PHIL 0012 - INTRODUCTION TO SYMBOLIC LOGIC

Catalog Description

Advisory: Eligibility for ENGL 1A
Hours: 54 lecture
Description: Introduction to the principles of deductive reasoning including formal techniques of sentential and predicate logic. (C-ID PHIL 210) (CSU, UC)

Course Student Learning Outcomes

- CSLO #1: Use and apply terms: deductive, validity, soundness and consistency.
- CSLO #2: Utilize deductive methods to test arguments for validity.
- CSLO #3: Use the natural proof system to derive conclusions from premises.

Effective Term

Fall 2022

Course Type

Credit - Degree-applicable

Contact Hours

54

Outside of Class Hours

108

Total Student Learning Hours

162

Course Objectives

1. Define and demonstrate through truth tables, truth trees and deductive proofs the concept of and criteria for validity;
2. Define, explain and apply in written, oral and problem solving formats the concepts of a) truth preservation, b) truth-functionality, c) negation, d) material implication, e) strict implication, f) disjunction, g) conjunction, h) biconditionality, i) universal quantification, k) validity, l) theorem-hood, m) logical entailment, n) logical truth and o) logical derivation;
3. Translate, in English, sentences into symbolic sentence and predicate logic formats;
4. Translate, in written and oral activities, symbolic and predicate logic formatted arguments into ordinary English language;
5. Construct and chart truth trees or truth tables as a means of validity detection;
6. Describe, explain and apply in written, oral and problem solving activities rules of logical proof and derivation;
7. Evaluate ordinary English arguments utilizing deductive symbolic proof techniques and truth tables or truth trees;
8. Describe, explain and apply in problem solving activities rules of quantification in derivations;
9. Evaluate ordinary English arguments containing quantification;
10. Utilize the natural deduction method in sentential and predicate logic.

General Education Information

- Approved College Associate Degree GE Applicability
  - AA/AS - Comm & Analyt Thinking
- CSU GE Applicability (Recommended-requires CSU approval)
  - CSUGE - A3 Critical Thinking
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)

Articulation Information

Methods of Evaluation

- Classroom Discussions
  - Example: Instructor will lead a discussion the concept of the material conditional in relation to the argument form of Modus Ponens and Modus Tollens. Student will demonstrate their understanding by completing the following two problems: #1 Deduce: t v w, and demonstrate validity using the truth-table method 1. (p v z) -> (t v w) Premise 2. p v z Premise 3. #2 Deduce ~(m V n), and demonstrate validity using the truth-table method 1. ~z Premise 2. (m V n) # z Premise 3.
- Objective Examinations
  - Example: Translate the following passage into an argument in sentential logic. Then, construct a deduction to prove the argument valid. Either the blood test and the EKG are not both accurate or else the patient has a heart disorder. Either the blood test was accurate or else neither the nurse nor the lab technician acted competently. The nurse acted competently. Therefore, either the EKG is not accurate or else the patient had a heart disorder. Let: B = Blood test E = EKG P = patient has a heart disorder N = nurse acted competently L = lab technician acted competently
- Problem Solving Examinations
  - Example: Construct truth tables to test the validity of the following arguments. a) p -> (q * r), ~p -> ~ (q * r), q * ~ p// ~r b) (p * q) -> ~r, (q * r) -> ~p, ~ (p v q) -> ~ (q v r)// ~ (p * (~ q * r)) c) ~ (r v q) -> ~ (p v r), ~ (p v q) -> ~ (q * r), (p v ~ q) -> ~ (r * p)// p -> (~r v ~q) d) ((p v q) -> r), ((r v s) -> ~ t) // (p -> ~ t)

Repeatable

No

Methods of Instruction

- Lecture/Discussion
- Distance Learning

Lecture:

1. Instructor will demonstrate the use of the 15 rules of inference to derive logical proofs. Instructor will then assign individual students (in-person or online) a derivation problem. This assignment will be available for four consecutive days. Students will use the 15 rules of inference After the four days, students will be asked to post their resolution of their unique derivation to a discussion board and check the work of the posts from other students. After three more days, the instructor will post correct derivations and allow students to correct their own work on this low-stakes, learning exercise.

Distance Learning

1. Instructor will demonstrate methods of translating claims in ordinary language into predicate logic symbolic form. Students will then be placed into small in-person or online discussion groups working collaboratively to translate a series of claims from in ordinary language into predicate logic symbolic form. Instructor will then evaluate the translations and provide corrective and/or reinforcing feedback.

Typical Out of Class Assignments

Reading Assignments

Read chapter on Sentential Logic: Semantics. Read the following philosophical argument, explicate the argument, symbolize the argument and construct a truth table to determine validity. 1. Computers can think if and only if they have emotions. If computers can have emotions, then they can have desires as well. But computers can't think if they have desires. Therefore computers can't think 2. If the butler murdered Devon, then the maid is lying, and if the gardener murdered Devon, then the weapon was a slingshot. The maid is lying if and only if the weapon wasn't a slingshot, and if the weapon wasn't a slingshot, then the butler murdered Devon. Therefore the butler murdered Devon.

Writing, Problem Solving or Performance

1. Construct Truth Tables for the following three arguments to determine validity. ~P ~(Q <-> R) // ~[P * (Q -> R)] P->Q R->S PvR //QvS P -> Q ~P // ~Q 2. Directions: Symbolize and test the following argument for validity by using a truth table. If I'm going to do well on this daily quiz, then I will have a better test average. If I will have a better test average, then my grade in logic will be good. I'm not going to do well on this daily quiz. Therefore, my grade in logic will not be good. Let: W = I'm going to do well on this daily quiz B = I will have a better test average. G = My grade in logic will be good.

Other (Term projects, research papers, portfolios, etc.)

Required Materials

- The Logic Book
  - Author: Merrie Bergmann
  - Publisher: McGraw-Hill
  - Publication Date: 2013
  - Text Edition: 6th
  - Classic Textbook?:
  - OER Link:
  - OER:
- A Concise Introduction to Logic
  - Author: Patrick Hurley and Lori Watson
  - Publisher: McGraw-Hill
  - Publication Date: 2017
  - Text Edition: 13th
  - Classic Textbook?:
  - OER Link:
  - OER:
- For All X: An Introduction to Formal Logic
  - Author: P.D. Magnus
  - Publisher: OER
  - Publication Date:
  - Text Edition: 2019
  - Classic Textbook?:
  - OER Link:
  - OER:

Other materials and-or supplies required of students that contribute to the cost of the course.