Discrete Math

Ch1: Logic and Proofs

Lab 2

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1) Translate the given statement into propositional logic using the propositions provided.

You can upgrade your operating system only if you have a 32-bit processor running at 1 GHz or faster, at least 1 GB RAM, and 16 GB free hard disk space, or a 64- bit processor running at 2 GHz or faster, at least 2 GB RAM, and at least 32 GB free hard disk space.

Express you answer in terms of :

u: “You can upgrade your operating system”

b_{32}: “You have a 32-bit processor”

b_{64}: “You have a 64-bit processor”

g_1: “Your processor runs at 1 GHz or faster”

g_2: “Your processor runs at 2 GHz or faster”

r_1: “Your processor has at least 1 GB RAM”

r_2: “Your processor has at least 2 GB RAM”

h_{16}: “You have at least 16 GB free hard disk space”

and h_{32}: “You have at least 32 GB free hard disk space.”

2) Express these system specifications using the propositions

p: “The user enters a valid password,”

q: “Access is granted,”

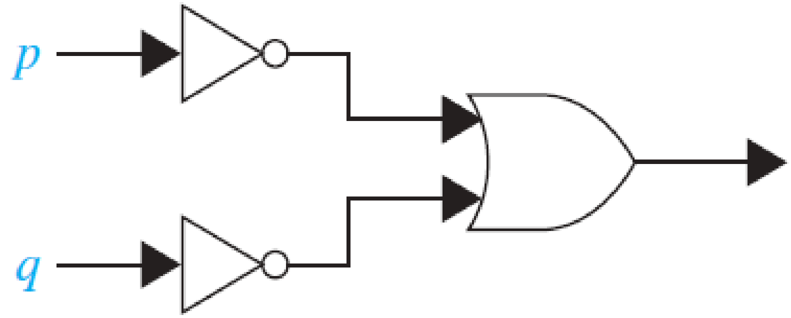
and r: “The user has paid the subscription fee”

a) “The user has paid the subscription fee, but does not enter a valid password.”
b) “Access is granted whenever the user has paid the subscription fee and enters a valid password.”
c) “Access is denied if the user has not paid the subscription fee.”
d) “If the user has not entered a valid password but has paid the subscription fee, then access is granted.”

Assignment

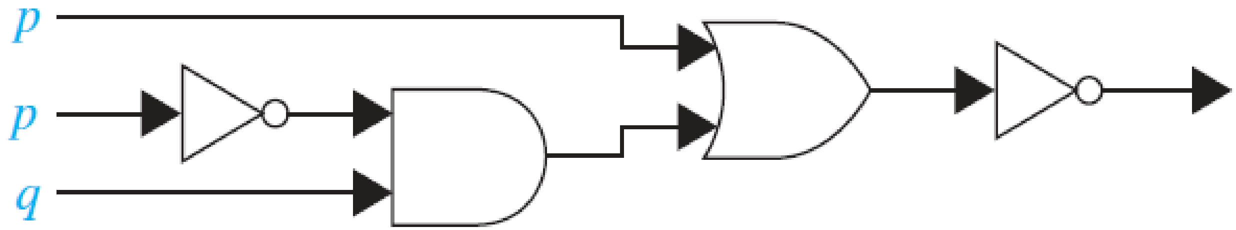
3) Find the output of each of these combinatorial circuits.

a)



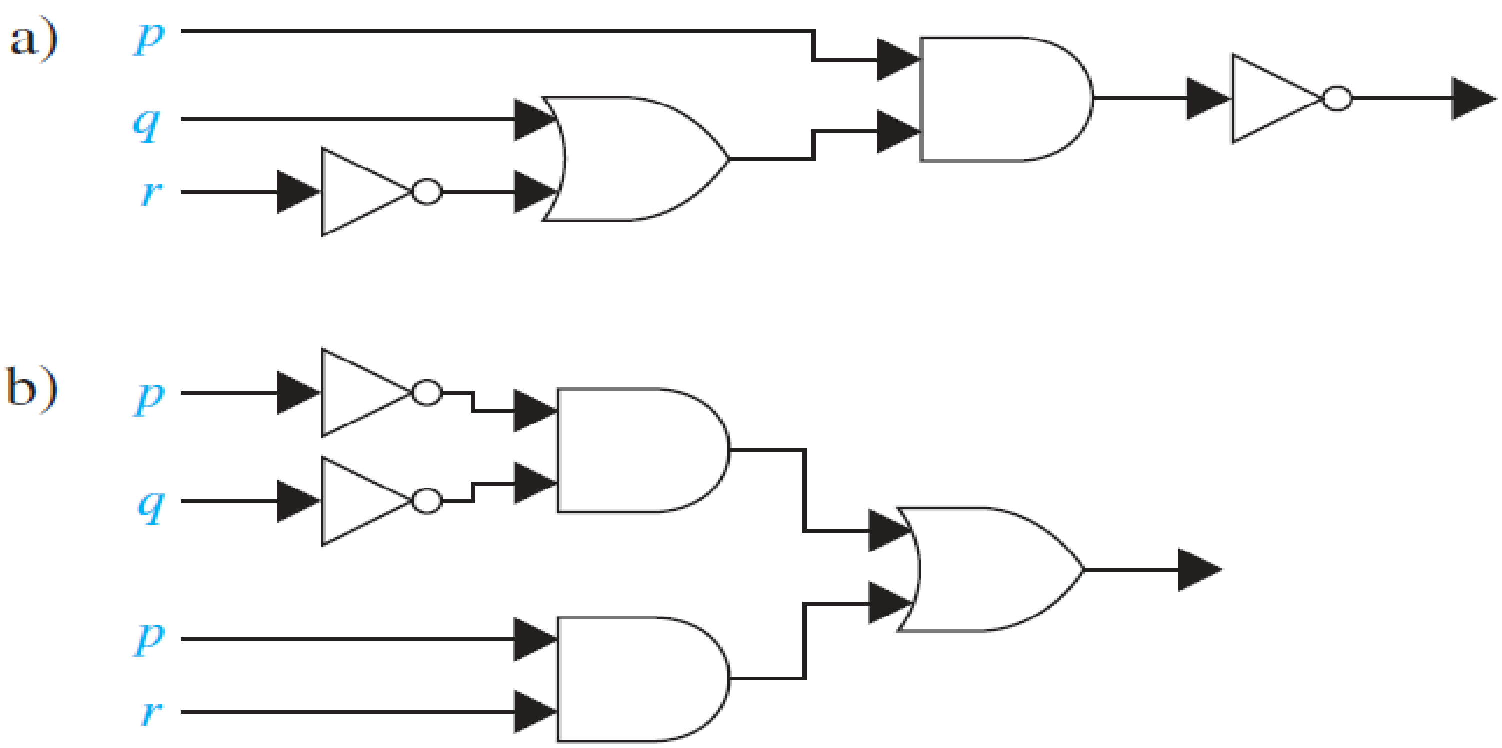
"$\neg p \vee \neg q$"

b)



"$\neg(p \vee (\neg p \wedge q))$"

4) Find the output of each of these combinatorial circuits.



(a) Assignment

5) Use De Morgan's laws to find the negation of each of the following statements.

a) Jan is rich and happy.

"Jan is not rich or not happy"

b) Carlos will bicycle or run tomorrow.

"Carlos will not bicycle and not run tomorrow"

c) Mei walks or takes the bus to class.

d) Ibrahim is smart and hard working.

The first De Morgan law: $\neg(p \land q) \equiv \neg p \lor \neg q$

C and D Assignment

6) Use a truth table to verify

The first De Morgan law: $\neg(p \land q) \equiv \neg p \lor \neg q$

7) Show that each of these conditional statements is a tautology by using truth table.

a) $[\neg p \land (p \lor q)] \rightarrow q$

b) $[(p \rightarrow q) \land (q \rightarrow r)] \rightarrow (p \rightarrow r)$

c) $[p \land (p \rightarrow q)] \rightarrow q$

B Assignment

- $(\neg p \land (p \lor q)) \to q$

p	q	$\neg p$	$p \lor q$	$\neg p \land (p \lor q)$	$(\neg p \land (p \lor q)) \to q$
T	T	F	T	F	T
T	F	F	T	F	T
F	T	T	T	T	T
F	F	F	F	F	T

- $((p \to q) \land (q \to r)) \to (p \to r)$

p	q	r	$p \to q$	$q \to r$	$p \to r$	$((p \to q) \land (q \to r))$	$((p \to q) \land (q \to r)) \to (p \to r)$
T	T	T	T	T	T	T	T
T	T	F	T	F	F	F	T
T	F	T	F	T	T	F	T
T	F	F	F	T	F	F	T
F	T	T	T	T	T	T	T
F	T	F	T	F	T	F	T
F	F	T	T	T	T	T	T
F	F	F	T	T	T	T	T

8) Show that $\neg q \rightarrow \neg p \equiv p \rightarrow q$,using Truth Table.

9) Show that $(p \land q) \rightarrow r$ and $(p \rightarrow r) \land (q \rightarrow r)$ are **not logically Equivalent ,**using Truth table.

10) Show that **$p \leftrightarrow q$** and **$(p \wedge q) \vee (\neg p \wedge \neg q)$** are logically equivalent using Truth table.

p	q	$p \leftrightarrow q$	$p \wedge q$	$\neg p \wedge \neg q$	$(p \wedge q) \vee (\neg p \wedge \neg q)$
T	T	T	T	F	T
T	F	F	F	F	F
F	T	F	F	F	F
F	F	T	F	T	T

11) Show that **$\neg(p \oplus q)$** and **$p \leftrightarrow q$** are logically equivalent using Truth table.

Assignment