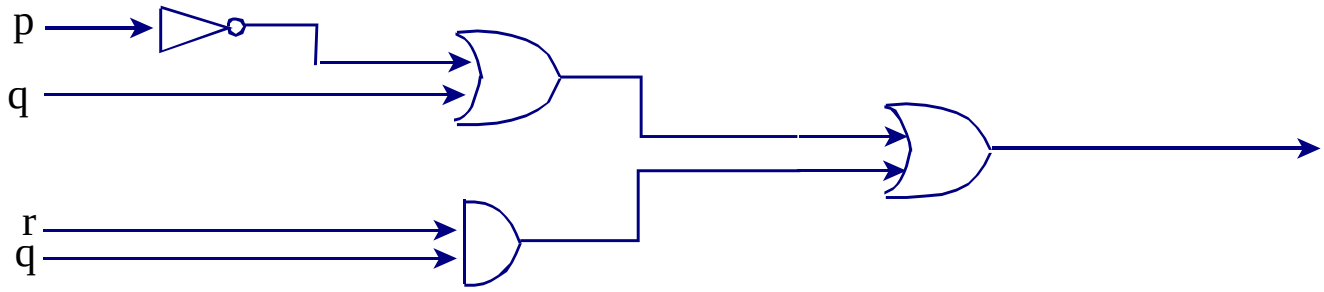
Logic Exercise Set #7 - Part 2 Solutions

Spring 2021

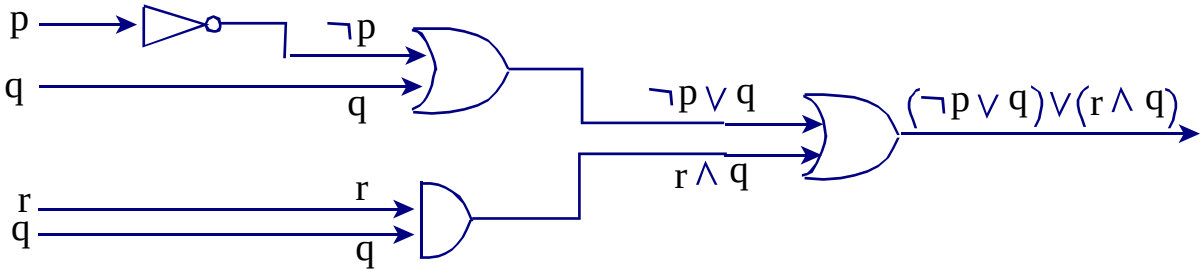
Pat Rossi Name _____

Instructions

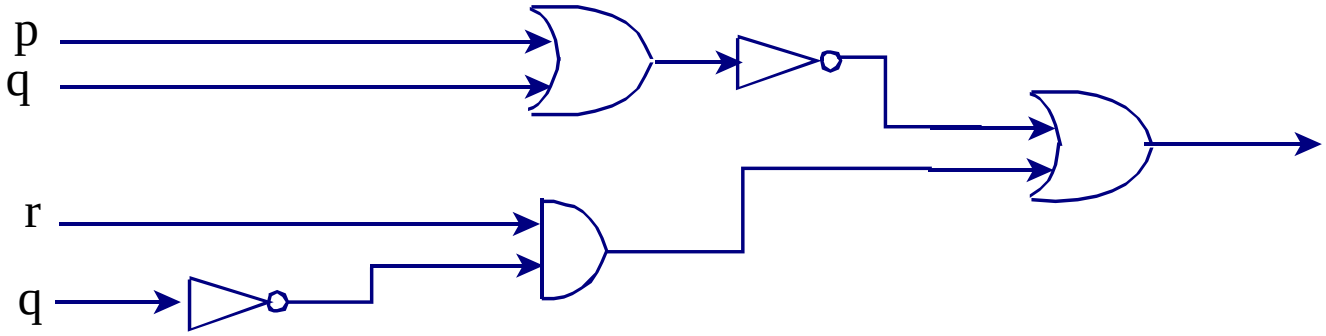
1. Determine the output of the combinatorial circuit:



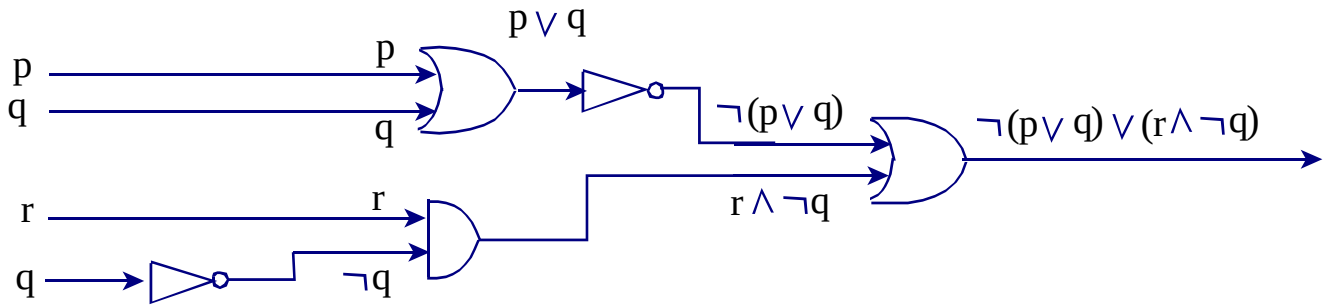
We follow the processing of the input step by step, yielding:



2. Determine the output of the combinatorial circuit:

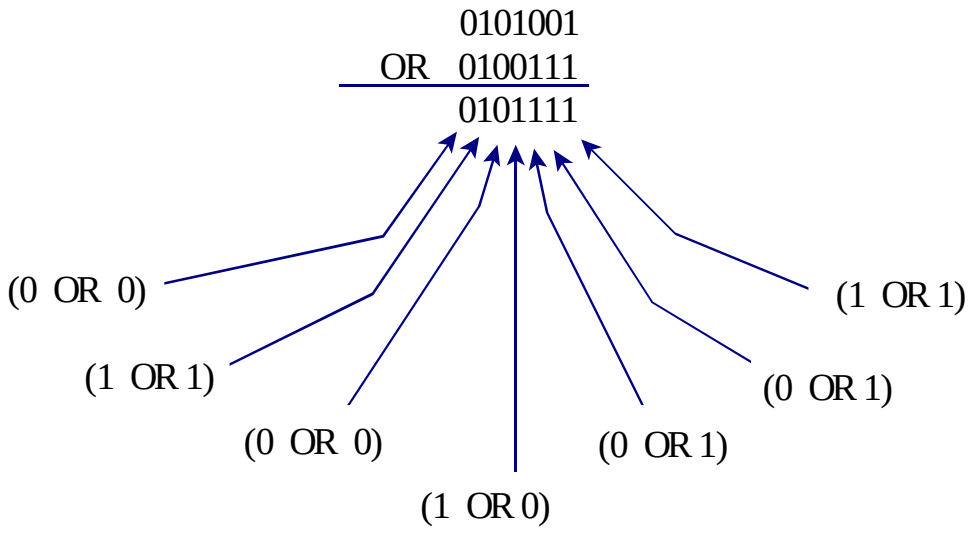


We follow the processing of the input step by step, yielding:

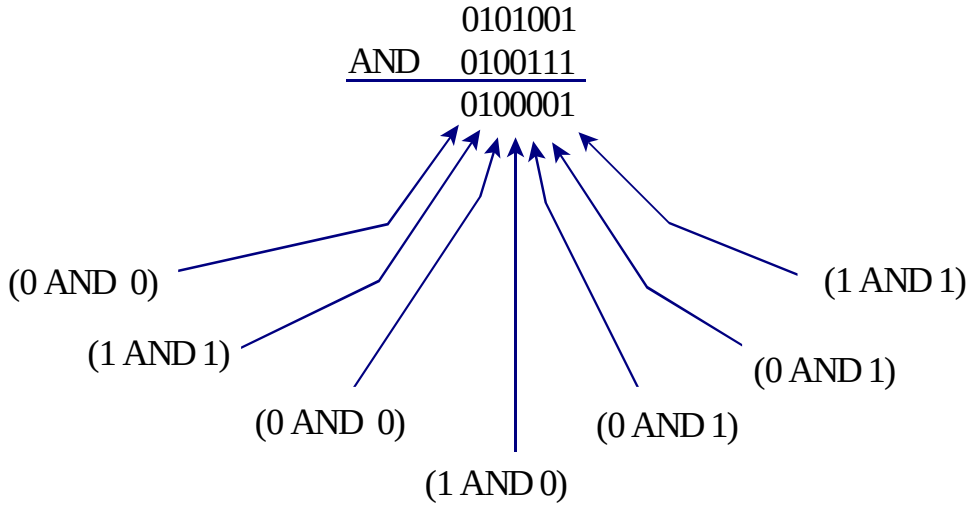


3. Find the bitwise OR, bitwise AND, and bitwise XOR of the pair of bit strings: 0101001 and 0100111

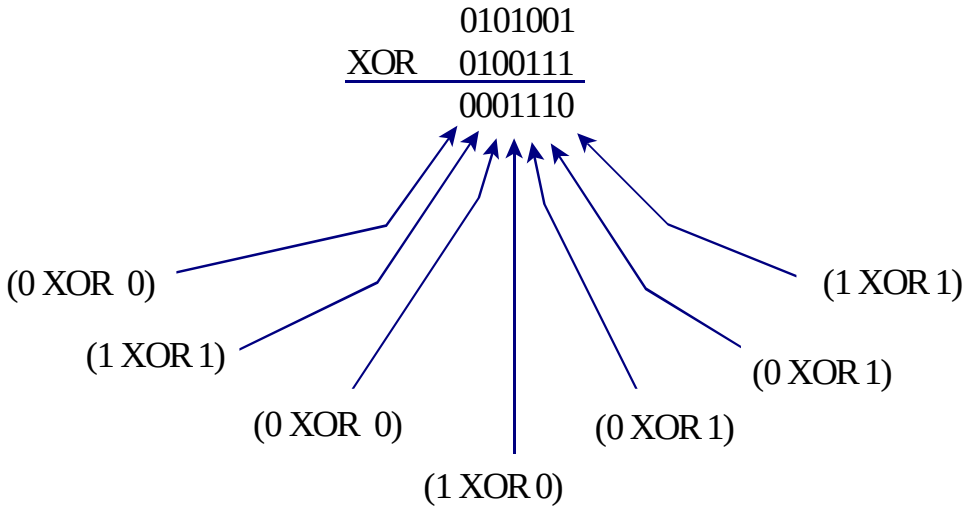
0101001 OR 0100111 ≡ 0101111 (The justification is given below)



0101001 AND 0100111 ≡ 0100001 (The justification is given below)

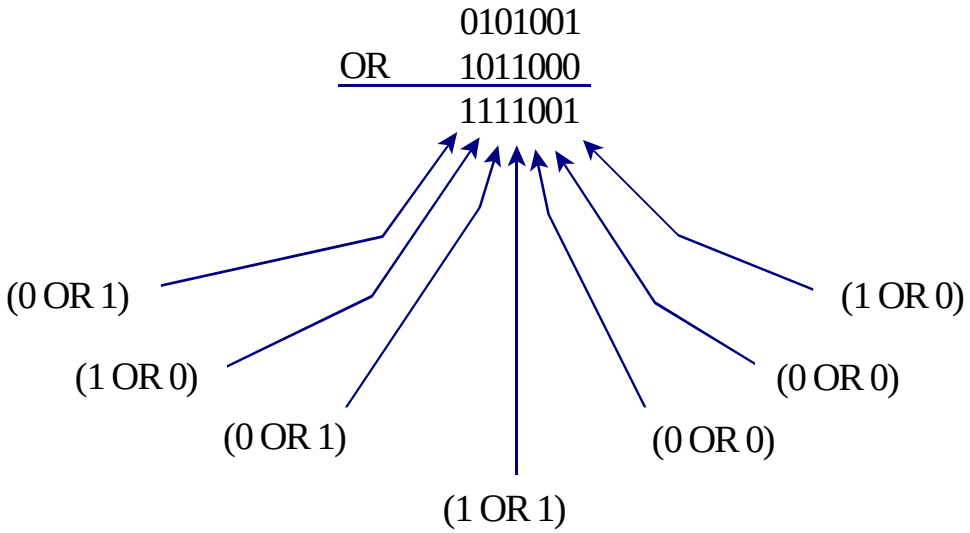


0101001 XOR 0100111 ≡ 0001110 (The justification is given below)

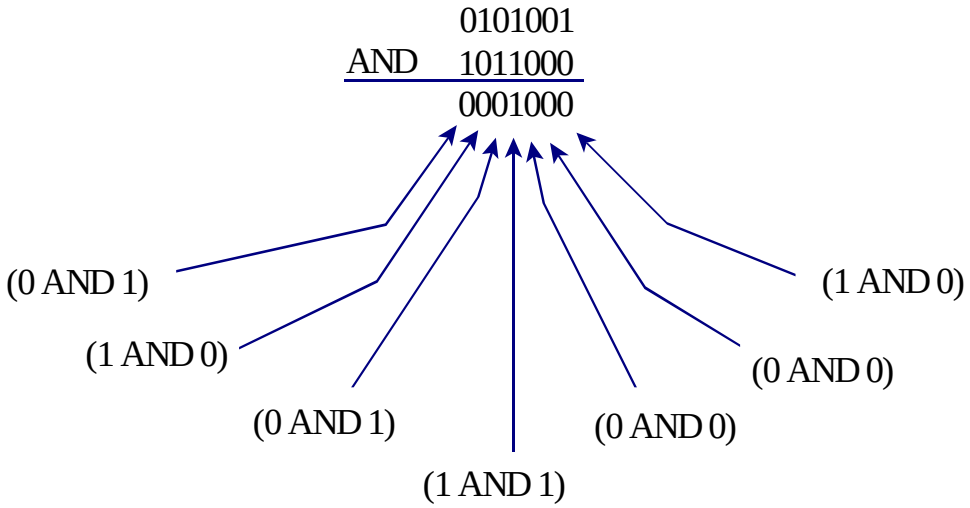


4. Find the bitwise OR, bitwise AND, and bitwise XOR of the pair of bit strings: 0101001 and 1011000

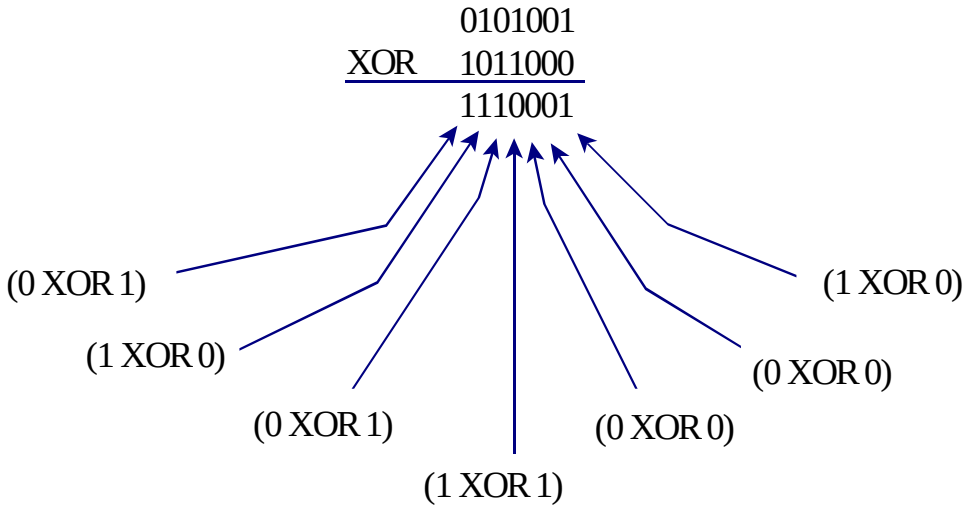
0101001 OR 1011000 ≡ 1111001 (The justification is given below)



0101001 AND 1011000 ≡ 0001000 (The justification is given below)



0101001 XOR 1011000 ≡ 1110001 (The justification is given below)



5. Determine whether the set of System Specifications is consistent:

s_1: The user paid the subscription fee, but does not enter a valid password.

s_2: Access is granted if the user has paid the subscription fee and has entered a valid password.

s_3: Access is denied if the user has not paid the subscription fee.

s_4: If the user has not entered a valid password, but has paid the subscription fee, then access is granted

We represent the simple statements above symbolically, using the following assignments:

p: The user paid the subscription fee

q: The user has entered a valid password

r: Access is granted

Our System specifications are as follows:

s_1: The user paid the subscription fee, but does not enter a valid password. $p \wedge (\neg q)$

s_2: Access is granted if the user has paid the subscription fee and has entered a valid password. $(p \wedge q) \rightarrow r$

s_3: Access is denied if the user has not paid the subscription fee. $(\neg p) \rightarrow (\neg r)$

s_4: If the user has not entered a valid password, but has paid the subscription fee, then access is granted $(\neg q \wedge p) \rightarrow r$

The System Specifications will be consistent exactly when the conjunction of the specifications is NOT a contradiction. (i.e., exactly when the conjunction of the specifications is True for at least one combination of truth values of p, q, and r.

p	q	r	$\neg p$	$\neg q$	$\neg r$	s_1: $p \wedge (\neg q)$	$(p \wedge q)$	s_2: $(p \wedge q) \rightarrow r$	s_3: $(\neg p) \rightarrow (\neg r)$	$(\neg q \wedge p)$	s_4: $(\neg q \wedge p) \rightarrow r$	$s_1 \wedge s_2 \wedge s_3 \wedge s_4$
T	T	T	F	F	F	T	T	T	T	F	T	T
T	T	F	F	F	T	T	T	F	T	F	T	F
T	F	T	F	T	F	T	F	T	T	T	T	T
T	F	F	F	T	T	T	F	T	T	T	F	F
F	T	T	T	F	F	F	F	T	F	F	T	F
F	T	F	T	F	T	F	F	T	T	F	T	F
F	F	T	T	T	F	T	F	T	F	F	T	F
F	F	F	T	T	T	T	F	T	T	F	T	T

The fact that "T" appears in the right most column, prevents the conjunction of the system specifications from being a contradiction.

The set of system specifications IS consistent.