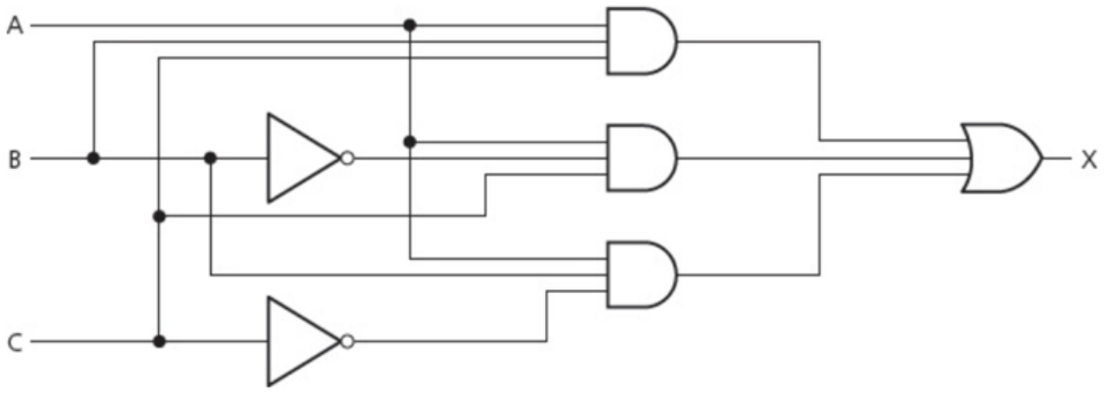
End of chapter questions

1 a) Write down the Boolean expression to represent the logic circuit below.

[2]



b) Produce the Karnaugh map to represent the above logic circuit and hence write down a simplified Boolean expression.

[3]

c) Draw a simplified logic circuit from your Boolean expression in part b) using AND and OR gates only.

[2]

2 a) Consider the following truth table.

INPUTS				OUTPUT
A	B	C	D	X
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

i) Draw a Karnaugh map from this truth table.

[3]

ii) Use your Karnaugh map from part a) i) to produce a Boolean expression.

[4]

b) Use the laws of Boolean algebra to simplify:

i) $(A + C).(A.D + A.\overline{D}) + A.C + C$

[2]

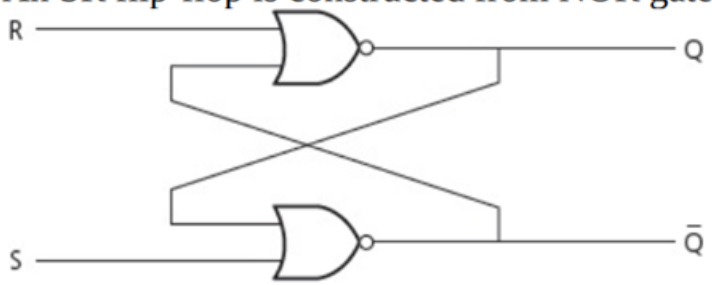
ii) $\bar{A}.(A + B) + (B + A.A).(A + \overline{B})$

[2]

ii) $\bar{A}.(A + B) + (B + A.A).(A + \bar{B})$

[2]

3 a) An SR flip-flop is constructed from NOR gates:



i) Complete the truth table for the SR flip-flop.

[4]

ii) One of the S, R combinations in the truth table should not be allowed to occur. State the values of S and R that should not be allowed to occur. Explain your choice of values.

[3]

INPUTS		OUTPUTS	
S	R	Q	$\bar{Q}$
1	0	1	0
0	0		
0	1		
0	0		
1	1		

b) JK flip-flops are another type of flip-flop.

i) State the three inputs to a JK flip-flop.

[1]

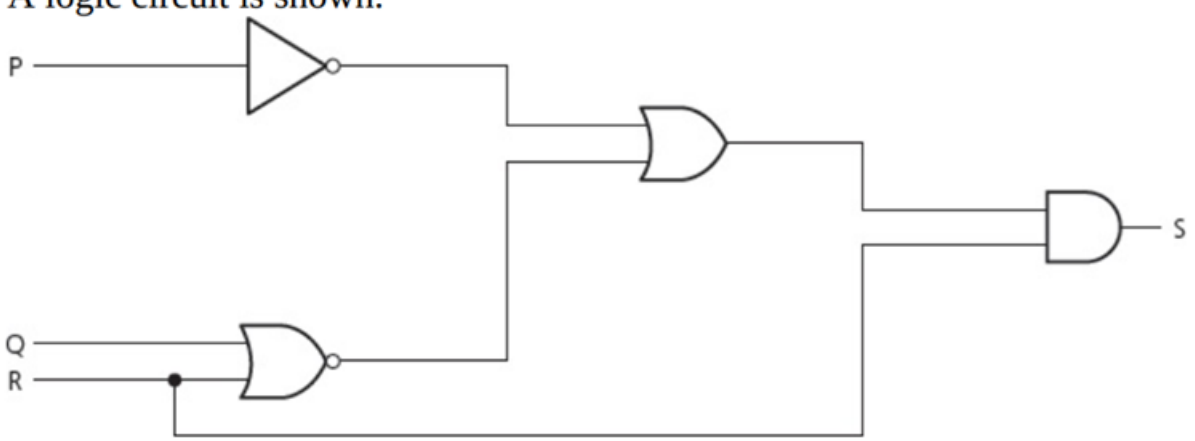
ii) Give an advantage of using JK flip-flops.

[1]

iii) Describe two uses of JK flip-flops in computers.

[2]

6 A logic circuit is shown.



a) Write the Boolean expression corresponding to this logic circuit.

[4]

b) Copy and complete the truth table for this logic circuit.

[2]

P	Q	R	Working space	S
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

c) i) Copy and complete the Karnaugh map (K-map) for the truth table in part b).

[1]

		PQ			
		00	01	11	10
R	0				
	1				

The K-map can be used to simplify the function in part a).

ii) Draw loops around appropriate groups to produce an optional sum-of-products.

[1]

iii) Write a simplified sum-of-products expression, using your answer to part ii).

[1]

d) One Boolean identity is:

(A + B).C = A.C + B.C

Simplify the expression for S in part a) to the expression for S in part c) iii). You should use the given identity and De Morgan's Laws.

[3]

Cambridge International AS & A Level Computer Science 9608
Paper 32 Q3 June 2017