Multiple Choice Questions for Review

In each case there is one correct answer (given at the end of the problem set). Try to work the problem first without looking at the answer. Understand both why the correct answer is correct and why the other answers are wrong.

1. Let
m = "Juan is a math major,"
c = "Juan is a computer science major,"
g = "Juan's girlfriend is a literature major,"
h = "Juan's girlfriend has read Hamlet," and
t = "Juan's girlfriend has read The Tempest."
Which of the following expresses the statement "Juan is a computer science major and a math major, but his girlfriend is a literature major who hasn't read both The Tempest and Hamlet."

(a) $c \wedge m \wedge (g \vee (\sim h \vee \sim t))$

(b) $c \wedge m \wedge g \wedge (\sim h \wedge \sim t)$

(c) $c \wedge m \wedge g \wedge (\sim h \vee \sim t)$

(d) $c \wedge m \wedge (g \vee (\sim h \wedge \sim t))$

(e) $c \wedge m \wedge g \wedge (h \vee t)$

2. The function $((p \vee (r \vee q)) \wedge \sim(\sim q \wedge \sim r)$ is equal to the function

(a) $q \vee r$

(b) $((p \vee r) \vee q)) \wedge (p \vee r)$

(c) $(p \wedge q) \vee (p \wedge r)$

(d) $(p \vee q) \wedge \sim(p \vee r)$

(e) $(p \wedge r) \vee (p \wedge q)$

3. The truth table for $(p \vee q) \vee (p \wedge r)$ is the same as the truth table for

(a) $(p \vee q) \wedge (p \vee r)$

(b) $(p \vee q) \wedge r$

(c) $(p \vee q) \wedge (p \wedge r)$

(d) $p \vee q$

(e) $(p \wedge q) \vee p$

4. The Boolean function $[\sim(\sim p \wedge q) \wedge \sim(\sim p \wedge \sim q)] \vee (p \wedge r)$ is equal to the Boolean function

(a) q (b) $p \wedge r$ (c) $p \vee q$ (d) r (e) p

5. Which of the following functions is the constant 1 function?

(a) $\sim p \vee (p \wedge q)$

(b) $(p \wedge q) \vee (\sim p \vee (p \wedge \sim q))$

(c) $(p \wedge \sim q) \wedge (\sim p \vee q)$

(d) $((\sim p \wedge q) \wedge (q \wedge r)) \wedge \sim q$

(e) $(\sim p \vee q) \vee (p \wedge q)$

6. Consider the statement, "Either $-2 \leq x \leq -1$ or $1 \leq x \leq 2$." The negation of this statement is

(a) $x < -2$ or $2 < x$ or $-1 < x < 1$

(b) $x < -2$ or $2 < x$

(c) $-1 < x < 1$

(d) $-2 < x < 2$

(e) $x \leq -2$ or $2 \leq x$ or $-1 < x < 1$

7. The truth table for a Boolean expression is specified by the correspondence $(P, Q, R) \rightarrow S$ where $(0,0,0) \rightarrow 0$, $(0,0,1) \rightarrow 1$, $(0,1,0) \rightarrow 0$, $(0,1,1) \rightarrow 1$, $(1,0,0) \rightarrow 0$, $(1,0,1) \rightarrow 0$, $(1,1,0) \rightarrow 0$, $(1,1,1) \rightarrow 1$. A Boolean expression having this truth table is

(a) $[(\sim P \wedge \sim Q) \vee Q] \vee R$

(b) $[(\sim P \wedge \sim Q) \wedge Q] \wedge R$

(c) $[(\sim P \wedge \sim Q) \vee \sim Q] \wedge R$

(d) $[(\sim P \wedge \sim Q) \vee Q] \wedge R$

(e) $[(\sim P \vee \sim Q) \wedge Q] \wedge R$

8. Which of the following statements is **FALSE**:

(a) $(P \wedge Q) \vee (\sim P \wedge Q) \vee (P \wedge \sim Q)$ is equal to $\sim Q \wedge \sim P$

(b) $(P \wedge Q) \vee (\sim P \wedge Q) \vee (P \wedge \sim Q)$ is equal to $Q \vee P$

(c) $(P \wedge Q) \vee (\sim P \wedge Q) \vee (P \wedge \sim Q)$ is equal to $Q \vee (P \wedge \sim Q)$

(d) $(P \wedge Q) \vee (\sim P \wedge Q) \vee (P \wedge \sim Q)$ is equal to $[(P \vee \sim P) \wedge Q] \vee (P \wedge \sim Q)$

(e) $(P \wedge Q) \vee (\sim P \wedge Q) \vee (P \wedge \sim Q)$ is equal to $P \vee (Q \wedge \sim P)$.

9. To show that the circuit corresponding to the Boolean expression $(P \wedge Q) \vee (\sim P \wedge Q) \vee (\sim P \wedge \sim Q)$ can be represented using two logical gates, one shows that this Boolean expression is equal to $\sim P \vee Q$. The circuit corresponding to $(P \wedge Q \wedge R) \vee (\sim P \wedge Q \wedge R) \vee (\sim P \wedge (\sim Q \vee \sim R)$ computes the same function as the circuit corresponding to

(a) $(P \wedge Q) \vee \sim R$

(b) $P \vee (Q \wedge R)$

(c) $\sim P \vee (Q \wedge R)$

(d) $(P \wedge \sim Q) \vee R$

(e) $\sim P \vee Q \vee R$

10. Using binary arithmetic, a number y is computed by taking the n-bit two's complement of $x - c$. If n is eleven, $x = 10100001001_{\mathbf{2}}$ and $c = 10101_{\mathbf{2}}$ then $y =$

(a) 01100001111_2

(b) 01100001100_2

(c) 01100011100_2

(d) 01000111100_2

(e) 01100000000_2

11. In binary, the sixteen-bit two's complement of the hexadecimal number $\texttt{DEAF}_{16}$ is

(a) 0010000101010111_2

(b) 1101111010101111_2

(c) 0010000101010011_2

(d) 0010000101010001_2

(e) 0010000101000001_2

12. In octal, the twelve-bit two's complement of the hexadecimal number $\texttt{2AF}_{16}$ is

(a) 6522_8

(b) 6251_8

(c) 5261_8

(d) 6512_8

(e) 6521_8

Answers: **1** (c), **2** (a), **3** (d), **4** (e), **5** (b), **6** (a), **7** (d), **8** (a), **9** (c), **10** (b), **11** (d), **12** (e).

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