

Math 112 - Test 2

March 7, 2018

Name key

Score _____

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

1. (6 points) Which of these sentences are statements? Circle all that apply.

- (a) I took a shower today.
(b) This book is about computer programming.
(c) Ouch, that hurts!
(d) $4.32 + 8\sqrt{7} = 3^2$
(e) Is that your iPad?
(f) Most scientists agree that global warming is a threat to the environment.

2. (8 points) Write the negation of each statement in a correct sentence.

- (a) All professors at PSC have brown eyes.

SOME PROFESSORS DO NOT HAVE BROWN EYES.

- (b) Friday is pizza day.

FRIDAY IS NOT PIZZA DAY.

- (c) No one enjoyed the show.

SOME ENJOYED THE SHOW.

- (d) Some students finished the assignment.

NO STUDENTS FINISHED THE ASSIGNMENT.

3. (3 points) Pinocchio's nose grows when he tells a lie, and only when he tells a lie. Suppose Pinocchio says, "My nose is about to grow." Is he saying a statement?

No. IF IT WAS TRUE, THEN IT WOULD NOT BE A LIE
AND HIS NOSE WOULD NOT GROW.

IF IT WAS FALSE, THEN IT WOULD BE A LIE
AND HIS NOSE WOULD GROW.

HIS SENTENCE CANNOT BE TRUE AND IT CANNOT
BE FALSE.

4. (5 points) Identify each as a conjunction, disjunction, conditional, or biconditional.

(a) You should wash your car if it is dirty.

CONDITIONAL

(b) Either she wakes up now, or she'll be late for class.

DISJUNCTION

(c) A number is odd if and only if it is one less than an even number.

BICONDITIONAL

(d) I listened to music while I was cutting the lawn.

CONJUNCTION

(e) I do not like green eggs, and I do not like ham.

CONJUNCTION

5. (6 points) Let p = "He is late." and let q = "He overslept." Write each statement in words.

(a) $q \rightarrow p$

IF HE OVERSLEPT, THEN HE IS LATE.

(b) $\sim p \vee \sim q$

HE IS NOT LATE OR HE HAS NOT OVERSLEPT.

(c) $p \leftrightarrow \sim p$

HE IS LATE IF AND ONLY IF HE IS NOT LATE.

6. (4 points) Refer to the statements p and q from the problem directly above. Write each statement in symbolic form.

(a) He overslept and he is late.

$q \wedge p$

(b) If he did not oversleep, then he is not late.

$\sim q \rightarrow \sim p$

7. (8 points) Construct the truth table for $(p \vee q) \rightarrow \sim p$.

p	q	$p \vee q$	$\sim p$	$p \vee q \rightarrow \sim p$
T	T	T	F	F
T	F	T	F	F
F	T	T	T	T
F	F	F	T	T

8. (4 points) Without actually constructing it, determine how many rows and columns the truth table for $(p \vee q) \wedge (r \wedge s)$ would have.

7 columns 16 rows

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

$F \rightarrow T$ is True

10. (8 points) Construct the truth table for $(p \rightarrow q) \wedge (q \rightarrow p)$.

p	q	$p \rightarrow q$	$q \rightarrow p$	$(p \rightarrow q) \wedge (q \rightarrow p)$
T	T	T	T	T
T	F	F	T	F
F	T	T	F	F
F	F	T	T	T

F

T

11. (6 points) Let p = "Today is Saturday" and let q = "Some dogs bite." Determine the truth value of each of the following statements.

(a) $p \vee \sim q$ $F \vee F$ is **FALSE**

(b) $p \rightarrow q$ $F \rightarrow T$ is **True**

(c) $(p \wedge q) \rightarrow \sim p$

↑
F AND T is F $F \rightarrow T$ is **True**

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

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

p	q	$\sim p$	$\sim q$	$(p \wedge \sim q)$	$(p \wedge \sim q) \wedge \sim p$
T	T	F	F	F	F
T	F	F	T	T	F
F	T	T	F	F	F
F	F	T	T	F	F

SELF-CONTRADICTION

(b) $(p \rightarrow q) \vee \sim q$

p	q	$p \rightarrow q$	$\sim q$	$(p \rightarrow q) \vee \sim q$
T	T	T	F	T
T	F	F	T	T
F	T	T	F	T
F	F	T	T	T

TAUTOLOGY

(c) $(p \wedge q) \rightarrow p$

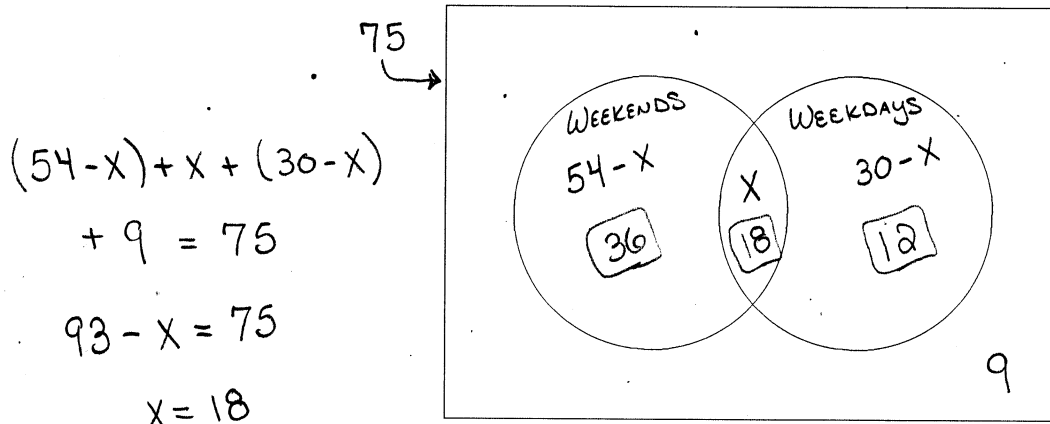
p	q	$p \wedge q$	$(p \wedge q) \rightarrow p$
T	T	T	T
T	F	F	T
F	T	F	T
F	F	F	T

TAUTOLOGY

13. (10 points) The following information was obtained from a survey of 75 college students.

- 54 studied on weekends
- 30 studied on weekdays
- 9 never studied

(a) Completely fill in an appropriate Venn diagram. Be sure to label the sets of your diagram.



(b) How many students studied on both weekends and weekdays?

SEE WORK ABOVE.

18

(c) How many students studied on weekends only?

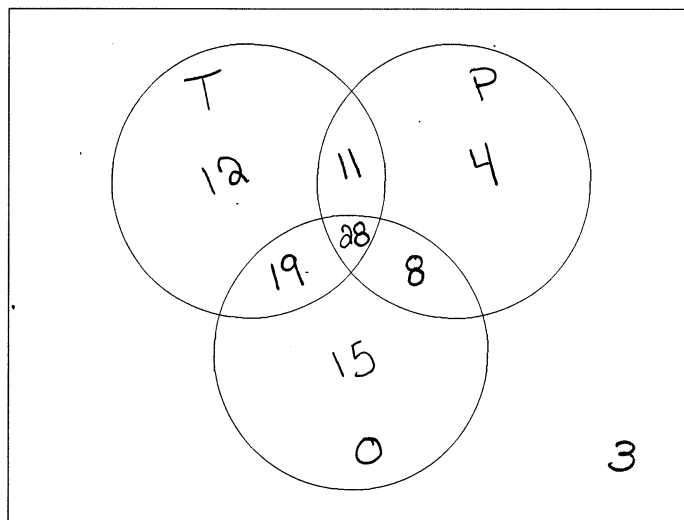
SEE WORK ABOVE.

36

14. (12 points) One hundred professionals were asked how they obtained their daily news. Here are the results:

- 70 got their news from television or radio (T)
- 51 got their news from print materials such as newspapers or magazines (P)
- 70 got their news from online sources (O)
- 47 got their news from both T and O
- 39 got their news from both T and P
- 36 got their news from both P and O
- 28 got their news from all three T, O, and P

(a) Count and sort these results using a three-set Venn diagram.



$$12 + 11 + 4 + 19 + 28 + 8 + 15 = 97$$

$$100 - 97 = 3$$

- (b) How many professionals did NOT get their daily news from any of these three sources?

3