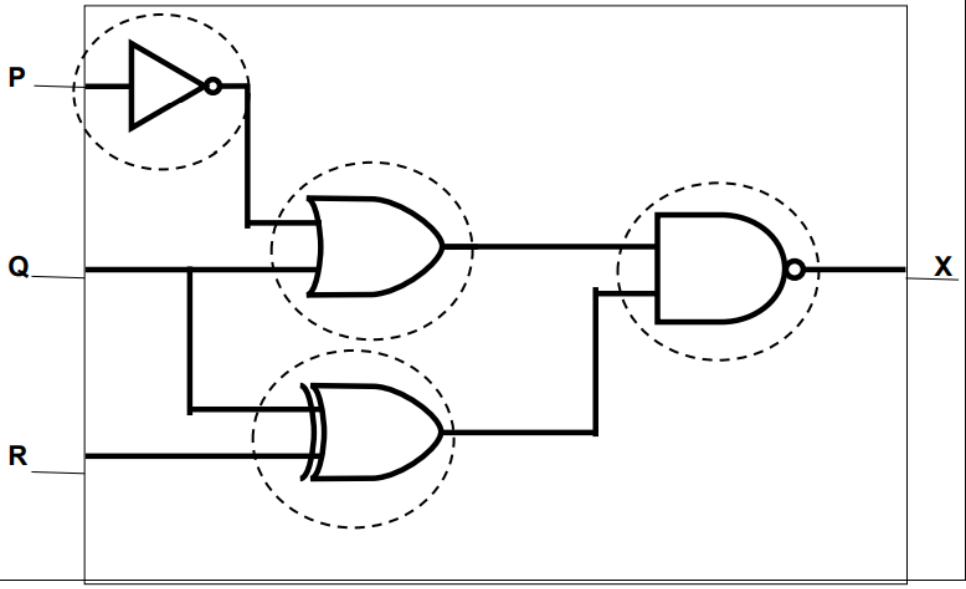
Q53)

Question	Answer	Marks
(a)	**One** mark for each point • NOT **X** • **Y** XOR **Z** • expression correct: NOT **X** OR (**Y** XOR **Z**) // (**Y** XOR **Z**) OR NOT **X**	**3**

Question	Answer	Marks
(b)	4 marks for 8 correct outputs 3 marks for 6/7 correct outputs 2 marks for 4/5 correct outputs 1 mark for 2/3 correct outputs	**4**

X	Y	Z	W
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

Q54)

Question	Answer	Marks
(a)	**One** mark for each correct gate, with the correct input(s) as shown. 	**4**

Question	Answer	Marks
(b)	**Four** marks for eight correct outputs **Three** marks for six or seven correct outputs **Two** marks for four or five correct outputs **One** mark for two or three correct outputs	**4**

P	Q	R	X
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

Q55)

Question	Answer	Marks
	One mark for each correct line	**4**