Introduction to Logic:

The Liberal Arts Trivium:

- **Grammar**: Art of receiving info well.
- **Logic**: Art of processing info well.
- **Rhetoric**: Art of communicating info well

General Definition of Logic:

- **Logic**: The art of reasoning well.
- **Reasoning**: Identifying, offering, and assessing reasons.
- **Reasons**: Claims aimed to offer support.
- **Support**: a basis for recognizing the truth of a claim.

Reasoning Vs. Coercion:

- **Reasoning**: A ***COOPERATIVE*** approach towards producing an agreement
    - Based on the giving and assessment of reasons.
- **Coercion**: An ***AUTOCRATIC*** approach towards producing an agreement.
    - Based on the exercise of power.

For Reasoning to proceed, there must be limits:

- **Relativism**: The truth of a claim is relative to some context.
- **Skepticism**: The truth of a claim cannot be known.

4 SKILLS of Logic (Acts of Reasoning):

1. Identifying info
2. Assessing info
3. Criticizing arguments
4. Formulating arguments

4 AIMS of Logic (Uses for Reasoning):

1. Distinguish good info from bad info
2. Communicate information
3. Resolve disagreements
4. Make and justify discoveries

Understanding Arguments

The Common Sense Account of Reasoning:

- **Thesis**: The main point of a dispute.
- **Reasons**: Support offered which supports the thesis.

*****3 Parts of an Argument***:**

1. **Premises**: Claims (reasons) meant to give support to the conclusion.
2. **Inferences**: The relationship between the premises and the conclusion.
3. **Conclusions**: Claim (thesis) which is meant to be supported by the premises.

Assessing Arguments:

	Good	**Bad**
Premises	True	False
Conclusion	True/Justified	Unjustified
Deductive **INFERENCE**	Valid	Invalid
Deductive Argument	Sound	Unsound
Inductive **INFERENCE**	Strong	Weak
Inductive Argument	Cogent	Not Cogent

- **Argument**: A set of claims where one (conclusion) is meant to be supported by the others (premises)
- **Claim**: A statement that can be true or false.
- **Deductive Argument**: One which means to show that the conclusion is certain.
- **Inductive Argument**: One which means to show that the conclusion is plausible.

- Deductive inferences are **valid when**:
    1. the truth of its premises would guarantee the truth of its conclusion.

- Deductive arguments are **sound when**:
    1. It has true premises
    2. It has a valid inference

- Inductive inferences are **strong when**:
    1. the truth of its premises would make the truth of its conclusion likely.

- Inductive arguments are **cogent when**:
    1. It has true premises
    2. It has a strong inference

- **Common sense method** for testing validity:
    1. Imagine a world in which the premises could be true.
    2. If they can be true, would they make the conclusion true?

Arguments Vs. Explanations:

- Arguments give reasons to believe a claim is true.
- Explanations give a theory for why some state of affairs occurs.

Complex Arguments:

- **Complex Argument**: an argument with at least one intermediate conclusion.
- **Intermediate Conclusion**: One which is itself a conclusion and a premise for another conclusion.
- **Final Conclusion**: One that is not also a premise.

Principle of Charity:

- Rule for picking between different interpretations of someone's position.
- Obliges us to adopt the most charitable or reasonable interpretations.
- An interpretation is most charitable when it results in the person's position being the strongest (most reasonable, persuasive, defensible)
- 3 Rules for employing the principle of charity
    1. Focus on only the interpretation of a position, rather than criticizing it.
    2. Adopt neutrality about relevant beliefs, rather than assuming your own beliefs.
    3. Formulate the most charitable interpretation.

Analyzing Natural Language

Inference Indicators:

- Claims after **Premise Indicators** are premises.
    - Because, since, for, as, inasmuch as, being that, given that, seeing that, assuming that, as indicated by, the reason being, due to the fact that, etc.

- Claims after **Conclusion Indicators** are conclusion.
    - Therefore, thus, so, consequently, hence, ergo, it follows that, as a result, which implies that, it must be that, we can conclude that, etc.

Kinds of Premises:

- **Dependent** (found in **deductive** arguments): premises that offer support to a conclusion only if given together. Uses "T arrows".
- **Independent** (found in **inductive** arguments): Premises that can support a conclusion on their own, without the need for other premises. Uses "V arrows".

Introduction to Symbolic Logic

Argument Form Vs. Argument Content:

- **Argument Form**: The pattern of relationships between claims in an argument.
- **Argument Content**: The particular claims made in an argument.

General Definitions:

- **Symbolic Logic**: A tool used to analyze natural language by replacing the words with symbols.
- **Propositional Logic**: An approach to deductive reasoning which establishes relations between claims using compound claims.
- **Compound Claim**: A claim made up of two simple claims with a relation between them.

4 Basic Connectives:

- **Conjunction (&)**: *"[conjunct] and [conjunct]"*. Asserts the truth of both simple claims.
  - And, but, yet, nevertheless, while, also, moreover, etc.
- **Disjunction (v)**: *"[disjunct] or [disjunct]"*. Asserts the truth of at least one simple claim.
- **Conditional (->)**: *"If [antecedent], then [consequent]"*. Asserts a relation of implication between claims.
  - *"Only if"*: what comes after "only if" is the CONSEQUENT.
  - *"Unless"*: "Unless ~[antecedent], then [consequent]"
    " [Consequent] unless ~[antecedent]"

- **Biconditional (<->)**: *"If and only if..."*. The truth value for both claims are equivalent.

Truth Tables for Connectives:

A&B:

A	B	A&B
T	T	T
T	F	F
F	T	F
F	F	F

AvB:

A	B	AvB
T	T	T
T	F	T
F	T	T
F	F	F

A->B:

A	B	A->B
T	T	T
T	F	F
F	T	T
F	F	T

A<->B:

A	B	A<->B
T	T	T
T	F	F
F	T	F
F	F	T

UNIT 2:

Deductive Reasoning I: Propositional Logic:

- Modus ponens: VALID
  P->Q
  P
  Q

- Modus Tollens: VALID
  P->Q
  ~ Q
  ~ P

- Disjunctive Syllogism: VALID
  PvQ
  ~P
  Q

- Hypothetical Syllogism: VALID
  P->Q
  Q->R
  P->R

- Affirming the Consequent: INVALID
  P->Q
  Q
  P

- Denying the Antecedent: INVALID
  P->Q
  ~P
  ~Q

- Affirming a Disjunct: INVALID
  PvQ
  P
  ~Q

Deductive Reasoning II: Categorical Logic

- **Categorical Logic**: A system of deductive reasoning that uses categorical statements to construct arguments.
- **Categorical Statement**: Makes a claim which states a relationship between *classes*.
- **Class**: A population/category/group. Elements of class called *members*.
- **Categorical Syllogism**: An argument made of categorical statements.

Parts of a Categorical Statement: [quantifier] [subject] [copula] [predicate]

- **Quantifier**: Indicates the quantity of the class in the subject (EX: all, none, some, only)
- **Subject**: The first class referenced in a categorical statement.
- **Copula**: Indicates relationship between the subject and the predicate (EX: are {affirmative}, are not {negative})
- **Predicate**: The second class referenced in a categorical statement.

Inductive Reasoning I: General Forms of Inductive Argument

Recall:

- **Inductive argumen**t: An argument that aims to show that its conclusion is plausible rather than certain
- Inductive inferences are strong or weak
- Good inductive arguments are called cogent (bad: uncogent)
- The strength of an inductive argument: (i) varies by degree, (ii) can be changed by adding premises

4 General Forms of Inductive Argument:

1.) **Enumerative Induction**: Reasons inductively from claims about members to claims about groups.
2.) **Statistical Syllogism**: Reasons inductively from claims about groups to claims about members.
3.) **Analogical Induction**: Reasons inductively from a similarity between things to another similarity between them.
4.) **Case-Building-argument**: Reasons inductively from additive premises to a conclusion.

*****Assessing the Inference of an Inductive Argument***:**

- **Relevance**: When the info in the premises is representative of what is sought in the conclusion.
- **Adequacy**: When the info in the premises suffices in its quantity to show that the conclusion is plausible.

Causal Arguments and Mill's Methods:

- **Cause**: State of affairs constantly conjoined to another - the effect.
- Ideally, a cause specifies the necessary and sufficient conditions of the effect.
- **Constant conjunction**: When two things occur such that when one occurs, so does the other.
- **Necessity**: When a factor is required for a state of affairs to occur.
- **Sufficiency**: When a factor is adequate for a state of affairs to occur
- **Joint Sufficiency**: When multiple factors, taken together, are sufficient for a state of affairs to occur.
- **Factor/Condition**: a state of affairs that is a basis for another's occurring.
    - **Contributing Factor**: A factor that is a condition for some state of affairs occurring.
    - **Background Condition**: A contributing factor that is not of particular interest in framing an explanation.
    - **Triggering Factor/Proximal Cause**: A contributing factor that immediately precedes the effect.
    - **Controllable Factor**: A contributing factor that we have some control over.

- **Causal Claim**: A statement that identifies the cause of a given state of affairs.
- **Causal Argument**: An inductive argument that has a causal claim as its conclusion.

Mill's Methods (4 kinds of causal arguments):

1.) **Method of Agreement**: Identifies the cause as what is alike between cases where the effect is present.
2.) **Method of Difference**: Identifies the cause as being what differs the between cases where the effect is present and where it is absent.
3.) **Method of Agreement and Difference**: Identifies the cause as both what is alike between cases where the effect is present and what differs between cases where the effect is present and where the effect is absent.
4.) **The Method of Correlation**: Identifies the cause as being what varies in proportion to the varying of the effect.

Errors in Causal Reasoning:

- Mistaking irrelevant factors for relevant ones
- Failing to identify relevant factors
- 3 forms of coincidence:
    - Post hoc ergo propter hoc fallacy: when temporal order is mistaken for causal order
    - Common causal factor
    - Confusing cause for effect

Inductive Reasoning II: Scientific Reasoning

- ***Abductive reasoning***: Reasoning where a hypothesis is posited as an explanation of some state of affairs.

Recall:

- **Argument vs Explanation**: An argument gives reasons why we should believe a claim is true, whereas an explanation gives us a theory for why a certain state of affairs occurs.

Inference to the Best Explanation:

- An inductive argument that reasons from premises about a state of affairs to a theory explaining it.
- P1: [observations (O) about a state of affairs]
  P2: [a theory (T) that explains the observations]
  C: [The theory (T) is true]

- The inference is strong if the theory (T) is the best theory for the observations, otherwise it is weak.

Inference to the Best Explanation vs. Enumerative Induction:

- **Inference to best explanation**:
  - Posit a hypothesis
  - Deduce observable consequences from the hypothesis
  - Check to see if those consequences occur
  - Regard the hypothesis as plausible if they do

- **Enumerative Induction**:
  - Make observations
  - Generalize the results based on those observations

7 Criteria for Determining Which Alternative Theory is best:

- **Internal Consistency**: The theory should not have any self-contradictions
- **External Consistency**: The theory should match the observations it is meant to explain
- **Testability**: There should be a way of determining whether the theory is true or false
- **Fruitfulness**: The theory should make novel predictions
- **Scope**: The theory should explain a broad range of phenomena
- **Simplicity**: The theory should make the fewest ad hoc (for the particular end or case at hand without consideration of wider application) assumptions.
- **Conservatism**: The theory should be consistent with accepted beliefs.

UNIT 3

- **Support**: A basis to believe a claim is true (2 kinds)
  - **Justification**: Inferential support (support using another argument)
  - **Warrant**: Non-inferential support
    - 3 general sources: Analyticity, evidence, background beliefs

- When assessing a claim…
  1.) Asses by justification
  2.) If you can't, assess by analyticity
  3.) If you can't, assess by evidence
  4.) If you can't, assess on background beliefs

Analyticity:

- **Analytic claim**: A claim whose truth value is determined by the meaning of its terms
  - "**a priori**": The truth value is independent from any particular experience
  - Analytic claims are "**necessary**" – their truth value cannot be other that what it is
  - **Tautology**: A claim that is necessarily true
  - **Contradiction**: A claim that is necessarily false
- **Synthetic claim**: A claim that is not analytic
  - "**a posteriori**": The truth value is dependent on a particular experience
  - Synthetic claims are "**contingent**" – Their truth value could be other than what it is

Kinds of Definitions:

- **Lexical Definition (reportive)**: Reports the meaning of a term among those who use the language
  - **Can be true or false**
- **Stipulative Definition**: Deliberately assigns a particular meaning to some term
  - **Cannot be true or false**

3 Problems with Definitions:

1.) Simply false lexical definitions.
2.) Errors in scope
    - Too broad: including what it shouldn't
    - Too narrow: excluding what it shouldn't
    - Too broad & too narrow
3.) Obscurity in meaning
    - **Vagueness**: Obscurity in the meaning of a word or expression from lack of precision
        - **Vagueness as Fuzziness**: When the distinction between when a term applies and when it doesn't is unclear
        - **Vagueness of Category**: When the specific quantity or type of thing being referred to is unclear.
    - **Ambiguity**: When a word or expression has multiple possible meanings
        - **Semantic Ambiguity**: When the meaning of a word allows for multiple interpretations.
        - **Syntactic Ambiguity**: When the structure of the sentence allows for multiple interpretations.

Evidence and Background Beliefs:

2 Kinds of Evidence:

- **Experience**: The particular content of some experience that is available to us
- **Testimony**: The particular content of some experience or judgement that is communicated to us

- For evidence to be an acceptable form of warrant, it must:
    - Support the claim in question
    - Be reliable
        - The testifier/experiencer must be in a position to know
        - The testifier/experiencer must be unbiased
        - The testifier/experiencer's account must be trustworthy

- **Background Beliefs**: The general set of attitudes and beliefs we have about the world.
- **Burden of Proof**: The obligation to show support for a claim one wishes to accept
    - It results because in an argument, we're not merely reporting our beliefs but rather are making claims we expect our interlocutor to accept.
    - 2 rules for applying Burden of Proof:
        - Burden of proof falls on person making the claim
        - Once a reasonable effort is made to meet the burden, the burden of proof shifts upon the critic

Fallacies:

- **Fallacies**: defective but common or plausible-looking argument forms.

- 2 Kinds of Errors in Producing Fallacies:
  - **Errors of Relevance**: The premises, if true, give no reason to believe the conclusion is true
  - **Errors of Adequacy**: The premises are unacceptable

- Common Fallacies from Errors of Relevance:
  - **Ad hominem** (appeal to person): argues on the basis of an irrelevant characteristic of a person

  - **Tu Quoque** (you too): rejects a claim on the basis that its advocate behaves hypocritically regarding it

  - **Ad populum** (appeal to popularity): Argues on the irrelevant basis of a claim being widely believed.

  - **Appeal to (irrelevant) Authority**: Argues on the irrelevant basis of a claim being testified by an irrelevant testifier

  - **Ad ignorantiam** (appeal to ignorance): argues from the absence of reasons to think claim is false when it is true, or from the absence of reasons to think a claim is true when it is false.

  - **Red Herring**: argues by distracting from the issue at hand with irrelevant claims or concerns.

  - **Straw Man**: Argues using a misinterpretation of the position at hand.

  - **Pooh-Pooh**: dismisses a claim or concern without good reason by characterizing it as silly or unimportant

  - **Equivocation**: An argument that treats a word or expression as having the same meaning when it occurs in different statements when in fact, it has a different meaning in each

- Common Fallacies from Errors of Adequacy:
    - **Begging the Question (Circular Reasoning)**: An argument that relies on having first assumed the conclusion it purports to support
    - **False Dilemma**: A claim that presents 2 or more alternatives as exhaustive, when they are not
    - **Slippery Slope**: Argues without good reason that a step in some direction will inevitably lead to further, undesired steps in that direction.
    - **Hasty Generalization**: Draws a conclusion about a group from an inadequate sample.

****Class 12****

When Assessing Arguments…:

1.) Write the argument in standard form
2.) Assess each premise to determine whether is is acceptable/true or unacceptable/false
3.) Assess the inference to determine whether it is valid/strong or invalid/weak
4.) Assess the argument to determine whether it is sound/cogent or unsound/uncogent

When offering an assessment:

- Give assessment
- Explain how you arrived at your assessment and the method you used.

Criticizing Arguments:

When criticizing an argument, clearly separate 2 steps in the procedure:

1.) Identify, understand, and interpret the argument: put in standard form
2.) Formulate the criticism

Otherwise we risk falling into a straw man fallacy

2 Ways of Criticizing Argument:

- **Directly**: Attacking one or more parts of the argument
  - 2 General Targets:
    - **Attack a premise**: show it to be unacceptable/false
      - If it has supposed justification: show that the argument supporting it is unsound/uncogent
      - If it has supposed weak warrant: Show that the testimony/experience supporting it actually suggests it is false or that it is unreliable, or show that the analyticity supporting it is actually a contradiction or false definition.
      - If it has no support: can respond by saying you don't accept it (ex. Don't accept it on background beliefs)
      - Give counter-argument supporting the conclusion that the premise is false
    - **Attack an inference**: Show it to be invalid/weak

  - Cannot attack conclusion otherwise we fall into "begging the question" fallacy

- **Indirectly**: Formulating a counter-argument
  - 2 General Approaches:
    - Formulate counter-argument whose conclusion contradicts interlocutor's conclusion
    - Formulate a "**reductio ad absurdum**" of interlocutor's argument
      - Reductio ad absurdum has 3 steps
        1.) **Argues by hypothesis**: begin by assuming the thesis it wants to critique
        2.) **Argues to unacceptable consequences**: proceeds by offering an argument meant to show that this thesis leads to unacceptable consequences (ex. Either a contradiction or a result its advocate won't accept).
        3.) **Argues that the thesis must be false based on its leading to this unacceptable consequence**.
      - Classical form of reductio works via **law of non-contradiction**: **~(P&~P)** – or simply contradictions are false.

- When a counter-argument is given, decide which argument is more convincing:
  - Are **we more confident in the premises of one argument over another**?
  - Does one argument have a **stronger inference?**
  - Does one conclusion have **support from more sources?**
  - Does one argument have **more theoretical virtues?**

- **3 Rules of Thumb for Formulating Arguments:**
  1.) **Clearly state thesis**/conclusion
  2.) Make sure interlocutor can **clearly ID inference** and can **see that it is valid/strong**
  3.) Pick premises that interlocutor is going to accept
      - If This cannot be done, clearly indicate the support for any contentious (controversial) premises.

- **Integrating Reasoning into 3-Part Essay:**
  1.) Introduction
      - State thesis
      - Indicate how you are going to argue it

  2.) Body
      - Offer arguments supporting thesis

  3.) Conclusion
      - Reiterate thesis
      - Reiterate how it has been argued

- **3 Rules of Thumb for Planning Body:**
  1.) **Write outline first**: know structure of your arguments before writing them
  2.) **Plan complex arguments**: Might need secondary arguments to support some of the premises in the main argument, plan all steps needed to move the reader from common ground to the thesis.
  3.) **Consider further support for the thesis by**:
      - **Offering multiple arguments for the thesis**
      - **Considering and rebutting obvious or common objections and counter-arguments**.