Lecture 1: Introduction
Philosophy 10

Content Introduction

Content Introduction

What is logic?

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What is logic?

Study of reasoning, the process
of going from given facts, information
or assumptions to ‘new’ information

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What is logic?

Study of reasoning, the process
of going from given facts, information
or assumptions to ‘new’ information

Put it another way: determining what follows,
and what doesn’t follow, from what

Content Introduction

What is logic?

Examples:

Content Introduction

What is logic?

Examples:

Pizza: Either the pizza in my hand is a cheese pizza or it is a pepperoni pizza.

It is not a pepperoni pizza.

Therefore, it must be a cheese pizza.

Content Introduction

What is logic?

Examples:

Bob: I don't know why your plants are dead. I watered them twice while you were gone.

Alice: You couldn't have. If you'd watered them, then you'd have had to use the hose, but it is in the same exact position it was in when I left.

Content Introduction

Why is logic important?

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- Reasoning governs everything you do

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- Reasoning governs everything you do
- Much human reasoning is bad

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Why is logic important?

- Reasoning governs everything you do
- Much human reasoning is bad
- Many groups (political campaigns, advertising agencies) know how to manipulate bad reasoning for their own ends.

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In many cases, what makes reasoning good or bad is formal features of the reasoning.

Pizza: Either the pizza in my hand is a cheese pizza or it is a pepperoni pizza.

It is not a pepperoni pizza.

Therefore, it must be a cheese pizza.

Either X or Y. Not Y. Therefore X.

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What are ‘informal fallacies’?

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Some common patterns of reasoning that are often bad are bad for reasons other than the formal features of the argument.

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Some common patterns of reasoning that are often bad are bad for reasons other than the formal features of the argument.

Every time Jerome Bettis carries more than 30 times, the Steelers win. So all Cowher has to do to keep the Steelers winning is to give the ball to Bettis at least 30 times a game.

Arguments

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Arguments are verbal, written, propositional, representations of episodes of reasoning

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Reasoning is determining what follows from facts or assumptions

Arguments

Arguments are verbal, written, propositional, representations of episodes of reasoning

Reasoning is determining what follows from facts or assumptions

An argument: A set of statements such that one (conclusion) is taken to follow from the others (premises)

1. Either the pizza in my hand is a cheese pizza or the pizza in my hand is a pepperoni pizza.

2. The pizza in my hand is not a pepperoni pizza.

∴ 3. The pizza in my hand is a cheese pizza.

1. Either the pizza in my hand is a cheese pizza or the pizza in my hand is a pepperoni pizza.

2. The pizza in my hand is not a pepperoni pizza.

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1. Either the pizza in my hand is a cheese pizza or the pizza in my hand is a pepperoni pizza.

2. The pizza in my hand is not a pepperoni pizza.

∴ 3. The pizza in my hand is a cheese pizza.

Will always be exactly 1 conclusion

Can be any number of premises

Varieties of arguments

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Two kinds of argument

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1. Deductive - Premises are taken to provide complete, watertight support for the conclusion (may or may not be successful)

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Two kinds of argument

1. Deductive - Premises are taken to provide complete, watertight support for the conclusion (may or may not be successful)

2. Inductive - Premises are taken to provide probable support for the conclusion, but not watertight support (may or may not be successful)

Example of deductive argument

1. If I file my taxes I will get a refund.

2. I will file my taxes.

∴ 3. I will get a refund.

Example of deductive argument

1. If my plants were watered, the hose would be moved.

2. The hose was moved.

∴ 3. My plants were watered.

Example of inductive argument

1. Southpark has always been on Wednesday at 10 pm.

2. It is now Wednesday at 10 pm.

∴ 3. Southpark is [probably] on now.

Example of inductive argument

1. The last time I watched Southpark, the first commercial was for Old Navy.

∴ 2. The first commercial on tonight's episode of Southpark will [probably] be for Old Navy.

Difference between deductive and inductive arguments is not a matter of how good the arguments are. There are good and bad inductive arguments, and good and bad deductive arguments.

There are two distinct measures of an argument's goodness:

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1. The inferential relationship between the premises and the conclusion

There are two distinct measures of an argument's goodness:

1. The inferential relationship between the premises and the conclusion

2. The truth of the premises

1. The inferential relationship between the premises and the conclusion

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If the premises were true, would the conclusion necessarily (deductive), or probably (inductive), be true?

1. The inferential relationship between the premises and the conclusion

If the premises were true, would the conclusion necessarily (deductive), or probably (inductive), be true?

Note: This can be assessed even if the premises are in fact false.

Example of deductive argument

1. If I file my taxes I will get a refund.

2. I will file my taxes.

∴ 3. I will get a refund.

Example of deductive argument

1. If I file my taxes I will get a refund.

2. I will file my taxes.

∴ 3. I will get a refund.

If these premises were/are true, then the conclusion would have to be true.

Example of deductive argument

1. If I file my taxes I will get a refund.

2. I will file my taxes.

∴ 3. I will get a refund.

If these premises were/are true, then the conclusion would have to be true.

If the conclusion is/were false, then at least one of the premises would have to be false.

Example of deductive argument

1. If my plants were watered, the hose would be moved.

2. The hose was moved.

∴ 3. My plants were watered.

Example of deductive argument

1. If my plants were watered, the hose would be moved.

2. The hose was moved.

∴ 3. My plants were watered.

Even if these premises were/are true, the conclusion could be false.

If a deductive argument has a good inferential relationship between the premises and conclusion, then it is valid.

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An argument (deductive) is valid iff:

If a deductive argument has a good inferential relationship between the premises and conclusion, then it is valid.

An argument (deductive) is valid iff:

-If all the premises of the argument were true, the conclusion would have to be true

If a deductive argument has a good inferential relationship between the premises and conclusion, then it is valid.

An argument (deductive) is valid iff:

-If all the premises of the argument were true, the conclusion would have to be true

-If the conclusion were false, then one or more of the premises would have to be false

A valid deductive argument with false premises and a false conclusion:

1. If I am President of the US, then I get all the free BMWs I want.

2. I am President of the US.

∴ 3. I get all the free BMWs I want.

An invalid deductive argument with true premises and a true conclusion:

1. If I have a mass greater than 0 kg, then I am subject to gravitational forces.

2. I like pizza.

∴ 3. I am explaining validity.

Example of inductive argument

1. Southpark has always been on Wednesday at 10 pm.

2. It is now Wednesday at 10 pm.

∴ 3. Therefore, Southpark is [probably] on now.

Example of inductive argument

1. Southpark has always been on Wednesday at 10 pm.

2. It is now Wednesday at 10 pm.

∴ 3. Therefore, Southpark is [probably] on now.

In this argument, there is a good inferential relation between premises and conclusion.

Example of inductive argument

1. The last time I watched Southpark, the first commercial was for Old Navy.

∴ 2. The first commercial on tonight's episode of Southpark will [probably] be for Old Navy.

Example of inductive argument

1. The last time I watched Southpark, the first commercial was for Old Navy.

∴ 2. The first commercial on tonight's episode of Southpark will [probably] be for Old Navy.

In this argument, there is not a good inferential relation between premises and conclusion.

If an inductive argument has a good inferential relationship between the premises and conclusion, then it is strong.

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An argument (inductive) is strong iff:

If an inductive argument has a good inferential relationship between the premises and conclusion, then it is strong.

An argument (inductive) is strong iff:

-If all the premises of the argument were true, the conclusion would probably be true

First kind of goodness that an argument can have: a good inferential relationship between the premises and the conclusion.

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If a deductive argument has it, it is valid.

First kind of goodness that an argument can have: a good inferential relationship between the premises and the conclusion.

If a deductive argument has it, it is valid.

If an inductive argument has it, it is strong.

Second kind of goodness an argument can have is the truth of its premises

1. If I am President of the US, then I get all the free BMWs I want.
2. I am President of the US.

∴ 3. I get all the free BMWs I want.

1. If I am over 21, then I can legally drink beer at the Pub.
2. I am over 21.

∴ 3. I can legally drink beer at the Pub.

1. If I am President of the US, then I get all the free BMWs I want.
2. I am President of the US.

∴ 3. I get all the free BMWs I want.

1. If I am over 21, then I can legally drink beer at the Pub.
2. I am over 21.

∴ 3. I can legally drink beer at the Pub.

Both are valid

Second kind of goodness an argument can have is the truth of its premises

Second kind of goodness an argument can have is the truth of its premises

If a deductive argument (i) is valid, and (ii) has all true premises, then it is sound.

1. If I am President of the US, then I get all the free BMWs I want.
2. I am President of the US.

∴ 3. I get all the free BMWs I want.

1. If I am over 21, then I can legally drink beer at the Pub.
2. I am over 21.

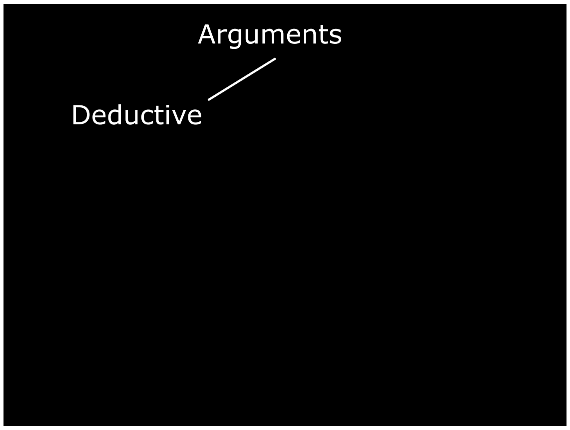
∴ 3. I can legally drink beer at the Pub.

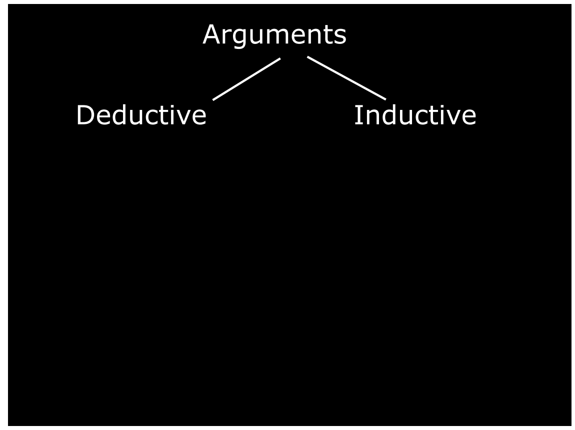
Only second is sound

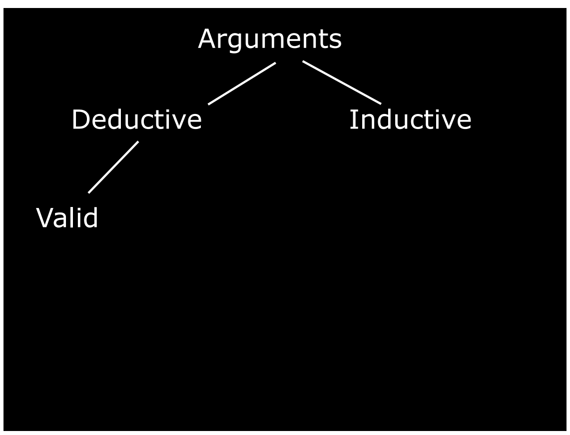
If a deductive argument (i) is valid, and (ii) has all true premises, then it is sound.

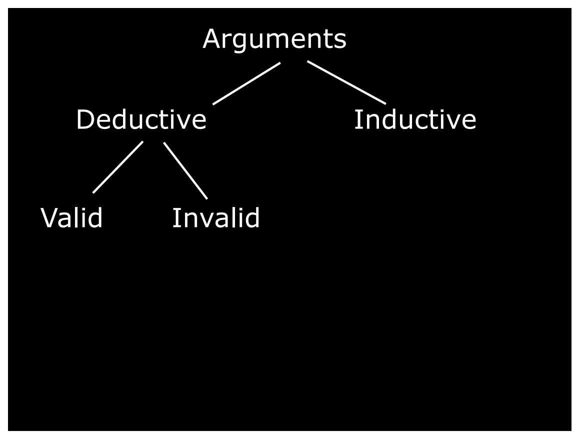
If an inductive argument (i) is strong, and (ii) has all true premises, then it is cogent.

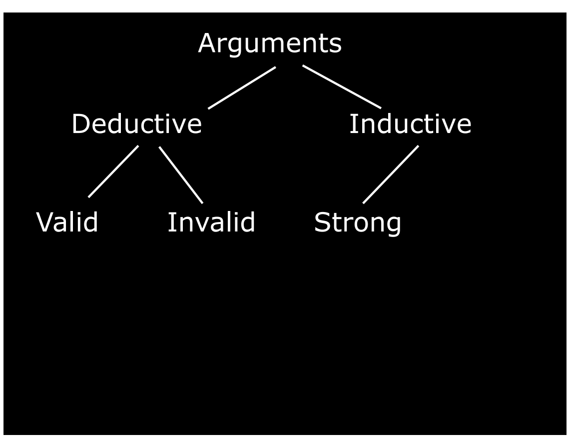
Arguments

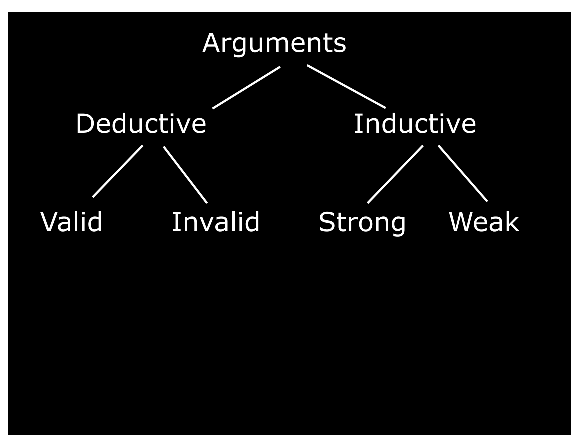

Arguments
Deductive

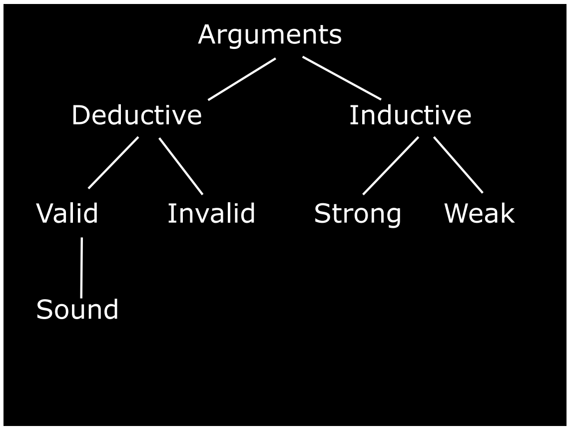

Arguments
Deductive
Inductive

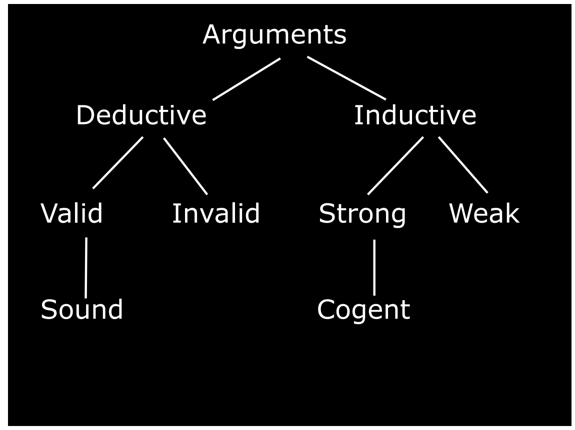

Arguments
Deductive
Inductive
Valid

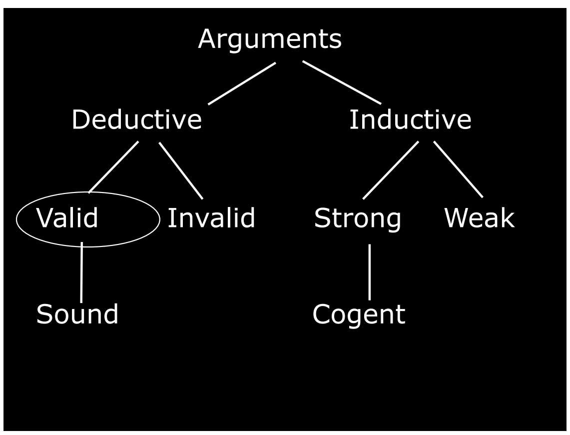

Arguments
Deductive
Inductive
Valid
Invalid


Arguments
Deductive
Inductive
Valid
Invalid
Strong


Arguments
Deductive
Inductive
Valid
Invalid
Strong
Weak







Validity

Validity is often a function of the formal features of an argument

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Either the pizza in my hand is a cheese pizza or it is a pepperoni pizza.

The pizza in my hand is not a pepperoni pizza.

Therefore, it is a cheese pizza.

Validity

Validity is often a function of the formal features of an argument

Either the pizza in my hand is a cheese pizza or it is a pepperoni pizza.

The pizza in my hand is not a pepperoni pizza.

Therefore, it is a cheese pizza.

Either X or Y.

Not Y.

Therefore X.

Validity

Validity is often a function of the formal features of an argument

Either the rabbit ran down the left trail or the rabbit ran down the right trail.
The rabbit did not run down the right trail.
Therefore, the rabbit ran down the left trail.

Either X or Y.
Not Y.
Therefore X.

So we will:

So we will:

1. develop means to determine an argument' s form

So we will:

1. develop means to determine an argument' s form

2. develop tools for determining, of a given formal representation of an argument, whether or not is it valid

Argument form

Argument form

An argument is a set of statements, and accordingly an argument' s logical form is determined by the logical form of the statements (the premises and conclusion).

Argument form

An argument is a set of statements, and accordingly an argument's logical form is determined by the logical form of the statements (the premises and conclusion).

A statement's logical form (at least those we will discuss in this course) is determined by the atomic statements it has as components, and the operators (if any) that combine those components.

Statements:
Atomic and Compound

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A statement is something that makes a claim: typically expressed with a declarative sentence (not a question, exclamation, imperative, etc.)

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An atomic statement is a statement that does not have parts that are themselves statements.

Statements:
Atomic and Compound

A statement is something that makes a claim: typically expressed with a declarative sentence (not a question, exclamation, imperative, etc.)

An atomic statement is a statement that does not have parts that are themselves statements.

A compound statement is a statement that does have parts that are themselves statements.

1. Either the rabbit ran down the left trail or the rabbit ran down the right trail.

2. It is false that the rabbit ran down the right trail.

∴ 3. The rabbit ran down the left trail.

1. Either the rabbit ran down the left trail or the rabbit ran down the right trail.

2. It is false that the rabbit ran down the right trail.

∴ 3. The rabbit ran down the left trail.

1. Either the rabbit ran down the left trail or the rabbit ran down the right trail.

2. It is false that the rabbit ran down the right trail.

∴ 3. The rabbit ran down the left trail.

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2. It is false that the rabbit ran down the right trail.

∴ 3. The rabbit ran down the left trail.

1. Either the rabbit ran down the left trail or the rabbit ran down the right trail.

2. It is false that the rabbit ran down the right trail.

∴ 3. The rabbit ran down the left trail.

Two atomic statements:
The rabbit ran down the left trail.
The rabbit ran down the right trail.

Compound statements

Compound statements are built up from atomic statements with statement operators

Compound statements

Compound statements are built up from atomic statements with statement operators

Either … or …

Compound statements

Compound statements are built up from atomic statements with statement operators

Either … or …

It is false that …

1. Either the rabbit ran down the left trail or the rabbit ran down the right trail.

2. It is false that the rabbit ran down the right trail.

∴ 3. The rabbit ran down the left trail.

Five statement operators (aka logical operators)

Five statement operators (aka logical operators)

Negation: It is false that … ; …n't

Five statement operators (aka logical operators)

Negation: It is false that … ; …n't

Conjunction: … and …

Five statement operators (aka logical operators)

Negation: It is false that … ; …n't

Conjunction: … and …

Disjunction: … or …

Five statement operators (aka logical operators)

Negation: It is false that ... ; ...n’t

Conjunction: ... and ...

Disjunction: ... or ...

Conditional: if ... then ...

Five statement operators (aka logical operators)

Negation: It is false that ... ; ...n’t

Conjunction: ... and ...

Disjunction: ... or ...

Conditional: if ... then ...

Biconditional: ... if and only if ...

John is at the party.

There is pizza at the party.

John is at the party.

There is pizza at the party.

John isn’t at the party.

John is at the party.

There is pizza at the party.

John isn’t at the party.

There is pizza at the party, and John is at the party.

John is at the party.

There is pizza at the party.

John isn’t at the party.

There is pizza at the party, and John is at the party.

Either John is at the party, or there is pizza at the party.

John is at the party.

There is pizza at the party.

John isn't at the party.

There is pizza at the party, and John is at the party.

Either John is at the party, or there is pizza at the party.

If there is pizza at the party, then John is at the party.

Recursion

The five statement operators are recursive, meaning that they can not only take as input atomic statements, but can also take as inputs compound statements formed by statement operators.

Arithmetic operators

Arithmetic operators

Four arithmetic operators

Arithmetic operators

Four arithmetic operators

Addition

Arithmetic operators

Four arithmetic operators

Addition
Subtraction

Arithmetic operators

Four arithmetic operators

Addition
Subtraction
Multiplication

Arithmetic operators

Four arithmetic operators

Addition
Subtraction
Multiplication
Division

Arithmetic operators

Arithmetic operators form complex arithmetic expressions from atomic numerical expressions (numerals)

Arithmetic operators

Arithmetic operators form complex arithmetic expressions from atomic numerical expressions (numerals)

5 + 3 5 - 3
5 x 3 5 ÷ 3

Arithmetic operators

Arithmetic operators are recursive, in that they can also operate on expressions that are themselves the product of an arithmetic operator:

Arithmetic operators

Arithmetic operators are recursive, in that they can also operate on expressions that are themselves the product of an arithmetic operator:

5 + 3

Arithmetic operators

Arithmetic operators are recursive, in that they can also operate on expressions that are themselves the product of an arithmetic operator:

5 + 3

(5 + 3) + (4 x 9)

Arithmetic operators

Arithmetic operators are recursive, in that they can also operate on expressions that are themselves the product of an arithmetic operator:

5 + 3

(5 + 3) + (4 x 9)

{(5 + 3) + (4 x 9)} + (3 - 1)

You pay me the $20 you owe me.
You come to the party.
I' ll jack your ride.
I' ll steal your wallet.

You pay me the $20 you owe me.
You come to the party.
I' ll jack your ride.
I' ll steal your wallet.

If you come to the party, then I' ll steal your wallet.

You pay me the $20 you owe me.
You come to the party.
I' ll jack your ride.
I' ll steal your wallet.

If you come to the party, then I' ll steal your wallet.

If you come to the party and you don' t pay me the $20 you owe me, then either I' ll steal your wallet or I' ll jack your ride.

You pay me the $20 you owe me.
You come to the party.
I' ll jack your ride.
I' ll steal your wallet.

If you come to the party, then I' ll steal your wallet.

If you come to the party and you don' t pay me the $20 you owe me, then either I' ll steal your wallet or I' ll jack your ride.

You pay me the $20 you owe me.
You come to the party.
I'll jack your ride.
I'll steal your wallet.

If you come to the party, then I'll steal your wallet.

If you come to the party and you don't pay me the $20 you owe me, then either I'll steal your wallet or I'll jack your ride.

You pay me the $20 you owe me.
You come to the party.
I'll jack your ride.
I'll steal your wallet.

If you come to the party, then I'll steal your wallet.

If you come to the party and you don't pay me the $20 you owe me, then either I'll steal your wallet or I'll jack your ride.

Translating from spoken language to formal notation

Translating from spoken language to formal notation

1. Translating five statement operators

Translating from spoken language to formal notation

1. Translating five statement operators
2. Translating compound statements

Translating from spoken language to formal notation

1. Translating five statement operators
2. Translating compound statements
3. Translating arguments

Five Statement Operators: Negation

Five Statement Operators: Negation

Negation is expressed in a number of ways in English

Five Statement Operators: Negation

Negation is expressed in a number of ways in English

The cat is on the mat.

Five Statement Operators: Negation

Negation is expressed in a number of ways in English

The cat is on the mat.

The cat is not on the mat.

Five Statement Operators: Negation

Negation is expressed in a number of ways in English

The cat is on the mat.

The cat is not on the mat.

The cat isn't on the mat.

Five Statement Operators: Negation

Negation is expressed in a number of ways in English

The cat is on the mat.

The cat is not on the mat.

The cat isn't on the mat.

It is false that the cat is on the mat.

Five Statement Operators: Negation

The cat is on the mat. = C

Five Statement Operators: Negation

The cat is on the mat. = C

The cat is not on the mat.
The cat isn't on the mat.

It is false that the cat is on the mat.

Five Statement Operators: Negation

The cat is on the mat. = C

The cat is not on the mat.
The cat isn't on the mat.

It is false that the cat is on the mat.

~C

Five Statement Operators: Conjunction

Five Statement Operators: Conjunction

Roses are red.
Violets are blue.

Five Statement Operators: Conjunction

Roses are red.
Violets are blue.

Roses are red and violets are blue.

Five Statement Operators: Conjunction

Roses are red.
Violets are blue.
Roses are red and violets are blue.
Both roses are red and violets are blue.

Five Statement Operators: Conjunction

Roses are red.
Violets are blue.
Roses are red and violets are blue.
Both roses are red and violets are blue.

Roses are red but violets are blue.

Five Statement Operators: Conjunction

Roses are red. = R
Violets are blue. = V
Roses are red and violets are blue.
Both roses are red and violets are blue.

Roses are red but violets are blue.

Five Statement Operators: Conjunction

Roses are red. = R
Violets are blue. = V
Roses are red and violets are blue.
Both roses are red and violets are blue.

Roses are red but violets are blue.

R • V

Five Statement Operators: Conjunction

Components of a conjunction are conjuncts.

R • V

Five Statement Operators: Disjunction

Dallas will win the Superbowl.
Buffalo will win the Superbowl.

Five Statement Operators: Disjunction

Dallas will win the Superbowl.

Buffalo will win the Superbowl.

Dallas will win the Superbowl or Buffalo will win the Superbowl.

Five Statement Operators: Disjunction

Dallas will win the Superbowl.

Buffalo will win the Superbowl.

Dallas will win the Superbowl or Buffalo will win the Superbowl.

Either Dallas will win the Superbowl or Buffalo will win the Superbowl.

Five Statement Operators: Disjunction

Dallas will win the Superbowl. = D

Buffalo will win the Superbowl. = B

Dallas will win the Superbowl or Buffalo will win the Superbowl.

Five Statement Operators: Disjunction

Dallas will win the Superbowl. = D

Buffalo will win the Superbowl. = B

Dallas will win the Superbowl or Buffalo will win the Superbowl.

D v B

Five Statement Operators: Disjunction

Components of a disjunction are called disjuncts.

D v B

Five Statement Operators: Conditional

You earn exactly 900 points. = N

You get some form of A. = A

Five Statement Operators: Conditional

You earn exactly 900 points. = N

You get some form of A. = A

If you earn exactly 900 points, then you will get some form of A.

Five Statement Operators: Conditional

You earn exactly 900 points. = N

You get some form of A. = A

If you earn exactly 900 points, then you will get some form of A.

N ⊃ A

Five Statement Operators: Conditional

You earn exactly 900 points. = N

You get some form of A. = A

If you earn exactly 900 points, then you will get some form of A.

N ⊃ A

Five Statement Operators: Conditional

You earn exactly 900 points. = N

You get some form of A. = A

If you earn exactly 900 points, then you will get some form of A.

N ⊃ A

Statement following ‘if’ is antecedent

Five Statement Operators: Conditional

You earn exactly 900 points. = N

You get some form of A. = A

If you earn exactly 900 points, then you will get some form of A.

N ⊃ A

Statement following ‘if’ is antecedent, statement following ‘then’ is consequent. (Does not apply to ‘only if’.)

Five Statement Operators: Conditional

If you earn exactly 900 points, you will get some form of A.

Five Statement Operators: Conditional

If you earn exactly 900 points, you will get some form of A.

N ⊃ A

Five Statement Operators: Conditional

If you earn exactly 900 points, you will get some form of A.

N ⊃ A

Statement following ‘if’ is antecedent, statement following where the ‘then’ would be is consequent.

Five Statement Operators: Conditional

Five Statement Operators: Conditional

Statement following ‘if’ is antecedent, statement following where the ‘then’ would be is consequent.

Five Statement Operators: Conditional

Statement following ‘if’ is antecedent, statement following where the ‘then’ would be is consequent.

Statement following ‘if’ is antecedent, statement following the ‘then’ is consequent.

Five Statement Operators: Conditional

Statement following ‘if’ is antecedent, statement following where the ‘then’ would be is consequent.

Statement following ‘if’ is antecedent, statement following the ‘then’ is consequent.

Notice: Order in which they appear is irrelevant!

Five Statement Operators: Conditional

If you earn exactly 900 points, you will get some form of A.

Five Statement Operators: Conditional

If you earn exactly 900 points, you will get some form of A.

You will get some form of A if you earn exactly 900 points.

Five Statement Operators: Conditional

If you earn exactly 900 points, you will get some form of A.

You will get some form of A if you earn exactly 900 points.

N ⊃ A

Five Statement Operators: Conditional

In English, which statement is the antecedent and which the consequent is not coded by linear order, but by words in sentence, like 'if', 'then', 'only if', and others. So to tell which is the antecedent and which the consequent, ignore the order, look for key words.

Five Statement Operators: Conditional

In our logical notation, the antecedent and conditional are coded by linear order: antecedent is always on the left, consequent always on the right.

N ⊃ A

Five Statement Operators: Conditional

Jim will go to Hawaii. = H

Jim wins Lotto. = L

Jim will go to Hawaii if Jim wins Lotto.

Five Statement Operators: Conditional

Jim will go to Hawaii. = H

Jim wins Lotto. = L

Jim will go to Hawaii if Jim wins Lotto.

L ⊃ H

Five Statement Operators: Conditional

Jim will go to Hawaii. = H

Jim wins Lotto. = L

Jim will go to Hawaii if Jim wins Lotto.

L ⊃ H

Jim will go to Hawaii only if Jim wins Lotto.

Five Statement Operators: Conditional

The statement following ‘only if’ is the consequent.

Five Statement Operators: Conditional

The statement following ‘only if’ is the consequent.

Jim will go to Hawaii only if Jim wins Lotto.

H ⊃ L

Five Statement Operators: Conditional

The statement following ‘only if’ is the consequent.

Jim will go to Hawaii only if Jim wins Lotto.

H ⊃ L

Five Statement Operators: Conditional

For conditionals using ‘if’ :

Five Statement Operators: Conditional

For conditionals using ‘if’ :

- If ‘if’ is by itself (not immediately preceded by ‘only’), the statement following the ‘if’ is the antecedent, the other statement (which may, or may not, be preceded by a ‘then’) is the consequent.

Five Statement Operators: Conditional

For conditionals using ‘if’ :

- If the expression is ‘only if’ , then statement following the ‘only if’ is the consequent, the other statement is the antecedent.

Five Statement Operators: Biconditional

... if and only if ...

... iff ...

... is necessary and sufficient for ...

Five Statement Operators: Biconditional

You will get a P in the class if and only if you earn a C- or better.

Five Statement Operators: Biconditional

You will get a P in the class if and only if you earn a C- or better.

You get a P. = P
You earn a C- or better. = C

Five Statement Operators: Biconditional

You will get a P in the class if and only if you earn a C- or better.

You get a P. = P
You earn a C- or better. = C

$P \equiv C$

Five Statement Operators: Biconditional

You will get a P in the class if and only if you earn a C- or better.

You get a P. = P
You earn a C- or better. = C

$$P \equiv C$$

No special name for components of a biconditional

Translating compound statements

Translating compound statements

If Sarah doesn't come to the party, then we won't need the vegetarian burgers.

Translating compound statements

If Sarah doesn't come to the party, then we won't need the vegetarian burgers.

S = Sarah comes to the party

Translating compound statements

If Sarah doesn't come to the party, then we won't need the vegetarian burgers.

S = Sarah comes to the party
V = We will need the vegetarian burgers.

Translating compound statements

If Sarah doesn't come to the party, then we won't need the vegetarian burgers.

S = Sarah comes to the party
V = We will need the vegetarian burgers.
If not-S, then not-V.

Translating compound statements

If Sarah doesn't come to the party, then we won't need the vegetarian burgers.

S = Sarah comes to the party

V = We will need the vegetarian burgers.

If not-S, then not-V.

$\sim S \supset \sim V$

Translating compound statements

I'll buy an Xbox 360, and either a PSP or Nintendo DS

Translating compound statements

I'll buy an Xbox 360, and either a PSP or Nintendo DS

X = I'll buy an Xbox 360

Translating compound statements

I'll buy an Xbox 360, and either a PSP or Nintendo DS

X = I'll buy an Xbox 360

P = I'll buy a PSP

Translating compound statements

I'll buy an Xbox 360, and either a PSP or Nintendo DS

X = I'll buy an Xbox 360

P = I'll buy a PSP

N = I'll buy a Nintendo DS

Translating compound statements

I'll buy an Xbox 360, and either a PSP or Nintendo DS

X = I'll buy an Xbox 360

P = I'll buy a PSP

N = I'll buy a Nintendo DS

X, and either P or N

Translating compound statements

I'll buy an Xbox 360, and either a PSP or Nintendo DS

X = I'll buy an Xbox 360
P = I'll buy a PSP
N = I'll buy a Nintendo DS

X, and either P or N
X, and (either P or N)

Translating compound statements

I'll buy an Xbox 360, and either a PSP or Nintendo DS

X = I'll buy an Xbox 360
P = I'll buy a PSP
N = I'll buy a Nintendo DS

X, and either P or N
X, and (either P or N)

X • (P v N)

Translating compound statements

I'll buy an Xbox 360 and a PSP or Nintendo DS

Translating compound statements

I'll buy an Xbox 360 and a PSP or Nintendo DS

X = I'll buy an Xbox 360
P = I'll buy a PSP
N = I'll buy a Nintendo DS

Translating compound statements

I'll buy an Xbox 360 and a PSP or Nintendo DS

X = I'll buy an Xbox 360
P = I'll buy a PSP
N = I'll buy a Nintendo DS

X and P or N

Translating compound statements

I'll buy an Xbox 360 and a PSP or Nintendo DS

X = I'll buy an Xbox 360
P = I'll buy a PSP
N = I'll buy a Nintendo DS

X and P or N

(X and P) or N

Translating compound statements

I' ll buy an Xbox 360 and a PSP or Nintendo DS

X = I' ll buy an Xbox 360
P = I' ll buy a PSP
N = I' ll buy a Nintendo DS

X and P or N

(X and P) or N   X and (P or N)

Translating compound statements

I' ll buy an Xbox 360 and a PSP or Nintendo DS

X = I' ll buy an Xbox 360
P = I' ll buy a PSP
N = I' ll buy a Nintendo DS

X and P or N

(X and P) or N   X and (P or N)

5 x 4 + 1

Translating compound statements

Translating compound statements

The car runs well and the motorcycle runs well, but you should be careful if you take the boat out.

Translating compound statements

The car runs well and the motorcycle runs well, but you should be careful if you take the boat out.

C = The car runs well
M = The motorcycle runs well
Y = You should be careful
B = You take the boat out

Translating compound statements

The car runs well and the motorcycle runs well, but you should be careful if you take the boat out.

C = The car runs well
M = The motorcycle runs well
Y = You should be careful
B = You take the boat out

C and M, but Y if B

Translating compound statements

The car runs well and the motorcycle runs well, but you should be careful if you take the boat out.

C and M, but Y if B

Translating compound statements

The car runs well and the motorcycle runs well, but you should be careful if you take the boat out.

C and M, but Y if B

(C and M), but (Y if B)

Translating compound statements

The car runs well and the motorcycle runs well, but you should be careful if you take the boat out.

C and M, but Y if B

(C and M), but (Y if B)

(C • M), • (Y if B)

Translating compound statements

The car runs well and the motorcycle runs well, but you should be careful if you take the boat out.

C and M, but Y if B

(C and M), but (Y if B)

(C • M), • (Y if B)

(C • M) • (B ⊃ Y)

Translating compound statements

Either you will get a fine or you will have to do hard time, if you don't pay your taxes and you don't file an extension.

Translating compound statements

Either you will get a fine or you will have to do hard time, if you don't pay your taxes and you don't file an extension.

F = You will get a fine
H = You will do hard time
T = You pay your taxes
E = You file an extension

Either you will get a fine or you will have to do hard time, if you don't pay your taxes and you don't file an extension.

F = You will get a fine
H = You will do hard time
T = You pay your taxes
E = You file an extension

Either you will get a fine or you will have to do hard time, if you don't pay your taxes and you don't file an extension.

F = You will get a fine
H = You will do hard time
T = You pay your taxes
E = You file an extension

Either F or H, if not-T and not-E

Either you will get a fine or you will have to do hard time, if you don't pay your taxes and you don't file an extension.

F = You will get a fine
H = You will do hard time
T = You pay your taxes
E = You file an extension

Either F or H, if not-T and not-E
(Either F or H), if (~T and ~E)

Either you will get a fine or you will have to do hard time, if you don't pay your taxes and you don't file an extension.

F = You will get a fine
H = You will do hard time
T = You pay your taxes
E = You file an extension

Either F or H, if not-T and not-E
(Either F or H), if (~T and ~E)
(F v H), if (~T • ~E)

Either you will get a fine or you will have to do hard time, if you don't pay your taxes and you don't file an extension.

F = You will get a fine
H = You will do hard time
T = You pay your taxes
E = You file an extension

Either F or H, if not-T and not-E
(Either F or H), if (~T and ~E)
(F v H), if (~T • ~E)
(~T • ~E) ⊃ (F v H)

Translating arguments

Translating arguments

An argument is a set of statements, so to translate an argument, you just translate all the statements, indicating which is the conclusion by placing it at the end with a triple-dot '∴'.

Either you were at work, or you were at the bar. But your office wasn't open today. Therefore, you were at the bar.

Either you were at work, or you were at the bar. But your office wasn't open today. Therefore, you were at the bar.

1. Either you were at work, or you were at the bar.
2. But your office wasn't open today.

∴ 3. You were at the bar.

1. Either you were at work, or you were at the bar.
2. But your office wasn't open today.

∴ 3. You were at the bar.

1. Either you were at work, or you were at the bar.
2. But your office wasn't open today.

∴ 3. You were at the bar.

W = You were at work
B = You were at the bar
O = Your office was open today

1. Either you were at work, or you were at the bar.
2. But your office wasn't open today.

∴ 3. You were at the bar.

W = You were at work
B = You were at the bar
O = Your office was open today

1. Either W, or B
2. But not-O.

∴ 3. B.

1. Either you were at work, or you were at the bar.
2. But your office wasn't open today.
∴ 3. You were at the bar.

W = You were at work
B = You were at the bar
O = Your office was open today

1. Either W, or B	1. W v B
2. But not-O.	2. ~O
∴ 3. B.	∴ 3. B

If Moe slaps Larry upside the head, then Larry will slap Curley upside the head. Curley will hit Moe with a hammer only if Larry slaps him (Curley) upside the head. Curley will hit Moe with a hammer unless Moe does not slap Larry upside the head. But Moe does slap Larry upside the head. Therefore, Curley will hit Moe with a hammer if Larry slaps Curley upside the head.

If Moe slaps Larry upside the head, then Larry will slap Curley upside the head. Curley will hit Moe with a hammer only if Larry slaps him (Curley) upside the head. Curley will hit Moe with a hammer unless Moe does not slap Larry upside the head. But Moe does slap Larry upside the head. Therefore, Curley will hit Moe with a hammer if Larry slaps Curley upside the head.

M = Moe slaps Larry upside the head
L = Larry slaps Curley upside the head.
C = Curley will hit Moe with a hammer

If Moe slaps Larry upside the head, then Larry will slap Curley upside the head. Curley will hit Moe with a hammer only if Larry slaps him (Curley) upside the head. Curley will hit Moe with a hammer unless Moe does not slap Larry upside the head. But Moe does slap Larry upside the head. Therefore, Curley will hit Moe with a hammer if Larry slaps Curley upside the head.

If M, then L.

If Moe slaps Larry upside the head, then Larry will slap Curley upside the head. Curley will hit Moe with a hammer only if Larry slaps him (Curley) upside the head. Curley will hit Moe with a hammer unless Moe does not slap Larry upside the head. But Moe does slap Larry upside the head. Therefore, Curley will hit Moe with a hammer if Larry slaps Curley upside the head.

If M, then L.
C only if L.

If Moe slaps Larry upside the head, then Larry will slap Curley upside the head. Curley will hit Moe with a hammer only if Larry slaps him (Curley) upside the head. Curley will hit Moe with a hammer unless Moe does not slap Larry upside the head. But Moe does slap Larry upside the head. Therefore, Curley will hit Moe with a hammer if Larry slaps Curley upside the head.

If M, then L.
C only if L.
C or not-M.

If Moe slaps Larry upside the head, then Larry will slap Curley upside the head. Curley will hit Moe with a hammer only if Larry slaps him (Curley) upside the head. Curley will hit Moe with a hammer unless Moe does not slap Larry upside the head. But Moe does slap Larry upside the head. Therefore, Curley will hit Moe with a hammer if Larry slaps Curley upside the head.

If M, then L.
C only if L.
C or not-M.
But M.

If Moe slaps Larry upside the head, then Larry will slap Curley upside the head. Curley will hit Moe with a hammer only if Larry slaps him (Curley) upside the head. Curley will hit Moe with a hammer unless Moe does not slap Larry upside the head. But Moe does slap Larry upside the head. Therefore, Curley will hit Moe with a hammer if Larry slaps Curley upside the head.

If M, then L.
C only if L.
C or not-M.
But M.
Therefore, C if L.

1. If M, then L
2. C only if L.
3. C or not-M.
4. But M.
Therefore 5. C if L.

1. If M, then L
2. C only if L.
3. C or not-M.
4. But M.
Therefore 5. C if L.

1. $M \supset L$
2. $C \supset L$
3. $C \vee {\sim}M$
4. M

$\therefore$ 5. $L \supset C$