CIS102 Tutorial 3 Answers

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1.

p	q	$\neg p \wedge q$	$q - p$	$p \vee \neg q$	$p \oplus q$
0	0	0	0	1	0
0	1	1	1	0	1
1	0	0	0	1	1
1	1	0	0	1	0

2. p : *n has exactly two digits*; q : *n is divisible by 3*

n	p	q	$\neg p$	$\neg q$	$\neg p \wedge q$	$q - p$	$p \vee \neg q$	$p \oplus q$
1	0	0	1	1	0	0	1	0
3	0	1	1	0	1	1	0	1
17	1	0	0	1	0	0	1	1
30	1	1	0	0	0	0	1	0
48	1	1	0	0	0	0	1	0
99	1	1	0	0	0	0	1	0

$\neg p = \{1, 3\}$
$\neg p \wedge q = \{3\}$
$p - q = \{3\}$
$p \vee \neg q = \{1, 17, 30, 48, 99\}$

3. p : *it is a vowel*; q : *it occurs in the word* BINARY

n	p	q	$\neg p$	$\neg q$	$p \vee q$	$p \wedge \neg q$	$p - \neg q$
a	1	1	0	0	1	0	1
b	0	1	1	0	1	0	0
c	0	0	1	1	0	0	0
d	0	0	1	1	0	0	0
e	1	0	0	1	1	1	0
f	0	0	1	1	0	0	0
g	0	0	1	1	0	0	0
h	0	0	1	1	0	0	0
i	1	1	0	0	1	0	1
j	0	0	1	1	0	0	0
k	0	0	1	1	0	0	0
l	0	0	1	1	0	0	0
m	0	0	1	1	0	0	0
n	0	1	1	0	1	0	0
o	1	0	0	1	1	1	0
p	0	0	1	1	0	0	0
q	0	0	1	1	0	0	0
r	0	1	1	0	1	0	0
s	0	0	1	1	0	0	0
t	0	0	1	1	0	0	0
u	1	0	0	1	1	1	0
v	0	0	1	1	0	0	0
w	0	0	1	1	0	0	0
x	0	0	1	1	0	0	0
y	0	1	1	0	1	0	0
z	0	0	1	1	0	0	0

it is not a vowel occurring in the word BINARY $= \neg(p \wedge q)$

$p \vee q = \{a, b, e, i, n, o, r, u, y\}$
it is either a consonant which occurs in the word BINARY or a vowel

$p \wedge \neg q = \{e, o, u\}$
it is a vowel which does not occur in the word BINARY

$p - \neg q = \{a, i\}$
it is a vowel which occurs in the word BINARY

4. $p : n < 20; q : n$ *is odd*; $r : n$ *is divisible by 5*
   $p \vee (q \wedge r)$ means it is a positive integer less than 20 or that it ends in a 5
   $p \vee (q \wedge r) = \{1, 2, 3, \ldots, 18, 19, 25, 35, 45, \ldots\}$
   $p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$
   $(p \vee q) \wedge (p \vee r) = \{1, 2, 3, \ldots, 18, 19, 25, 35, 45, \ldots\}$

5. $p : n < 20$; $q : n$ *is odd*

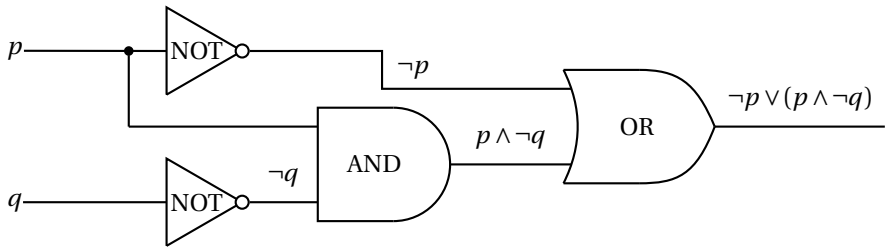
   (a) i. $n < 20$ *if* n *is odd* $\equiv q \rightarrow p$
   ii. $n < 20$ *only if* n *is odd* $\equiv p \rightarrow q$

   (b)

n	p	q	$p \rightarrow q$	$q \rightarrow p$	$p \leftrightarrow q$
36	0	0	1	1	1
29	0	1	1	0	0
10	1	0	0	1	0
17	1	1	1	1	1

6. If $n < 7$ then n does not have three $1s$ in its binary representation.

7.



   (a)

p	q	$\neg q$	$p \wedge \neg q$	$\neg p$	$\neg p \vee (p \wedge \neg q)$
0	0	1	0	1	1
0	1	0	0	1	1
1	0	1	1	0	1
1	1	0	0	0	0

   (b) $\neg p \vee (p \wedge \neg q) \equiv \neg(p \wedge q) \equiv \neg p \vee \neg q$