MATH A220: INTRODUCTION TO SYMBOLIC LOGIC

Item	Value
Curriculum Committee Approval Date	10/07/2020
Top Code	150900 - Philosophy
Units	3 Total Units
Hours	54 Total Hours (Lecture Hours 54)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	No
Basic Skills	Not Basic Skills (N)
Repeatable	No
Grading Policy	Standard Letter (S), • Pass/No Pass (B)
Associate Arts Local General Education (GE)	• OC Comm/Analytical Thinking - AA (OA2) • OC Humanities - AA (OC1)
Associate Science Local General Education (GE)	• OCC Comm/AnalyticalThinking-AS (OAS2) • OCC Mathematics (OMTH) • OCC Humanities - AS (OSC2)
California State University General Education Breadth (CSU GE-Breadth)	• CSU A3 Critical Thinking (A3) • CSU C2 Humanities (C2)

Course Description

Students learn to translate simple, quantified, and multiply-quantified English sentences into symbolic form in both sentence logic and predicate logic with quantifiers. Truth tables are used to both classify and compare symbolic sentence's properties. Proof techniques for determining validity or invalidity of arguments containing simple sentences, compound sentences, and sentences containing quantifiers in sentence and predicate logic systems are learned including truth tables, truth trees, and natural deduction style proofs with inference, replacement and quantifier rules. Enrollment Limitation: PHIL A220; students who complete MATH A220 may not enroll in or receive credit for PHIL A220. Transfer Credit: CSU; UC. C-ID: PHIL 210.**C-ID:** PHIL 210.

Course Level Student Learning Outcome(s)

1. Critically evaluate, assess and present types and properties of arguments and use logical techniques to determine and justify their structural features and claims.
2. Translate from English into either sentence or predicate logic and use proof techniques, including natural deduction style proofs, to derive valid conclusions in both sentence logic and predicate logic with quantifiers.

Course Objectives

- 1. Write English declarative sentences (simple, quantified, multiply-quantified) in symbolic form.
- 2. Define (in)validity, soundness, tautology, contradictory, contingency and equivalence.
- 3. Construct proofs that determine the validity and invalidity of arguments in sentence logic using truth tree proofs.
- 4. Construct truth tables to determine the validity of symbolic and English arguments involving truth-functional logic.
- 5. Write the standard rules of inference and replacement.
- 6. State two contrasts in the structures of rules of inference and replacement.
- 7. Construct direct proofs for symbolic and English arguments involving simple statements.
- 8. Construct conditional proofs for symbolic and English arguments involving simple statements.
- 9. Construct indirect proofs for symbolic and English arguments involving simple statements.
- 10. Construct direct, conditional, and indirect proofs for symbolic and English arguments involving simple, singly quantified and multiply-quantified statements.
- 11. Construct conditional and indirect proofs for symbolic tautologies involving singly quantified and multiply-quantified statements.

Lecture Content

Determine the validity of arguments composed of simple sentences Translate declarative English sentences into symbolic form Define basic terminology regarding statements and arguments Use truth tables to determine the truth value of a symbolic statement characterize symbolic statements as tautologies contradictions contingencies equivalences verify the validity of the rules of inference determine the validity of symbolic and English arguments Understand the concept of, and criteria of, validity Construct proofs for arguments composed of simple sentences Demonstrate familiarity with logic rules state basic inference and replacement rules contrast the structure of inference and replacement rules verify the validity of the inference rules by truth table Supply reasons for each line of a given proof segment Apply methods of proof to symbolic and English arguments direct proof conditional proof indirect proof Use an indirect truth table to determine the validity of symbolic and English arguments verify any of the replacement rules are tautologies Construct proofs that determine the validity and invalidity of arguments in sentence logic using truth tree proofs Determine the validity of arguments and prove arguments involving single quantification Translate English sentences to symbolic form Use truth tables on symbolic and English arguments to verify invalidity determine validity Prove symbolic and English arguments Prove arguments involving multiple quantification Translate English statemen ts involving multiple quantification to symbolic form Use the multiple quantifier inference rules state the rules of instanciation and generalization state the rules of quantifier negation identify correct use of quantifier rules in proof segments identify quantification errors in proof segments Prove symbolic and English arguments containing multiple quantification Prove symbolic tautologies containing multiple quantification

Method(s) of Instruction

- Lecture (02)

Instructional Techniques

Lecture, written homework, discussion, peer feedback.

Reading Assignments

From assigned text, 1 hour

Writing Assignments

Tests include writing out truth tables and various types of logical proofs. 1 hour

Out-of-class Assignments

Homework including writing out truth tables and various types of logical proofs. 4 hours

Demonstration of Critical Thinking

Comparison of student achievement with minimum standards on several written tests and final exam.

Required Writing, Problem Solving, Skills Demonstration

Assessment of written truth tables and logical proofs, which will evaluate the students problem-solving and critical-thinking abilities.

Eligible Disciplines

Mathematics: Masters degree in mathematics or applied mathematics OR bachelors degree in either of the above AND masters degree in statistics, physics, or mathematics education OR the equivalent. Masters degree required. Philosophy: Masters degree in philosophy OR bachelors degree in philosophy AND masters degree in humanities or religious studies, OR the equivalent. Masters degree required.

Textbooks Resources

1. Required Hurley, Patrick J. A Concise Introduction to Logic, 12th ed. Stamford: Cengage Learning, 2014

Other Resources

1. Other appropriate textbook as chosen by faculty.