1. (1 point)
Enter "T" for each true proposition, "F" for each false proposition and "N" for each statement which is not a proposition.

___1. 5+7=10.
___2. All insects are ants.
___3. x+1=5 if x=1.
___4. x+y=y+x for every pair of real numbers x and y.
___5. 2+3=5.
___6. Do not pass go.
___7. This statement is false.
___8. What time is it?

Answer(s) submitted:

- F
- F
- F
- T
- T
- N
- N
- N

(correct)

2. (1 point)
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. Experience with C++ or Java is required.
___3. Lunch includes soup or salad.
___4. To enter the country you need a passport or a voter registration card.

Answer(s) submitted:

- E
- I
- E
- I

(correct)

3. (1 point) 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	___	___	___	___

Answer(s) submitted:

- F
- T
- T
- F
- F
- F
- T
- F
- F
- F
- T
- F
- F
- T
- T
- F

(correct)

4. (1 point) 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 0.85 can be assigned to the statement "Fred is happy." since Fred is happy most of the time, and the truth value 0.45 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."

_____

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

_____

Answer(s) submitted:

- 0.45
- 0.15

(correct)

5. (1 point) Complete the following truth table by filling in the blanks with T or F as appropriate.

1

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 tautology
- B. a contradiction
- C. a contingency

Answer(s) submitted:

- F
- T
- F
- T
- F
- T
- F
- T
- T
- T
- T
- T
- T
- F
- F
- T
- A

(correct)

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6. (1 point) 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

Answer(s) submitted:

- T
- F
- T
- T
- F
- F
- F
- F
- F
- F
- F
- F
- F
- T

- T
- T
- A

(correct)

---

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

p	q	r	$p \rightarrow q$	$p \rightarrow r$	$[p \rightarrow q] \vee [p \rightarrow r]$	$q \vee r$	$p \rightarrow [q \vee r]$
T	T	T	___	___	___	___	___
T	T	F	___	___	___	___	___
T	F	T	___	___	___	___	___
T	F	F	___	___	___	___	___
F	T	T	___	___	___	___	___
F	T	F	___	___	___	___	___
F	F	T	___	___	___	___	___
F	F	F	___	___	___	___	___

"$[p \rightarrow q] \vee [p \rightarrow r]$" and "$p \rightarrow [q \vee r]$" are

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

Answer(s) submitted:

- T
- T
- T
- T
- T
- T
- F
- T
- T
- T
- F
- T
- T
- T
- T
- F
- F
- F
- F
- F
- T
- T
- T
- T
- T
- T
- T
- T
- T
- T
- T
- T
- T
- T

- T
- T
- T
- T
- F
- T
- B

(correct)

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8. (1 point) Convert the following statement using an "if-then" structure.

John doesn't own a dog, or he owns a cat.

Choose the correct statement:

- A. If John doesn't own a dog, then he owns a cat
- B. If John doesn't own a cat, then he owns a dog
- C. If John owns a dog, then he owns a cat
- D. If John owns a cat, then he owns a dog

Answer(s) submitted:

- C

(correct)

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9. (1 point) Negate the following statement:

Mike and Karen are tall.

Choose the correct statement:

- A. Mike is tall, or Karen is tall
- B. Mike is tall, and Karen is tall
- C. Mike is not tall, or Karen is not tall
- D. Mike is not tall, and Karen is not tall

Answer(s) submitted:

- C

(correct)

---

10. (1 point) Convert the following sentence into formal logic.

John is smart and John is tall.

p: John is smart
q: John is tall

Which of the following is the correct form?

- A. $p \vee q$
- B. $p \rightarrow q$
- C. $p \wedge q$

- D. $\neg p \wedge q$

Answer(s) submitted:

- C

(correct)

---

11. (1 point) Convert the following statement using an "or" structure.

if a is irrational and b is rational, then $a \cdot b$ is irrational.

Choose the correct statement:

- A. a is irrational, or b is rational, and $a \cdot b$ is irrational
- B. a is rational and b is rational, or $a \cdot b$ is irrational
- C. a is rational, or b is irrational, or $a \cdot b$ is irrational
- D. a is irrational, or b is rational, or $a \cdot b$ is irrational

Answer(s) submitted:

- C

(correct)

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12. (1 point) For the following proof (of equivalence of 2 formulae) provide the justifications at each step, using the following equivalences. Use the following key:

a	Idempotent Law
b	Double Negation
c	De Morgan's Law
d	Commutative Properties
e	Associative Properties
f	Distributive Properties
g	Equivalence of Contrapositive
h	Definition of Implication
i	Definition of Equivalence
j	Identity Laws $(p \vee F \equiv p \wedge T \equiv p)$
k	Tautology $(p \vee \neg p \equiv T)$
l	Contradiction $(p \wedge \neg p \equiv F)$

$\neg(\neg p \wedge q) \wedge (p \vee q)$
$= (\neg(\neg p) \vee \neg q) \wedge (p \vee q)$ by ___
$= (p \vee \neg q) \wedge (p \vee q)$ by ___
$= p \vee (\neg q \wedge q)$ by ___
$= p \vee (q \wedge \neg q)$ by ___
$= p \vee F$ by ___
$= p$ by ___

Answer(s) submitted:

- c
- b
- f
- d
- l
- j

(correct)