CS 70 Fall 2024 Discrete Mathematics and Probability Theory Rao, Hug

DIS 0B

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Propositional Practice

Note 1

Convert the following English sentences into propositional logic and the following propositions into English. State whether or not each statement is true with brief justification.

(a) There is a real number which is not rational.

IXER)(X &Q)

- (b) All integers are natural numbers or are negative, but not both.
- (d) $(\forall x \in \mathbb{Z}) (x \in \mathbb{Q})$

(c) If a natural number is divisible by 6, it is divisible by 2 or it is divisible by 3. (d) $(\forall x \in \mathbb{Z}) \ (x \in \mathbb{Q})$ $(\forall x \in \mathbb{Z}) \ (x \in \mathbb{Q})$

- (e) $(\forall x \in \mathbb{Z}) (((2 \mid x) \lor (3 \mid x)) \implies (6 \mid x))$
- (f) $(\forall x \in \mathbb{N}) ((x > 7) \implies ((\exists a, b \in \mathbb{N}) (a + b = x)))$

(a)]X, x & Q (T)

(b) (YXEZ) (XENVX<O)) (C) XEN, ÉEZ => ŽEZVŽEZ (T)

(d) All integers are rational (T)
(e) All integers that are divisible by 2 or 3

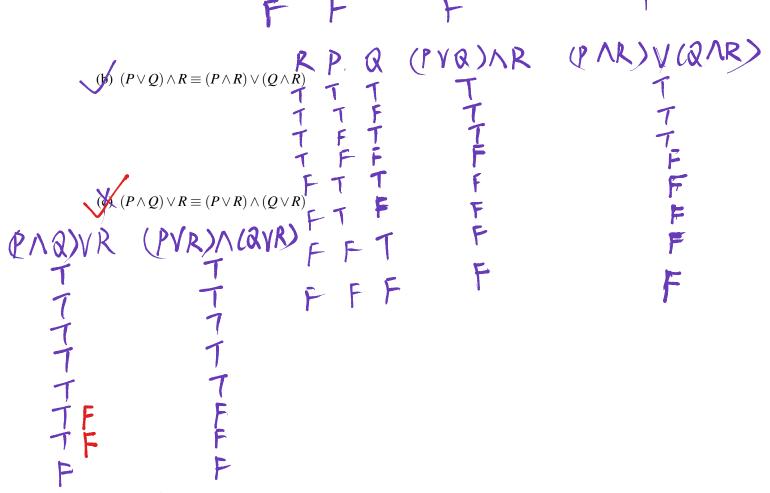
is divisible by 6 LF)

Truth Tables

Note 1

Determine whether the following equivalences hold, by writing out truth tables. Clearly state whether or not each pair is equivalent.

 $P \wedge (Q \vee P) \equiv P \wedge Q$ PM (QVP) CS 70, Fall 2024, DIS 0B



3 Implication

Note 0 Note 1 Which of the following implications are always true, regardless of P? Give a counterexample for each false assertion (i.e. come up with a statement P(x, y) that would make the implication false).

(a)
$$\forall x \forall y P(x,y) \implies \forall y \forall x P(x,y).$$





$$(c) \exists x \forall y P(x,y) \implies \forall y \exists x P(x,y).$$





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