Computer Science 1820

Solutions for Recommended Exercises

Section 1.1

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2. (a) This is an *imperative* sentence, *not* a declarative sentence, and is therefore $\boxed{\textit{not}\text{ a proposition.}}$

   (b) This sentence is *interrogative, not* declarative, and is therefore $\boxed{\textit{not}\text{ a proposition.}}$

   (c) This *is* a declarative sentence, and consequently $\boxed{\textit{is}\text{ a proposition.}}$

   Also, it is $\boxed{\textit{true}}$ (there are black flies *everywhere* that people live).

   (d) Not knowing the value of x means that we cannot say whether this statement is true or false; ergo, it is $\boxed{\textit{not}\text{ a proposition.}}$

   (e) This $\boxed{\textit{is}\text{ a proposition,}}$ and of course, it is $\boxed{\textit{false.}}$

   (f) Like (d), we cannot say whether this statement is true or false, so it is $\boxed{\textit{not}\text{ a proposition.}}$

4. (a) "$\neg$" means *negation:* "I did *not* buy a lottery ticket this week."

   (b) "$\vee$" means *inclusive or:* "I bought a lottery ticket this week *or* I won the million dollar jackpot on Friday *(or both).*"

   (c) "$\rightarrow$" means *implication:* "*If* I bought a lottery ticket this week *then* I won the million dollar jackpot on Friday."

   (d) "$\wedge$ means *and:* "I bought a lottery ticket this week *and* I won the million dollar jackpot on Friday."

   (e) "$\leftrightarrow$" means *bi-implication:* "I bought a lottery ticket this week *if and only* if I won the million dollar jackpot on Friday."

(continued)

(continued)

(f) Combining the logical operators yields: "*If* I did *not* buy a lottery ticket this week *then* I did *not* win the million dollar jackpot on Friday."

(g) "I did *not* buy a lottery ticket this week *and* I did *not* win the million dollar jackpot on Friday."

(h) The order of operations in a compound proposition may be indicated in its English form via the use of a comma: "I did *not* buy a lottery ticket this week, *or* I bought a lottery ticket this week *and* I won the million dollar jackpot on Friday."

6. (a) There are many ways to negate an English declarative sentence. For the given sentence, "It is not the case that the election is decided," "The election is not decided," and "The election is undecided" all suffice.

   (b) "The election is decided or the votes have been counted."

   (c) "The election is not decided and the votes have been counted."

   (d) "If the votes have been counted then the election is decided."

   (e) "If the votes have not been counted then the election is not decided."

   (f) "If the election is not decided then the votes have not been counted."

   (g) "The election is decided if and only if the votes have been counted."

   (h) "The votes have not been counted, or the election is not decided and the votes have been counted."

8. (a) "If you have the flu then you miss the final examination."

   (b) "You do not miss the final examination if and only if you pass the course."

   (c) "If you miss the final examination then you do not pass the course."

   (d) "You have the flu or you miss the final examination or you pass the course."

(continued)

(continued)

(e) "If you have the flu then you do not pass the course, or if you miss the final examination then you do not pass the course."

(f) "You have the flu and you miss the final examination, or you do not miss the final examination and you pass the course."

12. (a) A biconditional is *true* when its two propositional variables have the *same* truth value; it's *false* when their truth values are *different.* "$2+2=4$" and "$1+1=2$" are *both* true, so the given biconditional is $\boxed{\textit{true.}}$

(b) "$1+1=2$" is *true* while "$2+3=4$" is *false,* so the given biconditional is $\boxed{\textit{false.}}$

(c) "$1+1=3$" and "monkeys can fly" are *both* false, so the given biconditional is $\boxed{\textit{true.}}$

(d) "$0>1$" is *false* while "$2>1$" is *true;* ergo, the given biconditional is $\boxed{\textit{false.}}$

14. (a) The implication $p \to q$ is *false* when its hypothesis p is true and its conclusion q is false; it is *true* otherwise. Since the hypothesis in the given implication ("$1+1=3$") is *false,* the given implication is $\boxed{\textit{true.}}$

(b) Again, the hypothesis is *false,* so the given implication is $\boxed{\textit{true.}}$

(c) The hypothesis ("$1+1=2$") is *true,* and the conclusion ("dogs can fly") is *false,* so the given implication is $\boxed{\textit{false.}}$

(d) The hypothesis ("$2+2=4$") and the conclusion ("$1+2=3$") are *both true,* so the given implication is $\boxed{\textit{true.}}$

18. (a) "If you got promoted, then you washed the boss' car."

(b) "If the winds are from the south, then a spring thaw occurs."

(c) "If you bought the computer less than a year ago, then the warranty is good."

(continued)

(continued)

(d) "If Willy cheats, he gets caught."

(e) "If you can access the website, then you paid a subscription fee."

(f) "If you know the right people, then you get elected."

(g) "If Carol is on a boat, then she gets seasick."

20. (a) "If I remember to send you the address, then you have sent me an e-mail message."

(b) If you were born in the United States, then you are a citizen of that country."

(c) DUH! ($\smile$)

(d) "If their goalie plays well, then the Red Wings will win the Stanley Cup."

(e) "If you get the job, then you had the best credentials."

(f) "If there is a storm, then the beach erodes."

(g) "If you log on to the server, then you have a valid password."

(h) There are two ways to write this one as an if-then statement: "If you do not begin your climb too late, then you will reach the summit," and "If you do not reach the summit, then you began your climb too late."

28. (a)

p	$\neg p$	$p \to (\neg p)$
0	1	1
1	0	0

(b)

p	$\neg p$	$p \leftrightarrow (\neg p)$
0	1	0
1	0	0

(c)

p	q	$p \vee q$	$p \oplus (p \vee q)$
0	0	0	0
0	1	1	1
1	0	1	0
1	1	1	0

(d)

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

(continued)

(continued)

(e)

p	q	$\neg p$	$q \to (\neg p)$	$p \leftrightarrow q$	$(q \to (\neg p)) \leftrightarrow (p \leftrightarrow q)$
0	0	1	1	1	1
0	1	1	1	0	0
1	0	0	1	0	0
1	1	0	0	1	0

(f)

p	q	$\neg q$	$p \leftrightarrow (\neg q)$	$p \leftrightarrow q$	$(p \leftrightarrow q) \oplus (p \leftrightarrow (\neg q))$
0	0	1	0	1	1
0	1	0	1	0	1
1	0	1	1	0	1
1	1	0	0	1	1

30. (a)

p	$p \oplus p$
0	0
1	0

(or

p	p	$p \oplus p$
0	0	0
1	1	0

)

(b)

p	$\neg p$	$p \oplus (\neg p)$
0	1	1
1	0	1

(c)

p	q	$\neg q$	$p \oplus (\neg q)$
0	0	1	1
0	1	0	0
1	0	1	0
1	1	0	1

(d)

p	q	$\neg p$	$\neg q$	$(\neg p) \oplus (\neg q)$
0	0	1	1	0
0	1	1	0	1
1	0	0	1	1
1	1	0	0	0

(e)

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

(f)

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