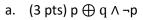# Section 5- Propositions (124 points)
To receive credit, you must show your work on the worksheet.

1. (21 points) Determine if the following statements are true or false *given p: true, q: true, r: false, s: false*

    a. (3 pts) $p \oplus q \wedge \neg p$

    $\wedge$ has precedence over $\vee$, $\oplus$

    $\neq \boxed{T}$

    $= \boxed{F}$

    I will accept this since the text does not discuss precedence

    b. (4 pts) $(p \wedge \neg p) \wedge (q \vee \neg r)$

    $= \boxed{F}$

    c. (4 pts) $((p \vee q) \wedge \neg s)$

    $\boxed{T}$
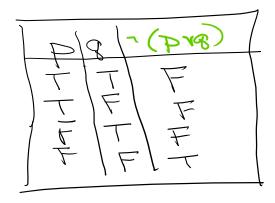
    d. (5 pts) $((r \vee s) \rightarrow \neg q) \rightarrow \neg p$

    $\neq \boxed{F}$

e.   (5 pts) $(((r \rightarrow q) \oplus p) \vee \neg s)$

2.   (30 points) Write the truth table for the following expressions:

a.   (5 pts) $\neg(p \vee q)$

p	q	$\neg(p \vee q)$
T	T	F
T	F	F
F	T	F
F	F	T

b.   (10 pts) $(p \wedge \neg p) \wedge (q \vee \neg r)$

p	q	r	Answer
T	T	T	F
T	T	F	F
T	F	T	F
T	F	F	F
F	T	T	F
F	T	F	F
F	F	T	F
F	F	F	F

c. (15 pts) (((r → q) ⊕ p) ∨ ¬s) (4 vars)

p	q	r	s	Answer
T	T	T	T	F
T	T	T	F	T
T	T	F	F	F
T	T	F	T	T
T	F	T	T	T
T	F	T	F	T
T	F	F	F	F
T	F	F	T	T
F	T	T	T	T
F	T	T	F	T
F	T	F	F	T
F	T	F	T	T
F	F	T	T	F
F	F	T	F	T
F	F	F	F	T
F	F	F	T	T

3. (8 points) State the **converse** of the following implications

    a. (4 pts) If it snows this weekend, then I will go skiing.

    If I will go skiing, then it snows this weekend.

    b. (4 pts) The river will freeze over if Texas has a heat wave.

    If the river freezes over, then Texas has a heat wave.

4. (8 points) State the **contrapositive** of the following implications

    a. (4 pts) If the DJ has a deep voice then there is another song to play

    If there is not another song to play, then the DJ does not have a deep voice.

    b. (4 pts) Hockey is a great sport if frogs have fleas.

    If hockey is not a great sport, then frogs do not have fleas.

5. (6 points) If $p \rightarrow q$ is false, can you determine the truth value of the following? Explain your answer.
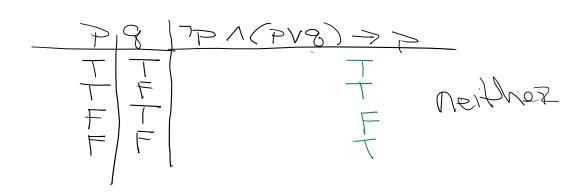
    a. $(\neg p) \vee (p \leftrightarrow q)$

    Yes,

6. (6 points) If $p \rightarrow q$ is true, can you determine the truth value of the following? Explain your answer.

    a. $(\neg p \rightarrow q) \wedge \neg p$

    No.

7. (30 points) Use a truth table to demonstrate that the following is a tautology, a contradiction (absurdity), or neither.

    i. ` (10 pts) $(\neg p \wedge (p \vee q) \rightarrow p)$

p	q	¬p ∧ (p∨q) → p
T	T	T
T	F	T
F	T	F
F	F	F

neither

b.   (10 pts) (q ∧ r) ∧ (¬(p ∨ q))

p	q	r	q∧r	∧	q∨p	¬(q∨p)
T	T	T	T	F	T	F
T	T	F	F	F	T	F
T	F	T	F	F	T	F
T	F	F	F	F	T	F
F	T	T	T	F	T	F
F	T	F	F	F	T	F
F	F	T	F	F	F	T
F	F	F	F	F	F	T

Contradiction (aka absurdity)

c.   (10 pts) ((p → (q ∧ r)) ↔ ((p ∧ q) →p)

p	q	r	p→(q∧r)	↔	(p∧q)→p
T	T	T	T	T	T
T	T	F	F	F	T
T	F	T	F	F	T
T	F	F	F	F	T
F	T	T	T	T	T
F	T	F	T	T	T
F	F	T	T	T	T
F	F	F	T	T	T

neither

8. (15 points) Use the laws of logic to show whether the following is equivalent:

   a. $p \leftrightarrow (p \land r) \equiv \neg p \lor r$

   equivalent

   To receive credit, you must show equivalency using the **laws of logic.**