\mathbf{Math}	112 -	Test	2
March 8	2017		

Name _	key		
	J	Score	

Show all work to receive full credit. Supply explanations where necessary.

- 1. (5 points) Identify each as a conjunction, disjunction, conditional, or biconditional.
 - (a) Either he passes the test, or he fails the course.

Disjunction

(b) A number is even if and only if it is divisible by 2.

BICONDITIONAL

(c) You should get a job if you need money.

CONDITIONAL

(d) It is going to rain or snow.

DISJUNCTION

(e) She listened to her iPod and did her homework.

Conjunction

2. (3 points) Give an example of a sentence that is not a statement and explain why it is not a statement.

HAVE A good DAY.

THIS SENTENCE CANNOT HAVE A TRUTH VALUE.

IT IS A DIRECTIVE RATHER THAN A SENTENCE THAT

- 3. (6 points) Which of these sentences are statements? Circle all that apply.
 - (a) Please do not sleep during class.
 - (b) David Pumpkins is taking Math 112.
 - (c) Do some push-ups.
 - (d) 9 3 = 2
 - (e) Alfred Tarski was a famous mathematician.
 - (f) Well, hello there.

- 4. (8 points) Write the negation of each statement in a correct sentence.
 - (a) I do not like to eat seafood.

LIKE TO EAT SEAFOOD.

(b) Every happy dog wags its tail.

Some HAPPY DOGS DO NOT WAS THEIR TAILS.

(c) Some students write with crayons.

. No STUDENTS WRITE WITH CRAYONS.

(d) No one gets out alive.

Some one gets out ALIVE.

- 5. (6 points) Let p = "The train arrives on time" and let q = "It is snowing." Write each statement in words.
 - (a) $\sim q \longrightarrow p$ /F IT IS NOT SNOWING, THEN THE TRAIN ARRIVES ON TIME.
 - (b) $\sim (q \vee p)$ /T IS NOT SNOWING AND THE TRAIN DOES $\sim q \wedge \sim p$ NOT ARRIVE ON TIME
 - (c) $q \longleftrightarrow (p \land q)$

IT IS SNOWING IF AND ONLY IF IT IS SNOWING AND THE TRAIN ARRIVES

ON TIME.

- 6. (6 points) Refer to the statements p and q from the problem directly above. Write each statement in symbolic form.
 - (a) The train arrives on time, or it is not snowing.

P v ~9

(b) The train does not arrive on time whenever it is snowing.

9 -> ~P

(c) It is snowing, but the train arrives on time.

9 1 P

7. (6 points) Construct the truth table for $(p \lor q) \longrightarrow \sim p$.

P	9	pvq	$\sim p$	$(pvq) \rightarrow \sim P$
T	T	T	· F	. F
T	F	T	F	F
F	T	$\overline{}$. T	T
F	. F	F	7	T

8. (8 points) Construct the truth table for $p \wedge (q \vee \sim r)$.

				*** **********************************	
P	9	7	~?	9 1 ~ 5	PN(QV~r)
T	7	T	F	T	T
T	T	F	T	T	, <u>T</u>
\mathcal{T}^{-1}	F		F	F	T
T	F.	F	<u> </u>	\	F,
F	T	E	'	+	F
F	F	Ť	F	F	F
F	F	F	T	1	٢

9. (2 points) Suppose p is false and q is true. What is the truth value of $p \longleftrightarrow q$?

10. (6 points) Let p = "Today is Saturday" and let q = "Some dogs bite." Determine the truth value of each of the following statements truth value of each of the following statements. VALUES.

(a)
$$p \lor \sim q$$

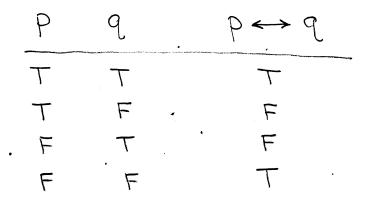
(b)
$$p \longrightarrow q$$

(c)
$$(p \land q) \longrightarrow \sim p$$

$$(F_{\Lambda}T) \rightarrow {}^{\Lambda}F$$

$$F \rightarrow T = (T_{RUE})$$

11. (6 points) Write the truth table for $p \longleftrightarrow q$.



12. (2 points) True or False: The biconditional statement $p \longleftrightarrow q$ means the same as $(p \longrightarrow q) \lor (q \longrightarrow p)$?

FALSE, IT MEANS
$$(p \rightarrow q) \land (q \rightarrow p)$$

13. (8 points) Consider the following conditional statement:

If Sarah wins the award, then she will get a good job.

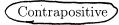
(a) State the inverse.

(b) State the contrapositive.

(c) State the converse.

(d) Of the three, which is logically equivalent to the original statement?

Inverse



Converse

14. (2 points) Without actually constructing it, determine how many rows the truth table for $(p \lor q) \land (r \land s)$ would have.

15. (6 points) Use truth tables to show that the statement $p \longrightarrow q$ is logically equivalent to $\sim p \lor q$.

P	.9.	$p \rightarrow q$	•	P	9	$\sim p$	$\sim p \vee q$
+	1	T		T	7	F	
T	F	F	v.	7	F	F	F
F	7	T		F	T	T	T
F	F	T		F	F	7	T
			~		and the same of th		
			1 DENTICAL	TRUT	H TA	3318	4
				1			
			p > q 1	s equ	NALEST	7 70	prq

16. (4 points) Use DeMorgan's Laws to write a logically equivalent statement.

(a)
$$\sim (p \vee q)$$
 $\sim p \wedge \sim q$

(b)
$$\sim (q \wedge r)$$
 $\sim q \quad \vee \quad \sim r$

17. (4 points) Write the negation of the statement "She drinks soda or tea."

SHE DOES NOT DRINK SODA, AND SHE DOES NOT DRINK TEA.

18. (12 points) By using truth tables, determine whether each statement is a tautology, a self-contradiction, or neither.

(a)
$$(p \land \sim q) \land \sim p$$

P	9_	~ P	į.	pn~q.	(p~~q) ~~p
T	T	F	F		F
T	F	F	. T	T	F
Ŧ.	T	T	Ł,	F	F
F	F	. T	T	F .	F

SELF-CONTRADICTION

(b)
$$(p \longrightarrow q) \lor \sim q$$

P	q	~ 9	$p \rightarrow q$	$(p \rightarrow q) \vee \sim q$
T	T	· F	T	T
Ť	F	T	F	T
F	T	F	T	T
F	F	T		TAUTOLOGY

(c)
$$(p \land q) \longrightarrow p$$

P	q	p ~ q	$(b \vee d) \rightarrow b$	
7	The management of the land of		T	
T	F	F	T T	TAUTOLOGY
F	T	F	'	174101093
F	F	F	·	