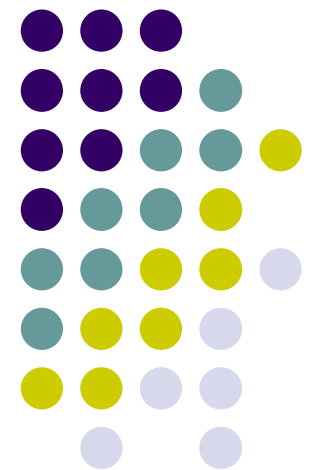
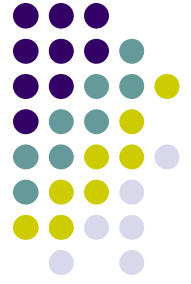


LOGIC I

General methodology and introduction to formal logic

DRAFT





- | INFORMAL LOGIC
- | ARGUMENTS
- | DEDUCTIVE VS. INDUCTIVE REASONING



- | Lectures on informal logic are based on books by Fogelin & Sinnott-Armstrong, *Understanding Arguments*; Fisher, *The logic of real arguments*, Thomson, *Critical Reasoning*

Lecture I

Informal reasoning



I Skills:

- recognizing reasoning (arguments)
- identifying conclusions
- identifying reasons (premises) and assumptions
- evaluating reasoning



- | **Logical theory**

- | Semantic relationships (relationships between true or false propositions)
- | Argument = set of propositions
- | Context irrelevant

- | **Logical pragmatics**

- | Use of propositions by an arguer to carry out the goal of dialogue (e.g. convince or persuade the second arguer)



A seaman drafted to our ship just before we sailed from Halifax had never seen his new captain, who at sea often went hatless and wore a nondescript jacket.

The new man had just begun a forenoon watch on the gun deck when the captain came along. The skipper suddenly stooped and picked up a butted cigarette. He thrust the butt at the seaman and demanded: „I want to know who the hell owns this damned thing”

The new hand considered for a moment, then said slowly to the rankless, hatless officer: „I'd say you do, mate. You found it.”



I Context of dialoge

Seaman: the ownership of the cigarette butt

Captain: the issue of keeping the ship clean

Types of argumentative dialogue



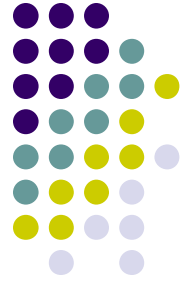
- | Dialogue – a sequence of exchanges of messages or speech acts (typically questions and replies) between two (or more) participants
- | Every dialogue has a goal and requires cooperation between the participants to fulfill the goal
- | Each participant has an obligation to work toward fulfilling his own goal in the dialogue and also an obligation to cooperate with the other participant's fulfillment of his own goal



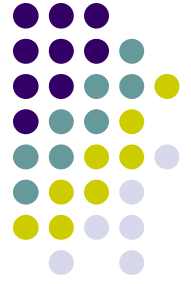
- | One context of dialogue is **the *personal quarrel***. A quarrel is a dialogue in which one tries to trick, cheat or even attack one's opponent directly, rather than one's opponent's views, using abusive language, appeal to emotions, intimidation, one-sided criticism, etc. Any means are available no matter whether they are fair or reasonable.
- | Aggressive personal attack
- | Appeal to emotions
- | Desire to win the argument at all costs



- | A second context of dialogue is **the (forensic) *debate***. In debates there are judges or referees who decide, maybe by voting, which side has the better argument. There are rules of procedure that determine who may speak and when and for how long. There are also some rules that disallow the more severe forms of personal attack, but many fallacious arguments may still be tolerated.



- | Audience
- | Rules are often very permissive and may allow fallacious arguments
- | Goal: win a verbal victory to impress the audience



- | A third context of dialogue is **the *persuasion dialogue (critical discussion)***. There are two participants each of whom has a thesis to prove. Internal proof by a participant means proof by inferring a proposition from the other participant's concession in the dialogue. External proof is the introduction of new facts into the argument by appealing to scientific evidence or expert opinion. The best one can hope for is plausible commitment to an opinion based on reasoned evidence.
- | My goal is to persuade you of my thesis; hence I should prove that thesis from premises that you accept or are committed to
- | Your goal is to prove your thesis from the premises that I accept or am committed to
- | Goal – persuade the other party of your thesis
- | Method – prove your thesis



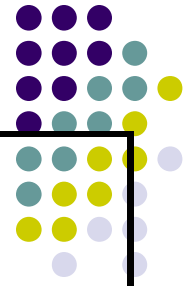
- | A forth context of dialogue is **the *inquiry*** in which premises can only be propositions that are known to be true, that have been established to the satisfaction of all parties to the inquiry. The inquiry seeks out as much certainty as can be obtained by the given evidence. The goal is to accumulate knowledge. The participants are neutral investigators of an objective truth. The inquiry is cooperative rather than adversarial.



- | In **negotiation dialogue**, the primary goal is self-interest and the method is to bargain. Bargaining makes no pretensions to be an objective inquiry into the truth of the matter.
- | Logical proof is not important
- | Frankly based on personal gain
- | Not neutral, not objective
- | Interest-based conflict



- | **Information-seeking** dialogue – one party has the goal of finding information that the other party is believed to possess
- | **Action-seeking dialogue** – one party has the goal to bring about a specific course of action by the other party
- | **Educational dialogue** – one party (the teacher) has the goal of imparting knowledge to the other party (the student)



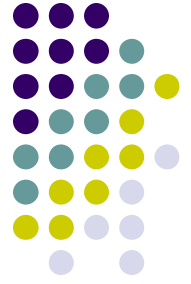
dialogue	initial situation	method	goal
quarrel	Emotional disquiet	Personal attack	„Hit” out at other
debate	Forensic contest	Verbal victory	Impress audience
Persuasion (critical discussion)	Difference of opinion	Internal and external proof	Persuade other
inquiry	Lack of proof	Knowledge-based argumentation	Establish proof
negotiation	Difference of interests	bargaining	Personal gain
Info-seeking	Lacking information	questioning	Find information
Action-seeking	Need for action	Issue imperatives	Produce action
educational	ignorance	teaching	Imparting knowledge

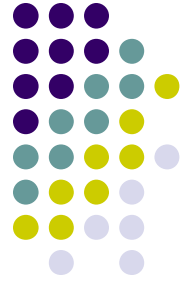
Arguments

Socrates is a man.

All men are mortal.

Socrates is mortal.





Since Socrates is a man and
all men are mortal,
Socrates is mortal.

Socrates is a man,
since all men are mortal and
Socrates is mortal.



Socrates is a man.

All men are mortal.

Therefore Socrates is mortal.

Since Socrates is a man,

all men are mortal and

Socrates is mortal.



- | An argument is a train of reasoning aimed at establishing a particular claim, the conclusion, from a number of other claims, the premises. The premises are offered as reasons to believe or accept the conclusion. Arguments attempt to persuade others to accept a claim by offering reasons or evidence in support of that claim. One must do two things in propounding an argument: justify the premises by providing reasons or evidence, and show how the conclusion follows from the premises.



Reason indicators

Because

For

Since

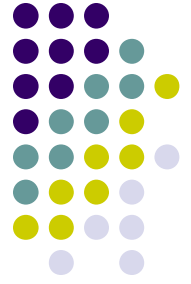
Follows from the fact that

The reason being

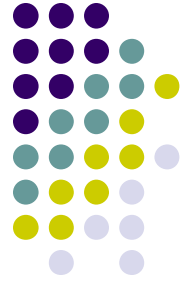
Firstly,secondly,

May be inferred from the fact that

Conclusion indicators

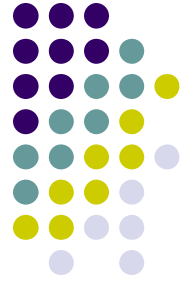


- | Therefore
- | So
- | Hence
- | Thus
- | Accordingly
- | Consequently
- | Which proves that
- | Justifies the belief that
- | I conclude that
- | Which implies that
- | Which allows us to infer that
- | It follows that
- | Establishes the fact that
- | Demonstrates that



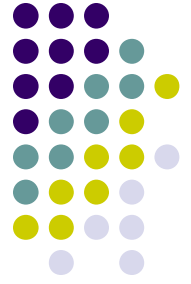
- | John broke the window **because** he tripped.
- | John broke the window **because** he has forgotten his key.
- | John must have broken the window **because** he was the only person in the house.

Indicative conditional vs. argument



- | **If** international terrorism continues to grow, there will be a worldwide crisis.
- | **Since** international terrorism continues to grow, there will be a worldwide crisis.

Standard form of arguments



Socrates is a man.

All men are mortal.

Socrates is mortal.

Evaluating arguments



Validity

- | An argument is valid if and only if (iff) it is not possible for the premises to be true and the conclusion false.

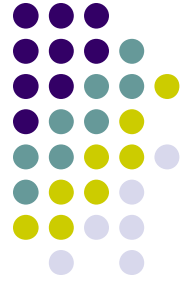


I Soundness

An argument is sound iff it is valid and all of its premises are true.



	All premises true	At least one false premise
VALID	SOUND	UNSOUND
INVALID	UNSOUND	UNSOUND



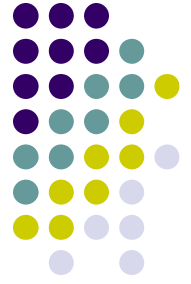
- | Truth and falsity are properties of claims, propositions or statements
- | Validity and soundness are properties of arguments
- | Valid arguments are truth-preserving.



- | If the argument is invalid, it cannot establish its conclusion.
- | But it may still be a reasonable or persuasive argument by some other standards. It may be that the premises lend *inductive support* to the conclusion.
- | Inductive arguments do not guarantee the truth of their conclusion, but yield more or less highly probable conclusions.
- | Or it may be that the truth of the conclusion is the *best explanation* of the truth of the premises.
- | When we talk about validity, we typically mean deductive validity.



- | Any argument must take something for granted. *Basic reasons* or *basic premises* are those that are presented without themselves being supported by other reasons or premises.

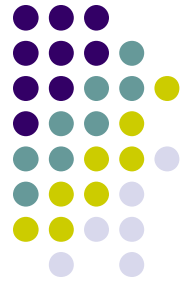


- | When a passage contains more than one premise we need find out whether *joint reasons* or *independent reasons* are being offered.
- | *It is right to ban cigarette advertising because it encourages young people to start smoking. But even if it had no such influence on young people, it would be right to ban smoking because it could give existing smokers the mistaken impression that their habit is socially acceptable.*



- | Some arguments are very complex in that they may contain an *intermediate conclusion* and a *main conclusion*. So, first premises are advanced in support of an intermediate conclusion, and then that conclusion itself features as a premise that is advanced together with other premises in support of the main conclusion.

Assumptions = suppressed (unstated) premises



- I We need to distinguish between premises, conclusions and *assumptions*. An assumption is something that is taken for granted in an argument without being explicitly stated.
- I *Assumptions* function in arguments either by giving support to the basic premises, or as a missing step within the argument—maybe as an additional premise that needs to be added in order for the conclusion to follow from the existent premises.



Unstated premises:

- | Shared facts
- | Linguistic principles

Harriet is in New York with her son.

Harriet's son is in New York.

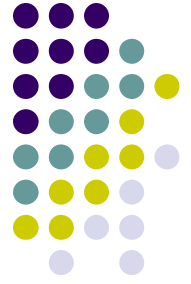
- *Carol has no sisters, because all her siblings are brothers.*
- Other kinds

You shouldn't buy pornography, because it leads to violence toward women.



- | An argument based on suppressed premises is called an *enthymeme* and is said to be *enthymematic*.

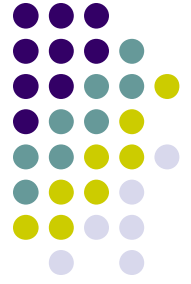
Donald Tusk cannot become president of the United States because he was born in Poland.



Assert, assume, suppose

- I To *assert* is to claim that something is true, or to present something as true. Assertions are expressed by means of assertoric sentences, e.g. 'the window is closed'. Premises and conclusions of arguments are asserted propositions. To assert that p is typically to express the belief that p .
- I To *assume* is to take something for granted without actually mentioning or asserting it. Assumptions (suppressed premises) are typically implicit, but can be made explicit by means of assertoric sentences.
- I To *suppose* is to take something for granted for the sake of argument. Suppositions are explicit, but are not asserted. To suppose that p needn't express belief or acceptance that p . P isn't presented as being true, but is put forward so that we may consider its implications. The supposition that p is often made in order to conclude that p is false.

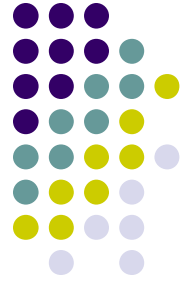
Supposing for the sake of argument that



- | suppositional arguments
- | In suppositional arguments, p is supposed to be true by the arguer. But the arguer doesn't have to believe that p .
- | *Suppose Darwin's theory of evolution is true. Then there should be fossil evidence which shows species changing and evolving, but this evidence simply doesn't exist so Darwin's theory must be wrong.*



- | In *suppositional arguments* the arguer often believes or knows that p is false. The arguer asks us to consider p with a view to drawing out its implications—implications which he takes to be implausible.



Supposition indicators:

- | Suppose that ...
- | Let us assume that...
- | Imagine that...
- | Consider the hypothesis/theory that...
- | Let us postulate that...

Conditionalisation



- I Suppose we have an argument which proceeds from some supposition R to the conclusion C by logically valid steps (i.e. the conclusion at each step follows from the reasons given for it) then the validity of the argument entitles us to infer the conditional (hence the name 'conditionalisation'), if R then C .

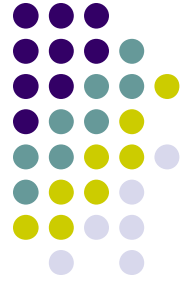


Rule

- | If we have an argument which proceeds from a supposition R to a conclusion C and then conditionalises to the conclusion „if R then C ”, whether this conditional conclusion is established *does not depend* on the truth of R . If other basic reasons are true and the argument is sound, „if R then C ” is established *whether R is true or false*.



- | This style of reasoning is called *reductio ad absurdum*: a particular claim is supposed for the sake of argument. Then an absurdity - a contradiction for instance - is deduced via logically valid steps.



Induction versus deduction

- | **Deductive:** P_1, \dots, P_n ; therefore Q
- | **Inductive:** P_1, \dots, P_n ; therefore Q is very likely to be true



All ravens are black.

If there is a raven on top of Mount Blanc, it is black.

All observed ravens have been black.

If there is a raven on top of Mount Blanc, it is black.



Inductive generalizations

In the past, when I tried to use Canadian quarters in American telephones, they have not worked.

Canadian quarters do not work in American telephones.



Slanted questions

- I Which do you favour:
 - (a) preserving a citizen's constitutional right to bear arms or
 - (b) leaving honest citizens defenseless against armed criminals?

The representative heuristics



- | You are randomly dealt five-card hands from a standard deck.
- | Which of the following two hands is more likely to come up?



(1)

Three of clubs

Seven of diamonds

Nine of diamonds

Queen of hearts

King of spades

(2)

Ace of spades

Ace of hearts

Ace of clubs

Ace of diamonds

King of spades



Statistical Syllogisms

Ninety-seven percent of the Republicans in California voted for Bush.

Marvin is a Republican from California.

Marvin voted for Bush.

STRONG



X percent of Fs have the feature G.
a is an F.

a has/ doesn't have the feature G.

F – the reference class



Less than 1 percent of the people in the world
voted for Bush.

Gale is a person in the world.

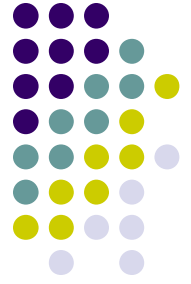
Gale didn't vote for Bush.



Reasoning about causes

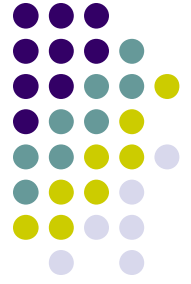
- | For all x , if x has the feature F , then x has the feature G .

- | If something is a square, then it is a rectangle.



Causal generalizations

- I For all x , if x has the feature F , then x has the feature G .
- I X 's having the feature F is a **sufficient condition** for its having the feature G , and x 's having the feature G is a **necessary condition** for its having the feature F .



- | *That F is a **sufficient condition** for G means that whenever F is present G is present .*

- | *That F is a **necessary condition** for G means that whenever F is absent G is absent.*

The sufficient-condition test (Mill's Method of Difference)



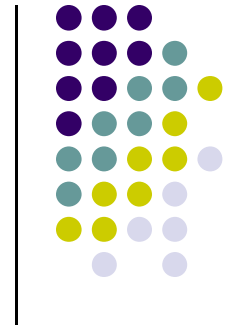
A, B, C, D – candidates for sufficient conditions

G – target feature

A	B	C	D	G
$\neg A$	B	C	$\neg D$	$\neg G$
A	$\neg B$	$\neg C$	$\neg D$	$\neg G$

SCT: Any candidate that is present when G is absent is eliminated as a possible sufficient condition of G.

The necessary-condition test (Mill's Method of Agreement)



A	B	C	D	$\neg G$
$\neg A$	B	C	D	G
A	$\neg B$	C	$\neg D$	G

NCT: Any candidate that is absent when G is present is eliminated as a possible necessary condition of G.

Inferences to the best explanation



- I The idea is that a hypothesis gains inductive support if, when it is added to our stock of previously accepted beliefs, it increases our ability to make reliable predictions and illuminating explanations.



Arguments from analogy

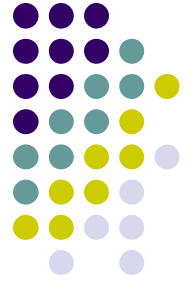
Object A has properties P, Q, R.

Objects B, C, D also have properties P, Q, R.

Objects B, C, D have property X.

Therefore, object A probably also has the property X.

| P, Q, R, X must be relevant and important



Strong or weak?

- | The premises must be true
- | The cited similarities must be relevant and important
- | The presence of relevant dissimilarities?
- | The weaker the conclusion, the stronger the argument:
 - The Odyssey will run for ten years without any repairs.
 - The Odyssey will probably run for ten years without any repairs.
 - The Odyssey will probably run for at least five years without any repairs.
 - The Odyssey will be very reliable.
 - The Odyssey will be reliable.

The paradox of the raven (confirmation)



(R) All ravens are black.

(R-) Nothing which is not black is a raven.

(R) and (R-) are logically equivalent, i.e. they are true or false together.

What would confirm (R)?

What would confirm (R-)?

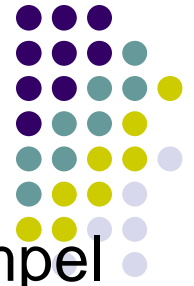


- | Confirmation is not a simple matter of enumerative induction, that is the mere accumulation of confirming instances.

Hempel's solution

- | It doesn't have to be absurd.
- | Let's suppose that someone observed a white object. He thinks that it is a raven.
- | Further observation reveals that it is a shoe, not a raven.
- | So it supports (R) in a sense.
- | Conclusion: when you determine whether a given information confirms the given hypothesis you have to take context into account. The mere logical form does not settle the issue.

Carl Gustav Hempel
(1905-1997)



Enumerative induction (form of inductive generalization)



1st observed swan was white.

2nd observed swan was white.

3rd observed swan was white.

.....

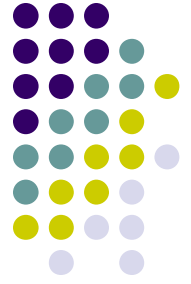
All swans are white.



Russell's chicken

- | 1st day – The chicken is fed by the farmer.
- | 2nd day – The chicken is fed by the farmer.
- | 3rd day – The chicken is fed by the farmer.
- |
- | -----
- | The farmer comes and wrings its neck.

Grue (New riddle of induction)



- | All examined emeralds are green.

All examined emeralds are green.

All emeralds are green.

- | Grue: x is grue if it is green and examined (by now) or blue and unexamined (by now).

All examined emeralds are green.

All emeralds are grue.



- | Only well-entrenched predicates are projectible.
- | Green: x is green if it is grue if examined and bleen if not