Week # 5

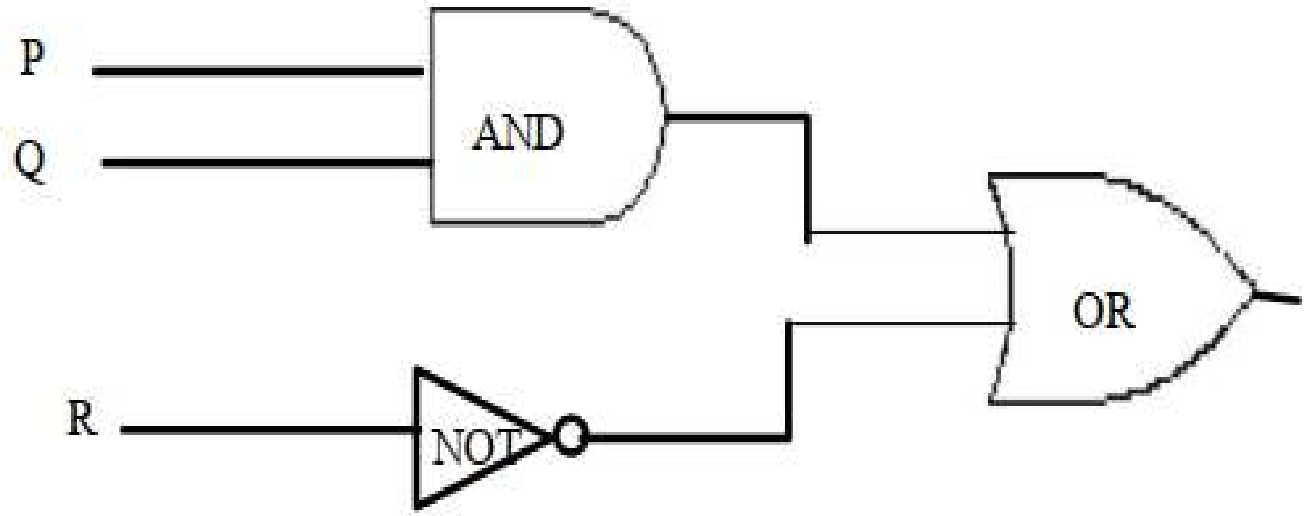
Discrete Structure

by

Syed Ibrahim

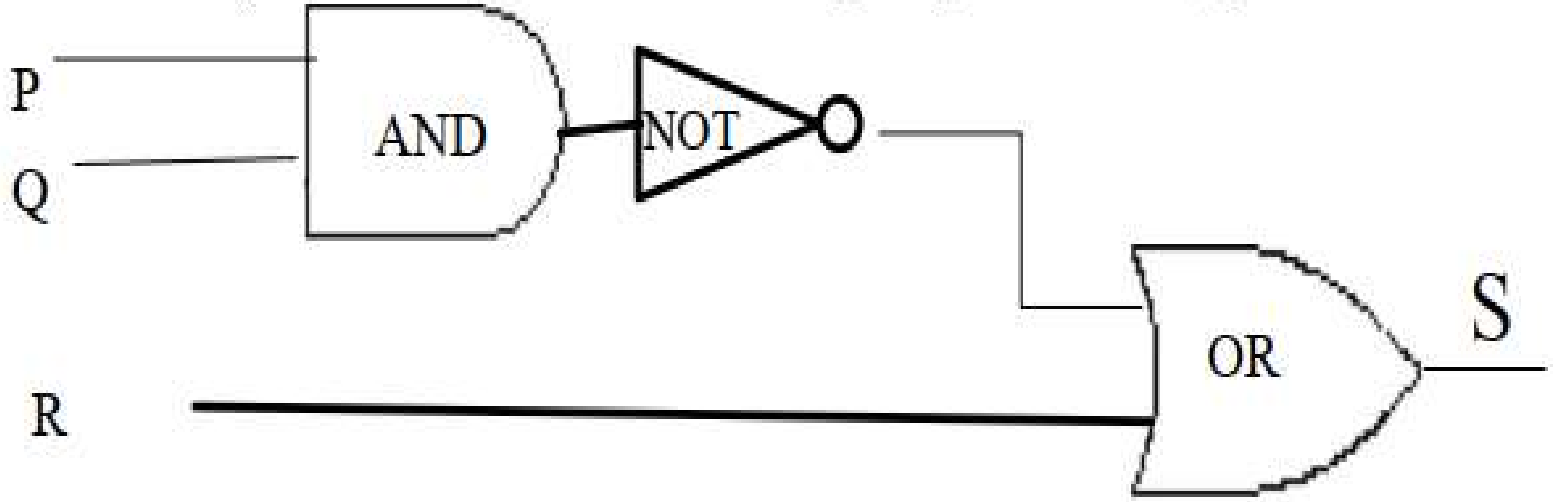
COMBINATIONAL CIRCUIT:

A Combinational Circuit is a compound circuit consisting of the basic logic gates such as NOT, AND, OR.



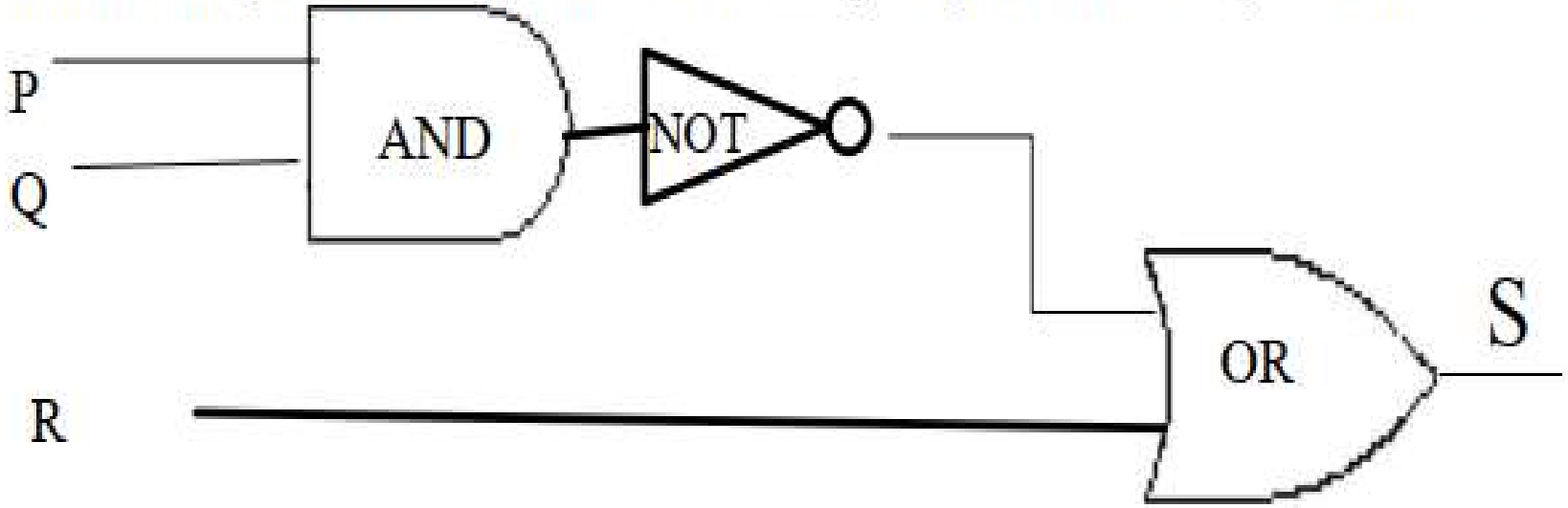
DETERMINING OUTPUT FOR A GIVEN INPUT:

Indicate the output of the circuit below when the input signals are P = 1, Q = 0 and R = 0

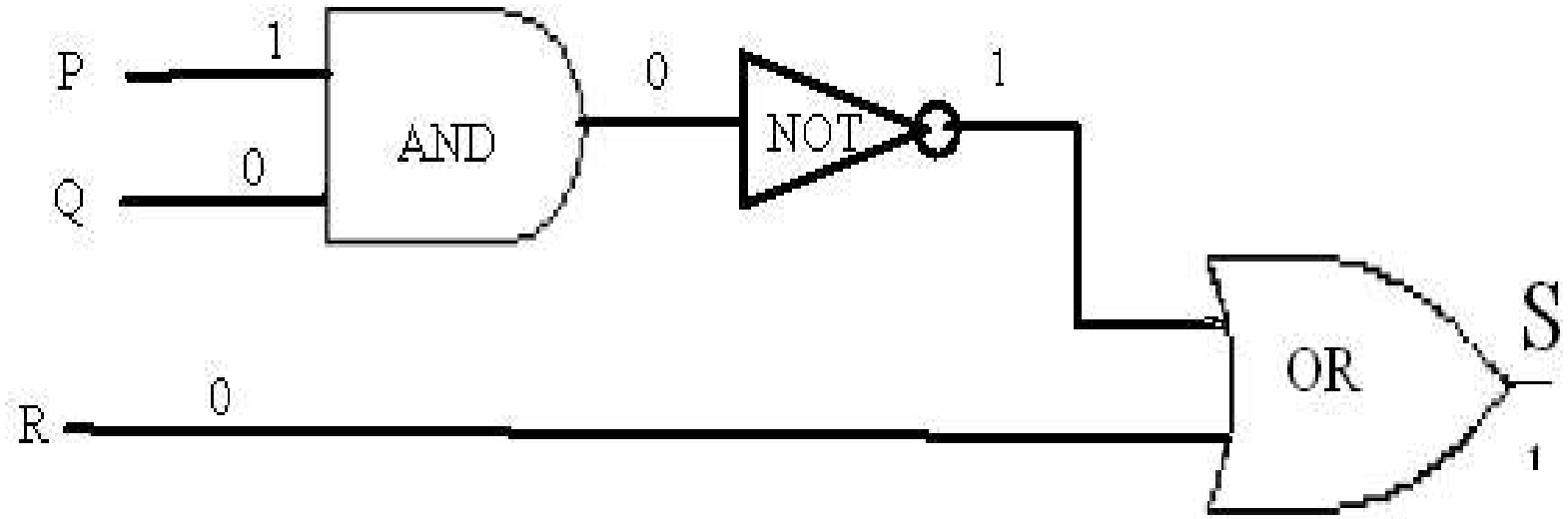


DETERMINING OUTPUT FOR A GIVEN INPUT:

Indicate the output of the circuit below when the input signals are P = 1, Q = 0 and R = 0

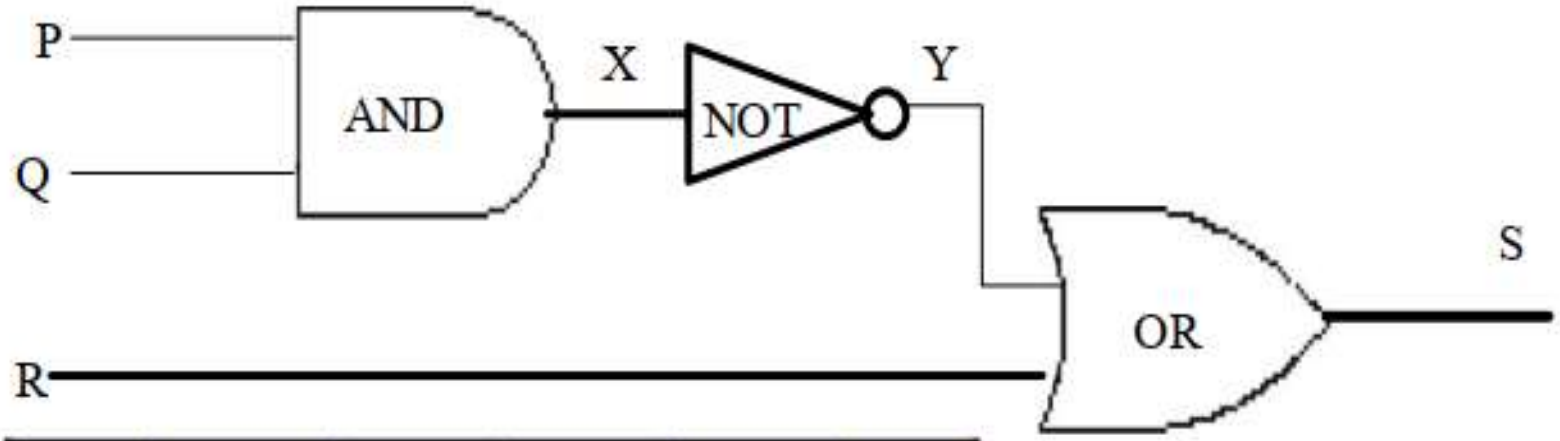


SOLUTION:



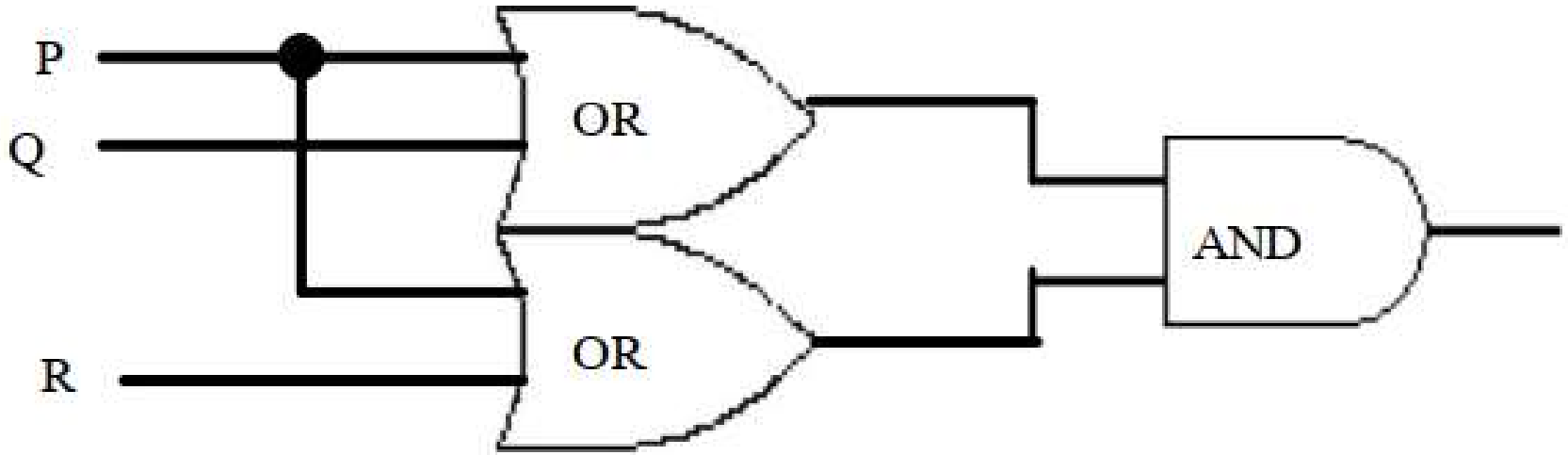
Output S = 1

LABELING INTERMEDIATE OUTPUTS:



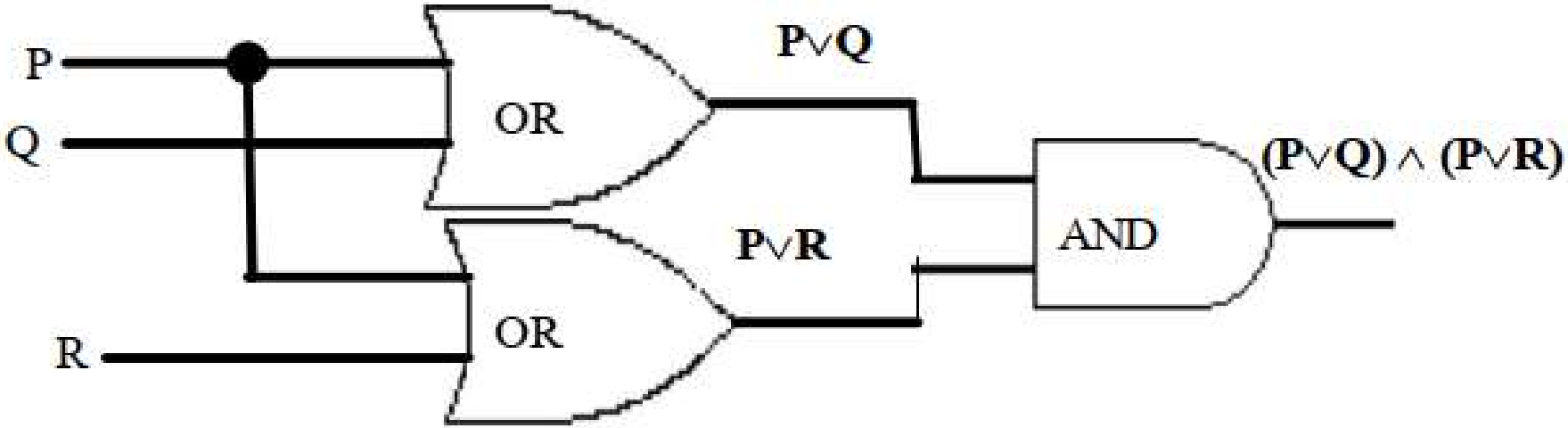
P	Q	R	X	Y	S
1	1	1	1	0	1
1	1	0	1	0	0
1	0	1	0	1	1
1	0	0	0	1	1
0	1	1	0	1	1
0	1	0	0	1	1
0	0	1	0	1	1
0	0	0	0	1	1

FINDING A BOOLEAN EXPRESSION FOR A CIRCUIT



SOLUTION:

Trace through the circuit from left to right, writing down the output of each logic gate.



Hence **(P∨Q) ∧(P∨R)** is the Boolean expression for this circuit.

CIRCUIT CORRESPONDING TO A BOOLEAN EXPRESSION

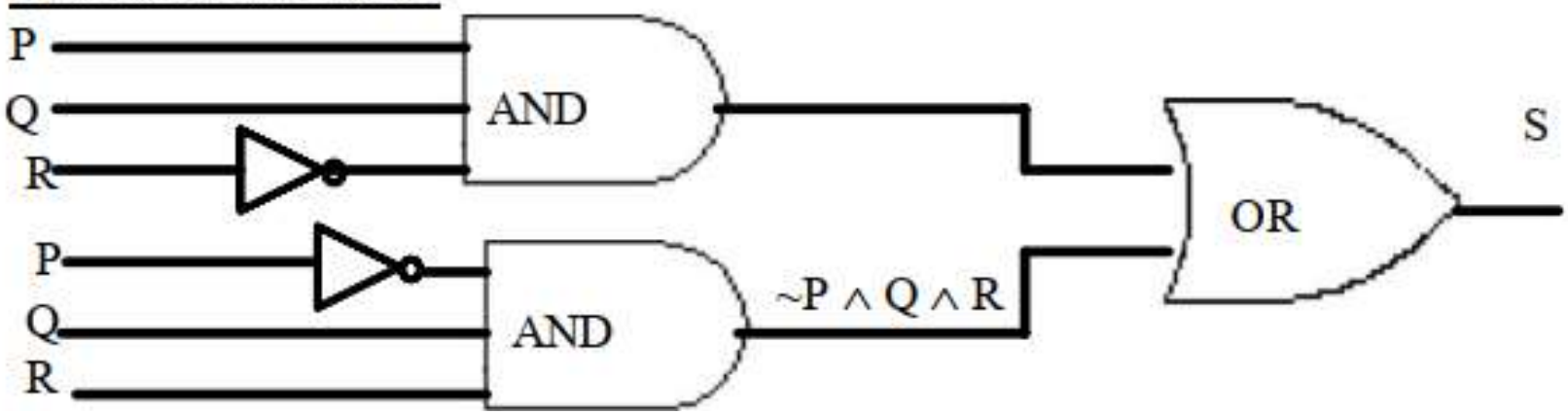
CIRCUIT FOR INPUT/OUTPUT TABLE:

INPUTS			OUTPU
P	Q	R	S
1	1	1	0
1	1	0	1
1	0	1	0
1	0	0	0
0	1	1	1
0	1	0	0
0	0	1	0
0	0	0	0

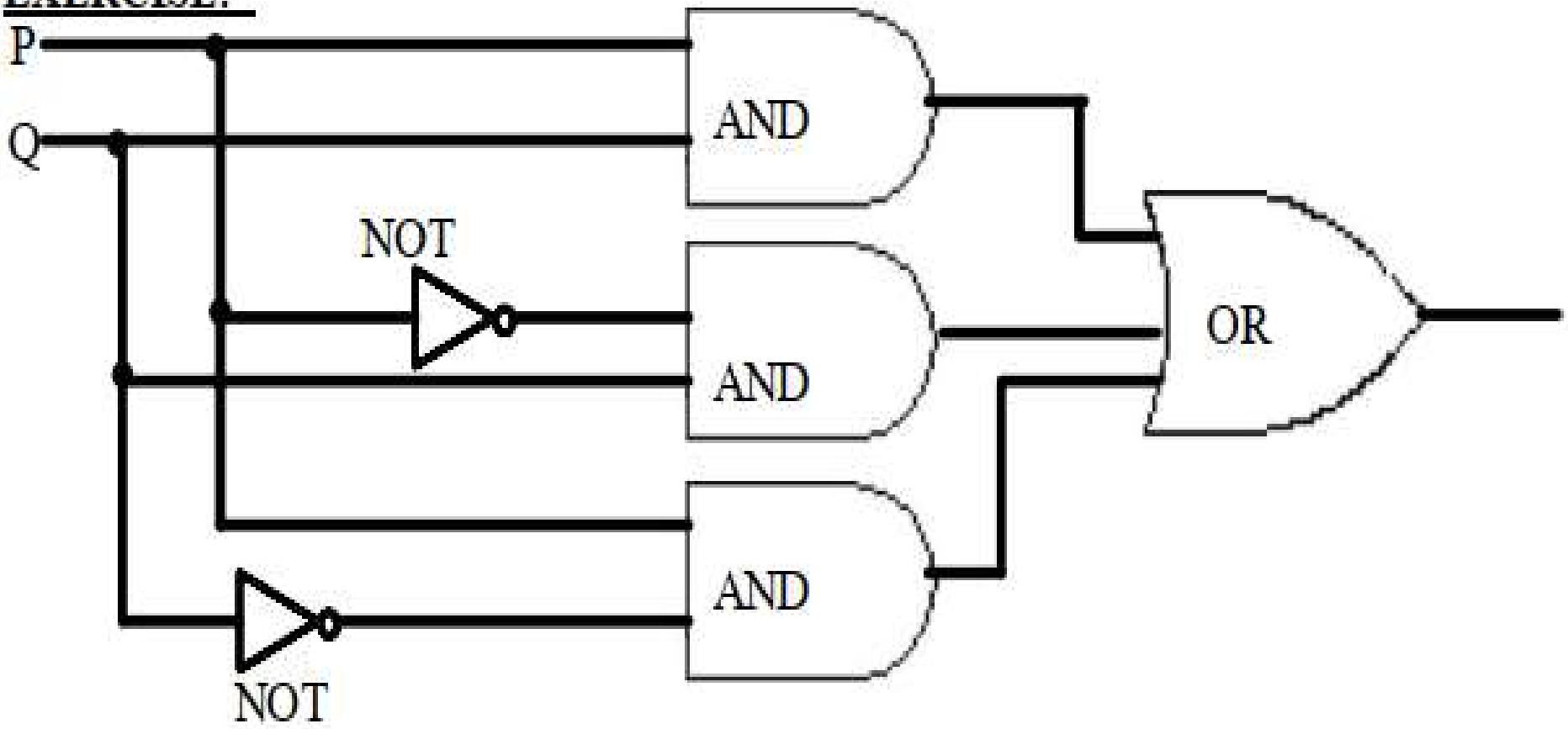
SOLUTION:

INPUTS			OUTPUT	
P	Q	R	S	
1	1	1	0	
1	1	0	1	→ $P \wedge Q \wedge \sim R$
1	0	1	0	
1	0	0	0	
0	1	1	1	→ $\sim P \wedge Q \wedge R$
0	1	0	0	
0	0	1	0	
0	0	0	0	

CIRCUIT DIAGRAM:



EXERCISE:

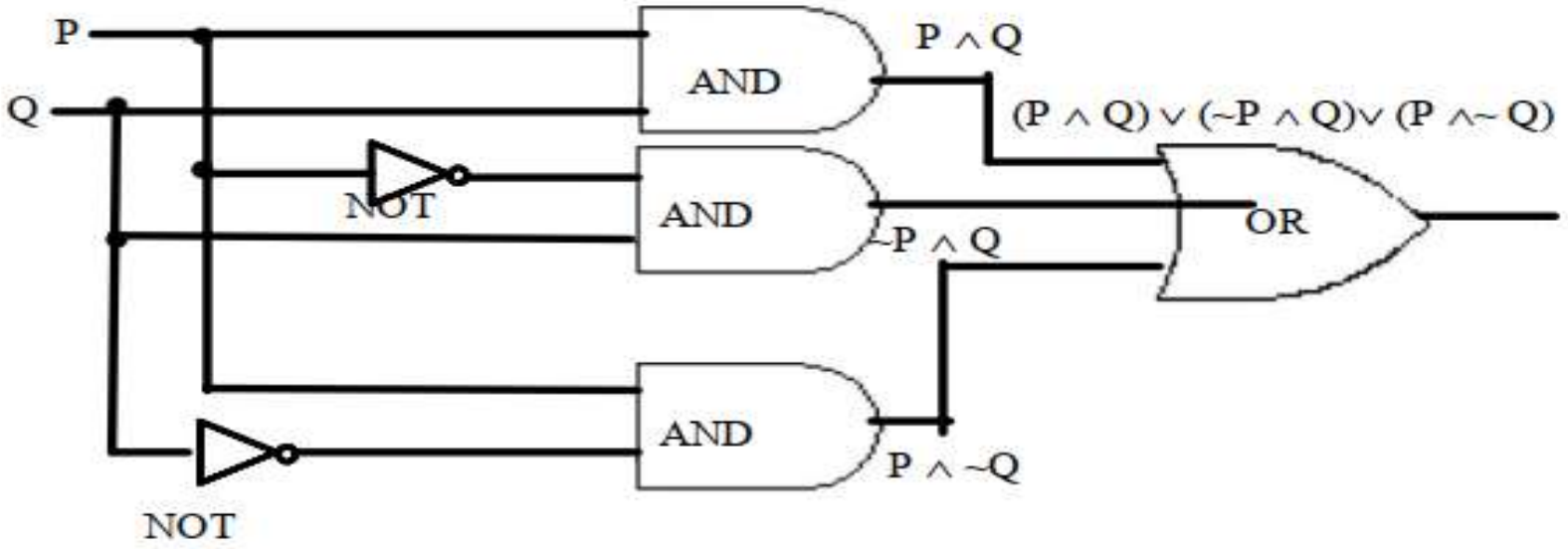


SOLUTION:

We find the Boolean expressions for the circuits and show that they are logically equivalent, when regarded as statement forms.

Quiz # 1

Correct the symbols in simplification according to the given circuit to get P v Q.



STATEMENT	**REASON**
(P ∧ Q) ∨(~P ∧ Q) ∧ (P ∧~ Q)	
≡ (P ∧ Q) ∧ (~P ∧ Q) ∧ (P ∧~ Q)	
≡ (P ∧ ~P) ∧ Q∧ (P ∧~ Q)	Distributive law
≡ t ∧Q ∧ (P ∧~Q)	Negation law
≡ Q ∧ (P ∧~Q)	Identity law
≡ (Q ∧ P) ∧ (Q ∧ ~Q)	Distributive law
≡ (Q ∧ P) ∧ t	Negation law
≡ (Q ∨ P) ∨ t	
≡ Q ∨ P	identity law
≡ P ∨ Q	Commutative law