Validity and Conditional Statements

Clicker Question

"I cannot believe you took the bet" is

A. An argument
B. A tautology
C. A statement
D. Neither true nor false

Clicker Question

Definitions seek to provide

A. All necessary conditions for satisfying a term
B. Can never be provided
C. Necessary and sufficient conditions for satisfying a term
D. Are neither true nor false

Clicker Question

An argument
  A. Involves at least two parties
  B. is a set of statements
  C. never contains a contradiction
  D. is always contentious

Clicker Question

Which of the following is a premise indicator
  A. Therefore
  B. Because
  C. This shows that
  D. Thus

Good and bad arguments

- Our concern is not just with whether the conclusion is true
  - but with whether the reasons stated in the premises give us good logical grounds for thinking that the conclusion is true
- The goal is not actual persuasion (people can be persuaded for bad reasons),
  - but establishing the truth
- Two factors relevant to the evaluation of arguments:
  - Are the premises true?
  - Is the connection between the premises and the conclusion such that if the premises were true, they would establish the conclusion?

Valid Arguments

- Validity has to do with the **connection**
  - **A valid argument is an argument in which, if the premises are true, the conclusion must also be true**
  - **A valid argument cannot have true premises and a false conclusion**
- This relationship is modal: it tells us what would be the case were certain conditions to be met. These conditions might not be satisfied, and the modal definition tells you nothing about what happens when they are not satisfied.
- One way to assess whether an argument is valid is to use your imagination and see if you can imagine a situation in which the premises are true and the conclusion false
  - If it is possible to imagine such a situation, then the argument is probably not valid.

Sound arguments

- A valid argument in which the premises are true is known as a **sound** argument.
  - This definition of a sound argument does not say anything about the truth of the conclusion.
    - Nonetheless the conclusion of a sound argument must be true
- A sound argument meets both of the desiderata of a good argument:
  - True premises
  - Valid

Examples: Validity and Soundness

- Consider the argument
  - You are an Independent, therefore you cannot be President of the US
    - Validity: Can the premise be true and the conclusion false?
      - Yes, so this argument is not valid
      - Consequently, it is not sound
- Consider the argument
  - The President is a human being, therefore he is a mammal
    - Validity: Can the premise be true and the conclusion false
      - No, so this argument is valid
      - Is the premise also true? Yes. So the argument is sound

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Clicker Question

The conclusions of valid arguments with false premises are always false

A. True
B. False

Clicker Question

An argument with all true premises and a true conclusion is

A. Sound
B. Valid
C. Valid but not sound
D. Cannot tell

Clicker Question

Can a valid argument have a false conclusion?

A. No, all valid arguments have true conclusions
B. Yes, any valid argument may have a false conclusion
C. Yes, but only if it has one or more false premises
D. No, since it would not then be sound

Conditional Statements

◆ Conditional statements consist of two component statements linked by the logical connective IF, THEN
  – If the dog barks, (then) the dog will bite.
◆ *If* and *then* are not argument indicator words— they are not marking premises and conclusions of an argument
  – *If it rains today there will be no picnic* is not an argument!
    ▪ It simply asserts a conditional relationship between two statements
  – Compare: *It is raining today, therefore there will be no picnic.*
    ▪ This is an argument whose conclusion is that there will not be a picnic.

Conditional Statements - 2

◆ IF (antecedent), THEN (consequent) is a *truth functional* connective: the truth of a compound (whole) statement depends only on the truth values of the component statements

If A, then B is false
    when the antecedent is true and the consequent is false.
        Otherwise, it is true.

◦ If you trespass, then you will be arrested

  ◦ is false if you trespass and are not arrested
  ◦ is true if you trespass and are arrested
  ◦ is true if you do not trespass and are not arrested
  ◦ is true if you do not trespass and are arrested

The last case may seem surprising, but of course there are other reasons you might be arrested

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Clicker Question

The statement "If the door is open, the alarm sounds" is false if
  A. The door is open and the alarm sounds
  B. The door is open and the alarm does not sound
  C. The door is not open and the alarm sounds
  D. The door is not open and the alarm does not sound

Reversing Antecedent and Consequent

♦ *IF A, THEN B* is **NOT** equivalent to *IF B, THEN A*
IF A, THEN B is false when A is true and B is false
IF B, THEN A is false when B is true and A is false

Contrast
If the economy has improved, we will go to war
If we go to war, then the economy has improved

IF A, THEN B **is equivalent to** *IF not B, THEN not A.*

If you trespass, then you will be arrested
is equivalent to
If you are not arrested, then you did not trespass

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Clicker Question

"If I miss this question, I need to study" is equivalent to

A. If I don't miss this question, I don't need to study.
B. If I don't need to study, I did not miss this question.
C. If I need to study, I missed this question.
D. I missed this question, therefore, I need to study.

ONLY IF

♦ *IF, THEN* versus *ONLY IF*

Compare:
If you trespass, then you will be arrested
False if you trespass and are not arrested
Only if you trespass will you be arrested
False if you don't trespass and are arrested

B ONLY IF A is equivalent to If B, then A

If you were arrested, then you trespassed

THERE IS NO IF IN *ONLY IF*

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ONLY IF - 2

- How to say "IF you are an officer, THEN you can eat in this room" with ONLY IF?
  - ONLY IF you can eat in this room are you an officer
    - Both are false if you are an officer but cannot eat in this room
- What does "ONLY IF you are an officer can you eat in this room" say?
  - IF you can eat in this room, THEN you are an officer
    - Both are false if: you can eat in this room but are not an officer

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UNLESS

UNLESS can also be used to assert conditional relations
  Rule: UNLESS = IF NOT

  Unless you complete the assignment, you will not get promoted
says the same thing as
  If you do not complete the assignment, you will not get promoted
or
  If you get promoted, then you completed the assignment.

Clicker Question

Which statement is not equivalent to the others?
  A. If there is a storm, the dogs will bark
  B. Only if the dogs bark is there a storm
  C. Only if there is a storm will the dogs bark
  D. Unless the dogs bark, there is no storm

Clicker Question

Which statement is not equivalent to the others?
A. Unless there is a test, there is no need to attend class
B. If there is a test, then there is a need to attend class
C. If there is a need to attend class, then there is a test
D. Only if there is a test is there a need to attend class

Sufficient Conditions

When a conditional statement uses general terms (e.g., *dog*, *mammal*) it expresses relations between categories of things that satisfy those terms

If something is a dog, then it is a mammal

Presents a relation between **being a dog** and **being a mammal**

It asserts that meeting the first condition (being a dog) *suffices* for meeting the second condition (being a mammal)

If _____, then_____

suffices for
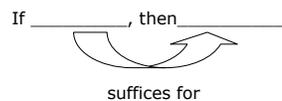
Necessary Conditions

Since a true conditional statement cannot have a true antecedent and a false consequent, the consequent of a conditional expresses something that is *necessary* if the antecedent is true

If something is a dog, then it is a mammal

Asserts that meeting the second condition (being a mammal) is necessary for meeting the first condition (being a dog)

If _____, then_____

is necessary for
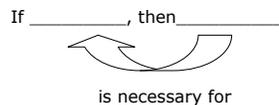
Necessary and Sufficient Conditions

- Passing statistics is a necessary condition for a B.S. in psychology.
  - If a person has a B.S. in psychology, that person has passed statistics.
- Voting is sufficient for being a U.S. citizen.
  - If someone votes, then that person is a U.S. citizen.
- Believing in God is necessary to be a Boy Scout.
  - If someone is a Boy Scout, then that person believes in God.
- Not taking the exam is sufficient for failing this course.
  - If you do not take the exam, then you fail this course.

If versus *Only if* again

What follows the *if* of a conditional is a sufficient condition

What follows *only if* is a necessary condition

You can vote only if you are at least 18 years old

Being 18 is a necessary condition for voting

If you are able to vote, then you are at least 18 years old

Being able to vote is sufficient (evidence) that you are at least 18 years old

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