Discrete Mathematics and Proof Unit 1 practice: Exclusive or and logic circuits

Name _____ Date _____ Period _____

1. Find each value. A bit stands for a truth value: 1 for T and 0 for F.

(a) $0 \oplus 1$

(b) $0 \oplus 1 \oplus 1$

(c) $0 \oplus 1 \oplus 1 \oplus 1$

(d) $(1 \oplus 0) \wedge 1$

(e) $0 \vee (1 \oplus 1)$

(f) $0 \oplus 1 \oplus 1 \oplus 0 \oplus 1$

2. Use the laws of exclusive or to reduce each statement to one of P, $\neg P$, Q, $\neg Q$, T or F.

(a) $P \oplus \mathrm{F} \oplus P$

(b) $P \oplus (\mathrm{T} \oplus P)$

(c) $\neg Q \oplus \mathrm{T}$

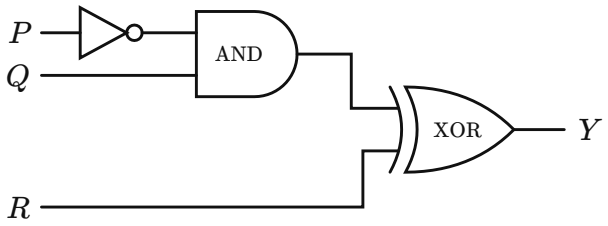
(d) $(P \oplus Q \oplus R) \oplus (R \oplus Q)$

(e) $\neg(P \oplus Q) \oplus Q$

(f) $(Q \oplus R) \oplus \neg(P \oplus R) \oplus Q$

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3. The circuit has inputs P, Q, R and output Y. Rows are numbered 1 to 8 in the fixed order P, Q, R = TTT, TTF, TFT, TFF, FTT, FTF, FFT, FFF. A bit 1 is T and 0 is F.



(a) Write Y as a statement in P, Q and R.

(b) Find the bit Y when $P = 0$, $Q = 1$ and $R = 0$.

(c) List the rows on which Y is true.

4. (a) A weather balloon sends each 7-bit reading followed by an even parity bit. Write the 8-bit word it sends for the reading 0010111.

(b) Another word from the balloon arrives as 10100101. Does it pass the parity check?

(c) With L "the left door is open", R "the right door is open" and C "the van is moving", a warning light V is on when the van is moving and a door is open. Write V as a statement in the three letters, and count the gates its circuit needs (XOR gates allowed).

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