MAT2440, Classwork1, Spring2025

ID:_____ Name:_____

1. Definition of a **Proposition**: Basic building blocks of logic

A proposition (or statement) is a declarative sentence (a sentence that declares a fact) that is either true or false, but **not** both.

2. Circle the following sentence if it is a proposition:

a. $2 + 3 = 4$. (false statement) b. $2 + 1 = 3$. (True statement) c. The capital of New York State is New York City. (False statement)

~~d. What time it is?~~ (question) ~~e. Read this carefully.~~ ~~f. $x + 2 = 3$.~~

3. **Compound Propositions** and **Logical Operators**:

Many mathematical statements are constructed by combining one or more propositions. New propositions, called compound propositions, are formed from existing propositions using logical operators.

$\sim p$. $\bar{p}$

4. Definition of **Negation** of a proposition:

Let p be a proposition. The negation of p, denoted by $\neg p$ (which is read "**not** p") is the statement "It is NOT the case that p".

5. The **Truth Table** for the negation of a proposition p:

p	$\neg p$
T	F
F	T

6. Find the negation of the given propositions:

a. The capital of New York State is New York City.

p The capital of New York State is New York City. $\neg p$: The capital of NY state is NOT New York City

b. 7 is great than or equal to 6 (or $7 \geq 6$) p

$\neg p$: $7 < 6$

7. Definition of **Conjunction** of two propositions: Let p and q be two propositions.

The Conjunction of p and q, denoted by $p \wedge q$, is the proposition "p and q".

8. The truth table for the conjunction of propositions p and q:

$2^2 = 4$ possible combination

p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

The conjunction $p \wedge q$ is **true** when both p and q are true and is false otherwise.

9. Given two propositions p and q. Find $p \wedge q$.

p: "The capital of New York State is Albany."

q: "New York City is the largest city in New York State."

$p \wedge q$: The captial of New York State is Albany and New York City is the largest city in NY state.

10. Definition of **Disjunction** of two propositions: Let p and q be two propositions.

The disjunction of p and q, denoted by $p \vee q$, is the proposition "p or q".

Disjunction corresponds to inclusion Or.

11. Definition of **Exclusion Or** of two propositions: Let p and q be two propositions.

The exclusion or of p and q, denoted by $p \oplus q$ (or p XOR q)

12. The truth table for the disjunction of propositions p and q:

p	q	$p \vee q$	$p \oplus q$
T	T	T	F
T	F	T	T
F	T	T	T
F	F	F	F

The **Disjunction** $p \vee q$ is **false** when both p and q are false and is true otherwise.

The **Exclusion Or** $p \oplus q$ is **true** when one of p and q is true and is false otherwise.