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ARGUMENT FORMS

MODUS PONENS

An example of an argument that fits the form modus ponens:

- If today is Tuesday, then John will go to work.
- Today is Tuesday.
- Therefore, John will go to work.

This argument is valid, but this has no bearing on whether any of the statements in the argument are actually true; for modus ponens to be a sound argument, the premises must be true for any true instances of the conclusion. An argument can be valid but nonetheless unsound if one or more premises are false; if an argument is valid and all the premises are true, then the argument is sound. For example, John might be going to work on Wednesday. In this case, the reasoning for John's going to work (because it is Wednesday) is unsound. The argument is only sound on Tuesdays (when John goes to work), but valid on every day of the week. A propositional argument using modus ponens is said to be deductive.

MODUS TOLLENS

For example:

- If the dog detects an intruder, the dog will bark.
- The dog did not bark.
- Therefore, no intruder was detected by the dog.

Supposing that the premises are both true (the dog will bark if it detects an intruder, and does indeed not bark), it follows that no intruder has been detected. This is a valid argument since it is not possible for the conclusion to be false if the premises are true. (It is conceivable that there may have been an intruder that the dog did not detect, but that does not invalidate the argument; the first premise is if the dog detects an intruder. The thing of importance is that the dog detects or does not detect an intruder, not whether there is one.)

Another example:

- If I am the axe murderer, then I can use an axe.
- I cannot use an axe.
- Therefore, I am not the axe murderer.

Another example:

- If Rex is a chicken, then he is a bird.
- Rex is not a bird.
- Therefore, Rex is not a chicken.

HYPOTHETICAL SYLLOGISM

An example in English:

- If I do not wake up, then I cannot go to work.
- If I cannot go to work, then I will not get paid.
- Therefore, if I do not wake up, then I will not get paid.

An example, derived from Ernest W. Adams, [3]

- If Jones wins the election, Smith will retire after the election.
- If Smith dies before the election, Jones will win the election.
- If Smith dies before the election, Smith will retire after the election.

Clearly, (3) does not follow from (1) and (2). (1) is true by default, but fails to hold in the exceptional circumstances of Smith dying. In practice, real-world conditionals always tend to involve default assumptions or contexts, and it may be infeasible or even impossible to specify all the exceptional circumstances in which they might fail to be true. For similar reasons, the rule of hypothetical syllogism does not hold for counterfactual conditionals.

Disjunctive Syllogism

An example in English:

- The breach is a safety violation, or it is not subject to fines.
- The breach is not a safety violation.
- Therefore, it is not subject to fines.

Constructive Dilemma

- If I win a million dollars, I will donate it to an orphanage.
- If my friend wins a million dollars, he will donate it to a wildlife fund.
- Either I win a million dollars or my friend wins a million dollars.
- Therefore, either an orphanage will get a million dollars, or a wildlife fund will get a million dollars.

Destructive Dilemma

- If it rains, we will stay inside.
- If it is sunny, we will go for a walk.
- Either we will not stay inside, or we will not go for a walk, or both.
- Therefore, either it will not rain, or it will not be sunny, or both.

Bidirectional Dilemma

Simplification

Conjunction

Addition

Composition

De Morgan's Theorem (1) and (2)

Commutation (1) , (2) and (3)

Association (1) and (2)

Distribution (1) and (2)

Double Negation

Transposition

Material Implication

An example: we are given the conditional fact that if it is a bear, then it can swim. Then, all 4 possibilities in the truth table are compared to that fact.

If it is a bear, then it can swim — T If it is a bear, then it can not swim — F If it is not a bear, then it can swim — T because it doesn’t contradict our initial fact. If it is not a bear, then it can not swim — T (as above)

- P: Sam ate an orange for lunch
- Q: Sam ate a fruit for lunch

Then, to say, Sam ate an orange for lunch implies Sam ate a fruit for lunch (P –> Q . Logically, if Sam did not eat a fruit for lunch, then Sam also cannot have eaten an orange for lunch (by contraposition). However, merely saying that Sam did not eat an orange for lunch provides no information on whether or not Sam ate a fruit (of any kind) for lunch.

Material Equivalence (1) and (2)

- Madison will eat the fruit if it is an apple. (equivalent to Only if Madison will eat the fruit, can it be an apple or Madison will eat the fruit ← the fruit is an apple)

This states that Madison will eat fruits that are apples. It does not, however, exclude the possibility that Madison might also eat bananas or other types of fruit. All that is known for certain is that she will eat any and all apples that she happens upon. That the fruit is an apple is a sufficient condition for Madison to eat the fruit.

- Madison will eat the fruit only if it is an apple. (equivalent to If Madison will eat the fruit, then it is an apple or Madison will eat the fruit → the fruit is an apple)

This states that the only fruit Madison will eat is an apple. It does not, however, exclude the possibility that Madison will refuse an apple if it is made available, in contrast with (1), which requires Madison to eat any available apple. In this case, that a given fruit is an apple is a necessary condition for Madison to be eating it. It is not a sufficient condition since Madison might not eat all the apples she is given.

- Madison will eat the fruit if and only if it is an apple. (equivalent to Madison will eat the fruit ↔ the fruit is an apple)

This statement makes it clear that Madison will eat all and only those fruits that are apples. She will not leave any apple uneaten, and she will not eat any other type of fruit. That a given fruit is an apple is both a necessary and a sufficient condition for Madison to eat the fruit.

Exportation and Importation

EXPORTATION

Example

- It rains and the sun shines implies that there is a rainbow.
- Thus, if it rains, then the sun shines implies that there is a rainbow.

If my car is on, when I switch the gear to D the car starts going. If my car is on and I have switched the gear to D, then the car must start going.

Tautology

Tertium non datur (Law of Excluded Middle)

For example, if P is the proposition:

Socrates is mortal. then the law of excluded middle holds that the logical disjunction:

Either Socrates is mortal, or it is not the case that Socrates is mortal. is true by virtue of its form alone. That is, the middle position, that Socrates is neither mortal nor not-mortal, is excluded by logic, and therefore either the first possibility (Socrates is mortal) or its negation (it is not the case that Socrates is mortal) must be true.

Law of Non-Contradiction

Heraclitus

If a philosophy of Becoming is not possible without change, then (the potential of) what is to become must already exist in the present object. In We step and do not step into the same rivers; we are and we are not, both Heraclitus's and Plato's object simultaneously must, in some sense, be both what it now is and have the potential (dynamic) of what it might become.

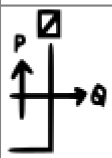
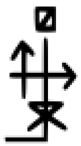
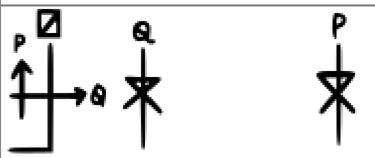
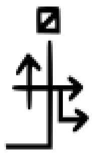
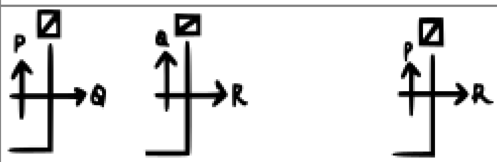
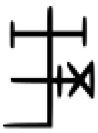
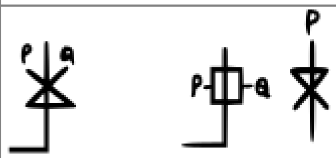
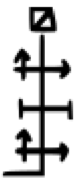
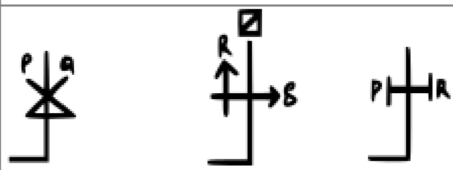
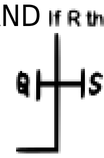
Protagoras

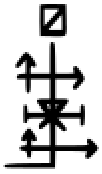
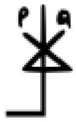
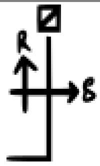
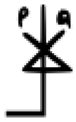
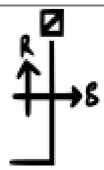
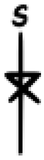
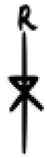
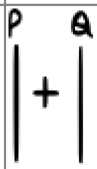
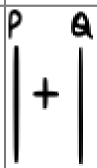
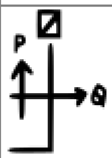
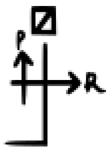
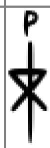
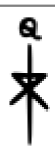
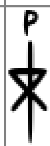
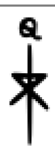
The most famous saying of Protagoras is: Man is the measure of all things: of things which are, that they are, and of things which are not, that they are not.[5] However, Protagoras was referring to things that are used by or in some way related to humans.

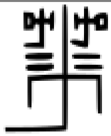
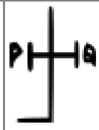
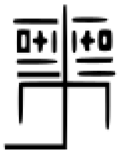
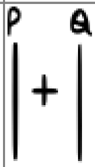
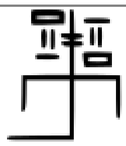
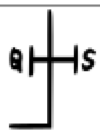
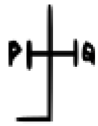
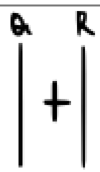
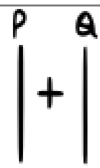
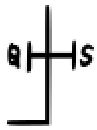
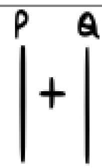
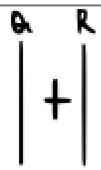
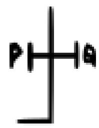
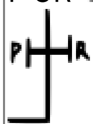
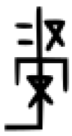
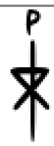
BASIC AND DERIVED ARGUMENT FORMS

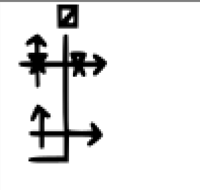
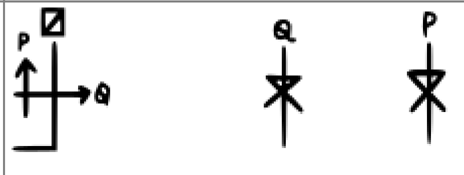
Name	Mantrakshar	Sequent	Description
Modus Ponens			If p then q; p; therefore q
Modus Tollens			If p then q; not q; therefore not p
Hypothetical Syllogism			If p then q; if q then r; therefore, if p then r
Disjunctive Syllogism			Either p or q, or both; not p; therefore, q
Constructive Dilemma			If p then q; and if r then s; but p or r; therefore q or s
Destructive Dilemma			If p then q; and if r then s; but not q or not s; therefore not p or not r
Bidirectional Dilemma			If p then q; and if r then s; but p or not s; therefore q or not r
Simplification			p and q are true; therefore p is true
Conjunction			p and q are true separately; therefore they are true conjointly
Addition			p is true; therefore the disjunction (p or q) is true
Composition			If p then q; and if p then r; therefore if p is true then q and r are true
De Morgan's Theorem (1)			The negation of (p and q) is equiv. to (not p or not q)
De Morgan's Theorem (2)			The negation of (p or q) is equiv. to (not p and not q)
Commutation (1)			(p or q) is equiv. to (q or p)
Commutation (2)			(p and q) is equiv. to (q and p)
Commutation (3)			(p is equiv. to q) is equiv. to (q is equiv. to p)
Association (1)			p or (q or r) is equiv. to (p or q) or r
Association (2)			p and (q and r) is equiv. to (p and q) and r
Distribution (1)			p and (q or r) is equiv. to (p and q) or (p and r)
Distribution (2)			p or (q and r) is equiv. to (p or q) and (p or r)
Double Negation			p is equivalent to the negation of not p
Transposition			If p then q is equiv. to if not q then not p
Material Implication			If p then q is equiv. to not p or q
Material Equivalence (1)			(p iff q) is equiv. to (if p is true then q is true) and (if q is true then p is true)
Material Equivalence (2)			(p iff q) is equiv. to either (p and q are true) or (both p and q are false)

Name	Mantrakshar	Sequent	Description
Material Equivalence (3)			(p iff q) is equiv to., both (p or not q is true) and (not p or q is true)
Exportation[13]			from (if p and q are true then r is true) we can prove (if q is true then r is true, if p is true)
Importation			If p then (if q then r) is equivalent to if p and q then r
Tautology (1)			p is true is equiv. to p is true or p is true
Tautology (2)			p is true is equiv. to p is true and p is true
Tertium non datur (Law of Excluded Middle)			p or not p is true
Law of Non-Contradiction			p and not p is false, is a true statement

LOGIC	Mantrakshar	formula / sequent	DESCRIPTION
Modus Ponens			 If P then Q ; P Therefore Q
Modus Tollens	 Modus tollens		 If P then Q ; Not Q therefore Not P
Hypothetical Syllogism	 lypothetical syllogisn		 If P then Q ; If Q then R therefore If P then R
Disjunctive Syllogism	 Or - not		 Either P or Q or Both P and Q Not P therefore Q
Constructive Dilemma	 :onstructive dilemma		 Either P or Q ;AND If R then S BUT P or R  THEREFORE Q or S

LOGIC	Mantrakshar	formula / sequent	DESCRIPTION
Destructive Dilemma	 Destructive dilemma		  Either P or Q ;AND If R then S BUT NOT Q or NOT S THEREFORE NOT P Or NOT R
Bidirectional Dilemma			   Either P or Q ;AND If R then S BUT P OR Not S  THEREFORE Q OR Not R
Simplification			 P and Q ARE TRUE ;
Conjunction			 P and Q ARE TRUE SEPARATELY ;
Addition			P IS TRUE
Composition	 Composition		  If P then Q ;AND If P then R ; therefore if p is true then q and r are true
De Morgan's Theorem (1)			  Not P and Not Q
De Morgan's Theorem (2)			  Not P and Not Q

LOGIC	Mantrakshar	formula / sequent	DESCRIPTION
Commutation (1)	 Commutation 1		 P or Q is equivalent to Q OR P
Commutation (2)	 Commutation 2		 P and Q is equivalent to q and p
Commutation (3)	 Commutation 3		-
Association (1)			  P OR Q or S is equivalent to P or Q OR S
Association (2)			  P AND Q and R is equivalent to P and Q AND R
Distribution (1)			  P AND Q or S is equivalent to P and Q OR (P AND S)
Distribution (2)			  P OR Q and R is equivalent to P or Q AND  P or R
Double Negation	 Double negation		 P is equivalent to the negation of Not P

LOGIC	Mantrakshar	formula / sequent	DESCRIPTION
Transposition			 If P then Q is equiv to Not Q THEN Not P
Material Implication			 If P then Q is equiv to Not P OR Q
Material Equivalence (1)			(p iff q) is equiv. to (if p is true then q is true) and (if q is true then p is true)
Material Equivalence (2)			(p iff q) is equiv. to either (p and q are true) or (both p and q are false)
Material Equivalence (3)			(p iff q) is equiv to., both (p or not q is true) and (not p or q is true)
Exportation[13]			from (if p and q are true then r is true) we can prove (if q is true then r is true, if p is true)
Importation			
Tautology (1)			p is true is equiv. to p is true or p is true
Tautology (2)			p is true is equiv. to p is true and p is true
Tertium non datur (Law of Excluded Middle)			p or not p is true
Law of Non-Contradiction			P and not P