Ricardo Barbosa

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CST 329: Reasoning with Logic

Practice Problems

Language of logic

Consider working with others when needed on the following problems:

1. Which of the following sentences are declarative?
    a. **I like chocolate.**
    b. **Chocolate contains cocoa solids.**
    c. **Chocolate is delicious.**
    d. Please get me some chocolate.
2. Which of the following sentences are declarative?
    a. **Dreaming is free.**
    b. **He who laughs last, laughs best.**
    c. Go and listen.
    d. PC or Mac?
3. Does this sentence below violate the principle of bivalence?

    "Alicia is smart"

    This is vague however Alicia could be smart or she could not be smart: so no, it does not violate the principle of bivalence.
4. Which of the following sentences are atomic?
    a. My aunt lives in Canada and does not own a car.
    b. **My Canadian aunt does not own a car.**
    c. When I grow up I want to own a donut shop.

5. Is the following statement about syntax or semantics?

   When I write "51" I mean the number 51.

   Semantics

6. Is the following statement about syntax or semantics?

   When writing positive integers, you should write them like "0", "5", "126". The first digit should not be 0 unless you're writing zero. In other words, don't write "05" or "00" or "0126".

   Syntax

7. Is the following statement about syntax or semantics?

   "Do not begin a sentence with a preposition".

   Syntax

8. Yoda says things like "Power you have become". What is strange about Yoda's statement, the syntax or the semantics?

   Syntax

Metalanguage

1. Can a sentence in our logical language contain the symbol P?

   Yes

2. Is a truth table about syntax or semantics?

   Semantics

3. The text below contains more than one atomic sentence. Identify the atomic sentences and create a translation key.

   Not everyone has a vote. A convicted felon does not have a vote. A child does not have a vote.

   P: Everyone has a vote

   Q: A convicted felon has a vote

   R: A child has a vote

Implication and negation

1. Your friend says "If you give me 50 bucks I'll eat a cheeseburger in 20 seconds or less". How many atomic sentences in the statement?

   There are 2 atomic sentences in the statement.

2. Write a translation key for the previous problem.

   P: You give me 50 bucks

   Q: I'll eat a cheeseburger in 20 seconds or less

3. Write the English statement of problem 1 as a logical sentence, using your translation key of the previous problem.

   If P then Q

4. Is the statement of problem 1 true if you don't give your friend 50 bucks but your friend eats a cheeseburger in 20 seconds anyway?

   P --> Q ; F --> T

   True

5. For each of the following English sentences, write a translation key and then write the sentence in logic:

   a. Josie is a cat

      P: Josie is a cat

      P

   b. If Bez studies, Bez will pass the exam

      P: Bez studies

      Q: Bez will pass the exam

      P --> Q

   c. Josie is a cat only if Josie is a mammal

      P: Josie is a cat

      Q: Jose is a mammal

      P-->Q

6. If P is false and Q is false, then what is the value of the logical sentence $P \rightarrow Q$?

True

7. If P is true, Q is false, and R is true, then what is the value of the logical sentence $P \rightarrow (Q \rightarrow R)$?

   True

8. If P is false and Q is true, then what is the value of the logical sentence $\neg(P \rightarrow \neg Q)$?

   ~(F->~T)

   ~(F->F)

   ~(T)

   False

9. Translate the following phrase into our logical language:

   P provided that Q

   Q --> P

10. For the following English sentence, write a translation key and then write the sentence in logic:

    If Jessica studies, then Jessica will pass the exam, provided she wakes up in time.

    P: Jessica Studies

    Q: Jessica will pass the exam

    R: Jessica Wake up in time

    R --> (P --> Q)

11. For the following English sentence, write a translation key and then write the sentence in logic:

    If Tom does not pass the exam, then if Steve studies, Steve will pass the exam.

P: Tom passes the exam

Q: Steve studies

R: Steve will pass the exam

¬P → (Q→R)

12. Do you think the following two English sentences mean the same thing?

    a. If Chris eats breakfast and works out, then he will stay awake all day.

       P ^ Q → R

    b. If Chris eats breakfast, then if he works out he will stay awake all day.

       P → (Q → R)

    If not, give an example of a situation in which one of the statements would be true, and the other would be false.

    Chris can eat breakfast and not work out or stay awake all day and the second statement will be true. However, for the first statement, if he does not eat breakfast or he does not work out, then the first statement is false.

Arguments

1. Is it possible for an argument to have no conclusion?

   No

2. Must all the premises of an argument be true?

   No

3. If a sentence is not true, we also refer to it as: (select all that apply)
   a. an invalid sentence
   b. an undefined sentence
   c. a false sentence

4. (True/False) In a valid argument, it could be that the premises are true but the conclusion is false.

   False

5. Is the following argument valid?

   I graduated from a California high school

   if I graduated from a California high school then I can legally vote

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I can legally vote

Valid

6. (True/False) Every valid argument is also a sound argument.

   False