MAT2440, Classwork5, Spring2025

ID:	Name:
1. Trai	nslating Sentence into expression with propositional variables and logical connectives:
	'The automated reply cannot be sent when the file system is full."
	the file system is full.
A	The automated reply can be sent $\Rightarrow \neg A$
\Rightarrow	$f \rightarrow \neg A$

2. Translating Sentence into expression with propositional variables and logical connectives:

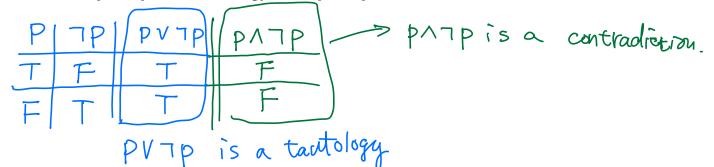
"You can access the Internet from campus only of you are a computer science major
or you are not a freshman"
P: You can access the internet
q: You can access the internet
q: You are a computer science major
r: you are not a freshman
$$P \rightarrow (qvr)$$

3. Translating Sentence into expression with propositional variables and logical connectives:

(You cannot ride the roller coaster if you are under 4 feet tall
unless you are older than 16 years old.")
P: You cannot ride the roller coaster
$$P$$
 if q or p unless r
 q : You are under 4 feet tall
 $(q \rightarrow p) \lor (\tau r \rightarrow p)$
 $(q \wedge \tau r) \rightarrow p$
 $(q \wedge \tau r) \rightarrow p$

4. Definition of Tautology, Contradiction, and Contingency:

- A compound proposition that is always **true** is called a <u>tautology</u>
- A compound proposition that is always false is called a <u>contradiction</u>.
- A compound proposition is neither a tautology nor a contradiction is called a <u>contingency</u>
- 5. Show that " $p \lor \neg p$ " is a tautology and " $p \land \neg p$ " is a contradiction.



6. Definition of Logical Equivalences:

The compound propositions p and q called $\underline{\left[\begin{array}{c} bq \\ fq \end{array}\right]} = \underbrace{quivalent}_{p}$ if $p \leftrightarrow q$ is a $\underline{tauto[squ}]$. The notation $\underline{p} \equiv \underline{q}$ denotes p and q are logically equivalent.

7. Using the logically equivalent symbol ' \equiv ' to rewire the following expressions:

(a) " $p \lor \neg p$ " is a tautology. $P \lor \neg P \equiv \top$

- (b) " $p \land \neg p$ " is a contradiction. $p \land \neg p \equiv F$
- (c) " $p \rightarrow q$ " and " $\neg q \rightarrow \neg p$ " have the same truth value.

 $P \rightarrow g \equiv \neg g \rightarrow \neg P$

(d) " $q \rightarrow p$ " and " $\neg p \rightarrow \neg q$ " have the same truth value.