

**Request for Renewal of  
Philosophy 110: Introduction to Deductive Logic  
as an FS course**

**Leeward Community College  
<Fall 2007>**

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## **Philosophy 110: Introduction to Deductive Logic**

**(3)**

AA/FSC

3 hours of lecture per week.

### **Course Description**

Principles of modern deductive logic

### **Student Learning Outcomes**

Students who successfully complete Philosophy 110 learn the principles of accurate thinking. They will know how to acquire reliable information and how to evaluate competing claims. The successful student will demonstrate the ability to:

- 1) recognize arguments and identify their premises and conclusions
- 2) distinguish deductive from inductive arguments
- 3) detect and identify some common informal fallacies
- 4) translate English propositions into symbolic language
- 5) use truth tables to characterize arguments as valid or invalid
- 6) prove the validity of arguments by means of formal proofs
- 7) prove the invalidity of arguments

### **Changes**

There are no significant changes to the original submission.

## **Assessment**

Samples of course materials that illustrate how the course meets the Foundations Hallmarks.

### **Hallmark 1: Students will be exposed to the beauty, power, clarity and precision of formal systems.**

The major focus and theme of Philosophy 110 at Leeward Community College is the clarity, precision, rigor, and usefulness of symbolic logic. Students will be lead into the world of symbols where they will encounter the elegance and the beauty of precise chains of inference. Students will also learn how to translate ordinary language propositions and arguments into symbolic language. They will learn the advantages of using symbols instead of ordinary language to advance humankind's ancient quest for truth.

#### **Lecture Topics that Address Hallmark 1**

- 1. The impact of formal or symbolic reasoning and its application to other disciplines and its historical place in civilization.**
- 2. The role of abstraction and formal analysis in the study of correct (valid) and incorrect (invalid) reasoning.**
- 3. How symbols and analysis elevate the power of critical thinking.**
- 4. The importance of clarity and precision in correct thinking.**
- 5. Deductive proofs as models of clarity and beauty in sentential and predicate logic.**
- 6. Translating truth functional connectives and simple and compound propositions into symbols.**

#### **Sample Study Problem or Exam Question**

Translate the following argument into symbols and test it for validity by constructing a deductive proof.

**If I pass logic, I will graduate from LCC.**

**If I do not pass Logic, I will not graduate from LCC.**

**Therefore, I will graduate from LCC if and only if I pass logic.**

Symbolic analysis of problems such as the above expose students to the power and clarity of symbolic reasoning. Students find the distinction between validity and truth worthwhile. They also gain an appreciation for the impact that formal thinking and especially abstraction has had on the development of many aspects of civilization. Perhaps most importantly of all they gain confidence in their own ability to work in formalized and abstract thinking environments and find joy in overcoming the challenges met in those environments.

## **Hallmark 2: Instructors will help students understand the concept of proof as a chain of inferences.**

Students learn all aspects of basic argumentation: 1) the recognition of premises, assumptions, or hypotheses, 2) the recognition of the end of argument in a clearly stated conclusion, and 3) the evaluation of the finished product of reasoning for relevance, clarity, sufficiency. Students learn methods of symbolization to assist in the analysis and evaluation of arguments. The student must master the concept of proof as a chain of justified inferences that follow from beginning statements of truth or assumptions. Students also create their own proofs. Students demonstrate their mastery of the concept of proof by creating their own visual constructions such as truth tables and formal proofs to enhance their understanding of both deductive proof and the underlying concepts of validity and invalidity. Students must be able to construct a sufficiently rigorous and correct chain of inferences using basic rules of inference to pass the course. Students are also introduced to the basic principles of relevance, clarity and sufficiency and their importance in the construction and evaluation of arguments.

### **Lecture Topics that Address Hallmark 2**

- 1. Valid Inferences and Deductive Proof**
- 2. The role of justification in Proof**
- 3. Simple proofs**
- 4. More complex proofs**
- 5. Predicates in proofs**

### **Sample Study Problem or Exam Question**

We ask students to translate basic arguments that have some relevance to their own aspirations and then to construct either a proof of invalidity or a proof of validity.

If I pass logic, I will graduate from LCC. If I do not pass logic, I will not graduate from LCC. Therefore, I will graduate from LCC if and only if I pass logic.

### **Translation**

- 1.  $P \supset G$**
- 2.  $\sim P \supset \sim G$**
- $\therefore G \equiv P$**

### **Hallmark 3. Instructors will teach students how to apply formal rules or algorithms.**

Philosophy 110 constantly engages the student in proof construction. The example above in Hallmark 2 illustrates the concept of deductive proof. By completing many proofs students learn that from a given set of premises they can progress, using valid rules of inference and replacements by alternative equivalent expressions, to a complete proof. Students learn a system of formal rules which will enable them to solve basic deductive logic problems. Students learn the importance of paying attention to detail in using formal rules as well as the role of precision and justification when applying the rules. The application of the rules of inference in proof construction requires students to use and understand how to apply the rules. Students apply the rules to problems of varying degrees of difficulty, progressing to the mastery of basic proof construction. Students learn to use basic algorithms that will assist them in the construction and analysis of deductive arguments. Students demonstrate logical mastery of various symbolic subroutines, repeated algorithmic patterns of reasoning which are necessary to solve complex problems. Students acquire a toolbox of algorithmic tools that will enable them to complete a wide variety of deductive proofs in a reasonable amount of time.

#### **Lecture Topics that Address Hallmark 3**

1. **Generating assumption using simple algorithms in a two value system.**
2. **The value of visual models in solving issues of validity.**
3. **Defining logical operators clearly and precisely.**
4. **Using analogy to judge multiple cases of similarly constructed arguments.**
5. **Translation into symbols as a prelude to logical analysis and proof construction.**

#### **Sample Study Problems or Exam Questions**

Construct a formal proof of validity.

$$\begin{array}{l} 1. \quad A \supset \sim B \\ \quad \sim (C \bullet \sim A) \\ \quad \therefore C \supset \sim B \end{array}$$

$$\begin{array}{l} 2. \quad (R \vee S) \supset (T \bullet U) \\ \quad \sim R \supset (V \supset \sim V) \\ \quad \sim T \\ \quad \therefore \sim V \end{array}$$

**Hallmark 4. Students will be required to use appropriate symbolic techniques in the context of problem solving, and in the presentation and critical evaluation of evidence.**

Students learn to translate ordinary language statements and arguments into appropriate symbolic form. They learn to recognize the elements, structure and standards of rigorous arguments and to distinguish correct and incorrect arguments. They learn to use valid argument forms to express their own lines of reasoning and to assess the reasoning of others. Students learn to work within rigorous logical standards. Students cannot pass the course if rules are left unlearned, applied incorrectly or misunderstood. Logic students are required to construct formal proofs and to show those proofs to other students in the course and the instructor for critical appraisal. Students learn a variety of different symbolic methods for evaluating arguments such as the basic truth table method, the brief truth table method, the proof of invalidity as well as formal deductive proof. Finally, students evaluate arguments presented in everyday contexts (advertising, political speeches, op-ed articles) and learn to recognize the sufficiency, relevance and clarity of the premises that are presented in support of conclusions. They demonstrate the ability to evaluate such arguments with appropriate rigor and to identify by name basic fallacious modes of reasoning which rely on emotional appeals, ambiguous language and irrelevant premises.

**Lecture Topics that Address Hallmark 4**

1. Deduction and Induction
2. The value of special symbols
3. Reducing Language to abstract form
4. Validity and Truth
5. Valid and Sound
6. Recognizing premises
7. The role of assumptions in arguments

**Sample Study Problem or Exam Question**

Sample Problem from the History of Philosophy: Origen, (ca 186-255 CE) thinks he has successfully proven that the Biblical literalists of his own time are wrong about Biblical literalism. Translate his argument into symbols and construct either a proof of validity or a proof of invalidity. Is Origen's proof compelling?

**If the Bible is taken literally, then God created the Sun on the third day. If day is defined in reference to the Sun then God did not create the Sun on the third Day. Day is defined in reference to the Sun. Therefore, the Bible is not to be taken literally. (Origen, ca 186-225 CE)**

1.  $L \supset T$
2.  $D \supset \sim T$
3.  $D / \therefore \sim L$

## **Hallmark 5. The course will not focus solely on computational skills.**

Computational skills are not the focus of Philosophy 110. Students are taught to reason deductively. Students are challenged to use symbolic trails of reasoning not only minimally but in maximally efficient and elegant ways. The focus is on providing students the means and techniques to distinguish correct from incorrect reasoning. This involves both the analysis of language as well as the reduction of arguments to symbols. The techniques of symbolization are not computational. The use of rules of inference and the understanding of logical equivalences help the student gain the ability to see relationships that are not apparent in ordinary language. Students also learn to clearly distinguish logically relevant from logically irrelevant reasons. Students learn the significance of citing rules to justify inferences. Most importantly students are constantly reminded that deductive validity is a key concept in the scientific testing of any hypothesis and when used in conjunction with experiment and observation provides the best pathway to demonstrating the falsehood of claims that pretend to be true.

### **Lecture Topics that Address Hallmark 5**

- 1. Establishing truth through argument**
- 2. Identifying irrelevant premises**
- 3. Identifying ambiguity in propositions**
- 4. Identifying assumptions**
- 5. Translating propositions**
- 6. Propositional and Predicate translations**

### **Sample Study Problem or Exam Question**

Background Information: Shoko Asahara led Japan's Aum Shinrikyo cult. In 1995 he and his organization were accused of the sarin gas attack in Tokyo. He was finally found guilty, and sentenced to death, in February 2004. The Supreme Court of Japan threw out his final appeal in September 2006. In the meantime 11 other members of the cult have also been sentenced to death for the 1995 sarin gas bombing in Tokyo which killed seven and injured five thousand commuters.

His followers who believe he is the reincarnation of the Hindu god Shiva claim he is innocent. Evaluate their arguments paying special attention to issues of logical relevance.

1. Shoko is innocent since anyone who believes he did it will be cast into the pit of hell for eternity.
2. The Japanese prosecutor in his trial is gay. Therefore he did not order the gas bombing in Tokyo.
3. Everything has been taken away from this poor saintly man including his vision and his freedom. Therefore, he did not order the gas bombing in Tokyo.
4. Since he is Shiva and Shiva is god. Therefore, he can not be held accountable by a mere Japanese court.

## **Hallmark 6. Instructors will build a bridge from theory to practice and show students how to traverse this bridge.**

Philosophy 110 emphasizes the role and relevance of formal and theoretical rules to the quest for truth. Logic provides tools for abstracting from real world experience to symbolic representation of experience. For thousands of years logicians have sought to clarify and distinguish poor reasoning from good reasoning. Students will learn that beliefs and actions are entwined and how the methods and principles of symbolic logic are valuable aids in their own self-examination and their own quest to fulfill their dreams. Students learn to root out errors which might lead to unwanted outcomes in their personal lives. We show the student how valid rules of inference, such as *Modus Ponens*, are not mere symbolic formulations but essential tools in the scientific realm that can also play a beneficial role in their own personal lives. The study of correct and incorrect argument imparts a deeper understanding of the relationship between good thinking, formal analysis and everyday life. Students learn to translate real world situations into symbols. Students learn that logical reasoning is not purely intellectual exercise but the road by which practical reasoning is clarified and improved. Students become less naïve, more aware of the difference between merely stating speculations and providing relevant grounds for reasonable beliefs. Students learn to approach advertising and political rhetoric with more skepticism while simultaneously gaining a greater respect for the scientific achievements of humankind. We believe that our students are provided with the opportunity to learn a mental discipline of problem solving that will stay with them for the rest of their lives. To live the examined life it is necessary to have the tools to examine your own beliefs as well as the beliefs of others. In Philosophy 110, we impart those skills. Students also learn the joy and intellectual satisfaction inherent in solving challenging problems.

### **Lecture Topics that Address Hallmark 6**

- 1. From the real world to the world of abstraction**
- 2. Translating word problems into an appropriate symbolic form**
- 3. Symbolism and Evaluation of arguments**
- 4. Translating logical and international events into symbols**

### **Sample Study Problems or Exam Questions**

Translating from English to Symbolic Logic. Each of the following statements are from the book, Who Killed Daniel Pearl by French Philosopher Bernard-Henri Levy. Translate them into symbolic form.

1. If the bait is enticing and the kidnapers trustworthy, then Daniel Pearl will walk into the trap.
2. Daniel Pearl's body was cut into ten pieces and reassembled in the grave.
3. If a civilization is not willing to defend itself, then it will perish.
4. Omar Sheik is convicted of the murder of Daniel Pearl and he does not repent his crime.
5. If English Moslems are willing suicide bombers, then Europe has incubated an enemy within its borders and this enemy predates English involvement in Iraq.

**Sample examination questions requiring the construction of proofs.**

**Hallmark 1: Students will be exposed to the beauty, power, clarity and precision of formal systems.**

**Hallmark 2: Instructors will help students understand the concept of proof as a chain of inferences.**

**I. Construct formal proofs of validity for the following arguments, each of which requires two additional lines:**

1.  $(R \supset S) \bullet (T \supset U)$   
 $\sim\sim (R \vee T) / \therefore S \vee U$

2.  $(A \vee B) \vee C / \therefore (C \vee A) \vee B$

**II. Construct formal proofs of validity for the following arguments, each of which requires three additional lines:**

3.  $U \supset V$   
 $\sim(V \vee W) / \therefore U$

4.  $C \vee (X \supset Y)$   
 $\sim C \supset (Y \supset Z)$   
 $\sim C / \therefore X \supset Z$

**III. Construct a formal proof of validity for the following argument, which requires four additional lines:**

5.  $X \bullet Y$   
 $(X \vee Z) \supset Q / \therefore X \bullet Q$

**IV. Construct a formal proof of validity for each of the following arguments.**

6.  $(x) (Gx \supset Rx)$   
 $\sim Rt / \therefore \sim Gt$

7.  $(x) (Rx \supset Ux)$   
 $(x) (Sx \supset Rx) / \therefore (x) (Sx \supset Ux)$

**Sample examination questions requiring the use of appropriate symbolic techniques. These problems do not require computation.**

**Hallmark 3. Instructors will teach students how to apply formal rules or algorithms.**

**Hallmark 4. Students will be required to use appropriate symbolic techniques in the context of problem solving, and in the presentation and critical evaluation of evidence.**

**Hallmark 5. The course will not focus solely on computational skills.**

**Prove the invalidity of each of the following by the method of assigning truth values.**

1.    L M K C D                      L • M  
   K  $\supset$  L  
   K  $\vee$  C  
    $\therefore$  C  $\vee$  D

2.    A C D E F                      A  $\vee$  B  
   B  $\supset$   $\sim$  F  
   (A  $\vee$  C)  $\supset$  D  
    $\therefore$  E  $\supset$  D

**Translate each of the following into the logical notation of propositional functions and quantifiers.**

1. Some politicians are liars.
2. No politicians are liars.
3. All politicians are liars.
4. Some politicians are not liars.
5. All politicians are not liars.

**Sample quiz questions on relevance in arguments.**

**Hallmark 5. The course will not focus solely on computational skills.**

**Hallmark 6. Instructors will build a bridge from theory to practice and show students how to traverse this bridge.**

Multiple-Choice. Always select the best answer. Two points each. Forty points.

- a. *Ad Populum – Appeal to Emotion*
  - b. *Ad Baculum – Appeal to Force*
  - c. *Ad Hominem* abusive
  - d. *Ad Ignorantiam – Appeal to Ignorance*
  - e. *Ad Verecundiam – Appeal to Inappropriate Authority*
1. Since the U.S.A cannot prove it did not plan the attack on the World Trade Center, the U.S.A planned the attack on the World Trade Center.
  2. Most Hawaiians believe that ethnic restrictions in OHA elections are legal. Therefore, ethnic restrictions in OHA elections are legal
  3. If you do not accept Christ as God, then you will be erased from the Book of Life. Therefore Christ is God.
  4. Osama Bin Laden says that should America stay in Iraq, then Al Qaeda will attack America. Therefore America should get out of Iraq.
  5. Mr. West, my Logic teacher, is not a good teacher because he does not accept the Lord.
  6. Shoko Asahara is really evil, because everyone in Japan knows he is evil.
  7. Shoko Asahara is really God, because no one can prove he is not god.
  8. Shoko Asahara is really God. Only fools doubt his divinity.
  9. Most people know that college is the best way to improve their income potential. Therefore college is the best way to improve your income potential.
  10. Mother to Child: “You must brush your teeth before you go to bed. Because, if you do not, you will get coal instead of toys for Christmas!”

**Leeward Community College**  
**Arts and Humanities Division**  
**Philosophy 110**

**Sample Course Syllabus**

**PHILOSOPHY 110: INTRODUCTION TO LOGIC**

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Fall 2007

**Catalogue Course Description:**

Principles of modern deductive logic.

**Co-requisites:**

None

**Prerequisites:**

None

**Recommended Preparation:**

None

**Textbooks and other Resources:**

COPI, IRVING. *Introduction to Logic, 11<sup>th</sup> Edition (custom)*

**Student Learning Outcomes:**

Students who successfully complete Philosophy 110 will have learned the principles of accurate thinking. They will know how to acquire reliable information and how to evaluate competing claims. The successful student will demonstrate the ability to:

1. Recognize arguments and identify their premises and conclusions
2. Distinguish deductive from inductive arguments
3. Detect and identify some common informal fallacies
4. Translate English propositions into symbolic language
5. Use truth tables to characterize arguments as valid or invalid
6. Prove the validity of arguments by means of formal proofs
7. Prove the invalidity of arguments

**Course Requirements:**

- ◆ **Regular Attendance.** Due to the nature of the subject matter, regular class attendance is critical. Five extra credit points will be awarded to any student who misses no more than three class meetings during the semester and regularly and meaningfully participates in class discussions.
- ◆ **Homework.** Students should plan on spending from three to five hours each week in study and practice outside of the classroom in order to properly master the course materials.
- ◆ **Completion of all Examinations.** Students who fail to complete all the required tests will not receive a passing grade for the course.
- ◆ **Grading Policy.** Student evaluation is based entirely on examination performance. Students are awarded letter grades based on the combined points earned on three exams.

A = 270-300 = excellent achievement in student learning outcomes  
B = 240-269 = above average achievement in student learning outcomes  
C = 210-239 = average achievement in student learning outcomes  
D = 180-209 = minimal passing achievement in student learning outcomes

F = 179 or below = less than minimal passing achievement

**Students with Disabilities Statement:**

Leeward Community College abides by Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, which stipulate that no student shall be denied the benefits of an education "solely by reason of a handicap." Any student with a documented disability (e.g., physical, learning, psychiatric, vision, or hearing, etc.) who believes that he or she may need accommodations in this class is encouraged to contact me privately to discuss your specific needs. Please contact the Kako'o 'Ike (KI) Program Office at 455-0421 in the Library Building (Room L208, near the elevator entrance) as soon as possible to ensure that such accommodations are implemented in a timely fashion.

## Course Assignments:

<u>Week #</u>	<u>Topic</u>	<u>Pages</u>
1	Introductory remarks on philosophy and logic Propositions, arguments, premises, conclusions	pp. 1-21
2	Recognizing arguments, deduction and induction Truth and validity	pp. 21-69
3	Fallacies	pp. 137-178
4	Conjunction, negation, disjunction, punctuation	pp. 299-312
5	Conditional statements and material implication	pp. 312-321
6-7	Argument forms and arguments Statement forms, equivalence	pp. 321-335 pp. 335-347
<b>Exam #1</b>		
8-12	Formal proof of validity	pp.349-371
13	Proof of Invalidity	pp. 372-383
<b>Exam #2</b>		
14-15	Singular propositions, quantification, traditional subject-predicate propositions	pp. 385-398
16	Proving Validity Proving Invalidity	pp. 398-406 pp. 406-410

## **Exam #3**