Dbj: 1. Technical Vocab: logical equivalence; contropositive i tau integrità introdictioni de partire la logical equivalence mes: DeMorson's, distributive law, implication breakon

1 Double Negation law: 7(7p) = p

9/5/23

3. the contrapositive of an if-then statement
4. Negate an if-then statement

5. A compound proposition is a toutohy, a contradiction, or neither

b. Logical symbols for "there exists" and for all " (3, 4)

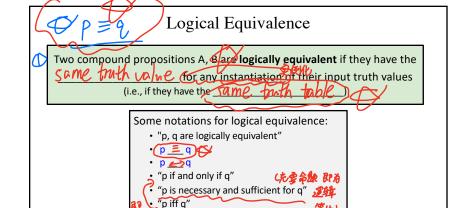
Lecture 3 Handout: Logical Equivalence

Translate each English statement to logic, then complete the truth table for each.

- 1. If I pet my cat then she is happy.
- 3. I didn't pet my cat or she is happy.

2. If my cat is unhappy then I didn't pet her.

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Т	F	۴	T	F	F	Ė
F	Т	Τ	F	7	T	T
F	F				-	T



DeMorgans Laws in Action (Words)

Negate each of the following:

roposition 1: I will go to the store or I will go to the park.

Negation: #5 at true that I will go to S or I will go to P

Simplify: I will not go to S and L will not go to P.

Proposition 2:

Negation: It's not true that I is and I wa

Simplify: I am met 18 and I don't live h wa.

(ADMORGAN'S Law #2: CZCY/W)=77 V7W

(negating an and statement)

Useful Logical Equivalence Rules

 $p \vee F \equiv P$ $p \vee T \equiv T$

 $p \wedge F \equiv F$

 $s \vee p$

 $v \wedge w$

Distributive Laws: 6 Distributive Law $p \lor (q \land r) \equiv (p \lor q) \land (q \lor r)$

 $p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge q)$ DeMorgan's Laws:

 $\neg (p \lor q) \equiv \neg p \land \neg D$

 $\neg(p \land q) \equiv \neg p \lor \neg q,$

"Implication breakout" rule: $p \rightarrow q \equiv$

Contrapositive: $p \rightarrow q \equiv 19.77$

Negating an "implies"

 $\neg(p \rightarrow q) \equiv$

Which of the following ALWAYS has the same truth value as $p \rightarrow q$?

A) Converse: $q \rightarrow p$

B) Inverse:

 $\neg p \rightarrow \neg q$

C) Contrapositive: $\neg q \rightarrow \neg p$

(P/2)/r = p/g/r) (P/2)/r = p/(g/r)

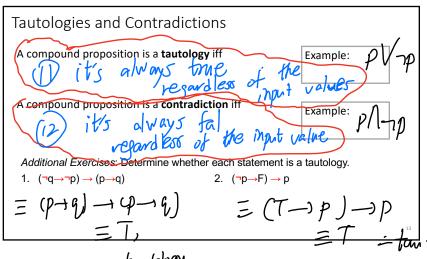
Contrapositives

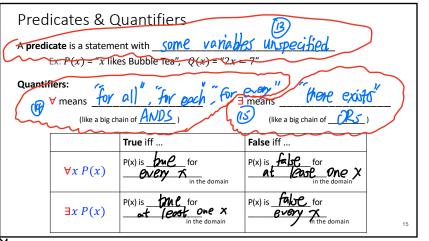
Statement: "If p, then q" $p \rightarrow q$ Contrapositive of statement: "If not q, then not p" $\neg q \rightarrow \neg p$ $p \rightarrow q \equiv \neg q \rightarrow \neg p$ Find the contrapositive of each statement:

• If it's Tuesday, then we have EECS 203 class. (PQSY)

• If you don't live in Michigan, then you don't live in Ann Arbor.

• If $not \ p$, then q. (Here p, q can stand for any propositions.)





 $P(X) = \frac{1}{2} \times \text{ likes Bubble Tea}$ $T \to P (T \to P) \to P$ $V \times P(X) = \frac{1}{2} \times \text{ likes Bubble Tea}$ $V \times P(X) = \frac{1}{2} \times \text{ likes Bubble Tea}$ $V \times P(X) = \frac{1}{2} \times \text{ likes Bubble Tea}$ $V \times P(X) = \frac{1}{2} \times \text{ likes Bubble Tea}$ $V \times P(X) = \frac{1}{2} \times \text{ likes Bubble Tea}$ $V \times P(X) = \frac{1}{2} \times \text{ likes Bubble Tea}$ $V \times P(X) = \frac{1}{2} \times \text{ likes Bubble Tea}$ $V \times P(X) = \frac{1}{2} \times \text{ likes Bubble Tea}$ $V \times P(X) = \frac{1}{2} \times \text{ likes Bubble Tea}$ $V \times P(X) = \frac{1}{2} \times \text{ likes Bubble Tea}$ $V \times P(X) = \frac{1}{2} \times \text{ likes Bubble Tea}$ $V \times P(X) = \frac{1}{2} \times \text{ likes Bubble Tea}$ $V \times P(X) = \frac{1}{2} \times \text{ likes Bubble Tea}$ $V \times P(X) = \frac{1}{2} \times \text{ likes Bubble Tea}$