

1.(1 pt)

Enter "T" for each true proposition, "F" for each false proposition and "N" for each statement which is not a proposition.

- \_\_\_ 1. What time is it?
- \_\_\_ 2.  $2+3=5$ .
- \_\_\_ 3.  $x+1=5$  if  $x=1$ .
- \_\_\_ 4. Do not pass go.
- \_\_\_ 5.  $5+7=10$ .
- \_\_\_ 6.  $x+y=y+x$  for every pair of real numbers  $x$  and  $y$ .
- \_\_\_ 7. All ants are insects.
- \_\_\_ 8. All insects are ants.

2.(1 pt)

For each of the following sentences, determine whether an "inclusive or" or an "exclusive or" is usually what is meant by the sentence. Enter "I" for the inclusive case and "E" for the exclusive case.

- \_\_\_ 1. Publish or perish.
- \_\_\_ 2. Lunch includes soup or salad.
- \_\_\_ 3. Experience with C++ or Java is required.
- \_\_\_ 4. To enter the country you need a passport or a voter registration card.

3.(1 pt) Complete the following truth table by filling in the blanks with T or F as appropriate.

$p$	$q$	$p \oplus p$	$p \oplus \neg q$	$(p \oplus q) \vee (p \oplus \neg q)$	$(p \oplus q) \wedge (p \oplus \neg q)$
T	T	___	___	___	___
T	F	___	___	___	___
F	T	___	___	___	___
F	F	___	___	___	___

4.(1 pt) What is the value of  $x$  after each of the following statements is encountered in a computer program, if  $x=8$  before the statement is reached?

- (a) if  $x < 2$  then  $x := x + 1$

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- (b) if  $(1 + 1 = 3)$  OR  $(2 > x)$  then  $x := x + 1$

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- (c) if  $(2 + 3 = 5)$  AND  $(3 + 4 = 7)$  then  $x := x + 1$

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- (d) if  $(1 + 1 = 2)$  XOR  $(x = 5)$  then  $x := x + 1$

5.(1 pt) Evaluate each of the following expressions:

- (a)  $11000 \wedge (01011 \vee 11011)$

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- (b)  $(01111 \wedge 10101) \vee 01000$

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- (c)  $(01010 \oplus 11011) \oplus 01000$

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- (d)  $(11011 \vee 01010) \wedge (10001 \vee 11011)$

6.(1 pt) Fuzzy Logic is used in artificial intelligence. In fuzzy logic, a proposition has a truth value that is a number between 0 and 1 inclusive. A proposition with a truth value of 0 is false and one with truth value of 1 is true. Truth values that are between 0 and 1 indicate varying degrees of truth. For instance, the truth value 0.9 can be assigned to the statement "Fred is happy." since Fred is happy most of the time, and the truth value 0.4 can be assigned to the statement "John is happy." since John is happy slightly less than half the time.

The truth value of the negation of a proposition in fuzzy logic is 1 minus the truth value of the proposition. The truth value of a conjunction of two propositions in fuzzy logic is the minimum of the truth values of the two propositions.

What are the truth value of the statements:

- (a) "Fred and John are happy."

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- (b) "Neither Fred nor John is happy."

7.(1 pt) Complete the following truth table by filling in the blanks with T or F as appropriate.

$p$	$q$	$\neg p$	$p \vee q$	$\neg p \wedge (p \vee q)$	$[\neg p \wedge (p \vee q)] \rightarrow q$
T	T	___	___	___	___
T	F	___	___	___	___
F	T	___	___	___	___
F	F	___	___	___	___

The proposition in the final column is

- A. a contradiction
- B. a tautology
- C. a contingency

8.(1 pt) Complete the following truth table by filling in the blanks with T or F as appropriate.

$p$	$q$	$p \wedge q$	$\neg p \wedge \neg q$	$(p \wedge q) \vee (\neg p \wedge \neg q)$	$p \leftrightarrow q$
T	T	___	___	___	___
T	F	___	___	___	___
F	T	___	___	___	___
F	F	___	___	___	___

The propositions in the last two columns are

- A. logically equivalent
- B. not logically comparable
- C. not logically equivalent

9.(1 pt) Complete the following truth table by filling in the blanks with T or F as appropriate.

$p$	$q$	$p \rightarrow q$	$\neg p$	$\neg q$	$\neg q \rightarrow \neg p$
T	T	___	___	___	___
T	F	___	___	___	___
F	T	___	___	___	___
F	F	___	___	___	___

" $p \rightarrow q$ " and " $\neg q \rightarrow \neg p$ " are

- A. logically equivalent
- B. not logically equivalent
- C. not logically comparable

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**10.**(1 pt) Complete the following truth table by filling in the blanks with T or F as appropriate.

$p$	$q$	$p \oplus q$	$\neg(p \oplus q)$	$p \leftrightarrow q$
T	T	_____	_____	_____
T	F	_____	_____	_____
F	T	_____	_____	_____
F	F	_____	_____	_____

The propositions in the last two columns are

- A. logically equivalent
- B. not logically comparable
- C. not logically equivalent