MATH 0015 - DISCRETE MATHEMATICS

Catalog Description

Prerequisite: Completion of MATH 30 with grade of "C" or better
Hours: 72 lecture
Description: Study of set theory, relations and functions, logic, combinatorics and probability, algorithms, computability, matrix algebra, graph theory, recurrence relations, number theory including modular arithmetic. Various forms of mathematical proof are developed: proof by induction, proof by contradiction. (CSU, UC)

Course Student Learning Outcomes

- CSLO #1: Logically present clear, complete, accurate, and sufficiently detailed solutions to communicate reasoning and demonstrate the method of solving problems.
- CSLO #2: Construct valid proofs of theorems using the following techniques: mathematical induction, direct and indirect proofs, by contradiction, with truth tables, and by logical equivalences.
- CSLO #3: Solve counting problems using combinatorics, recurrence relations, and generating functions.
- CSLO #4: Solve applied problems using discrete probability theory, graph theory, tree diagrams, and Boolean Algebra.

Effective Term

Fall 2021

Course Type

Credit - Degree-applicable

Contact Hours

72

Outside of Class Hours

144

Total Student Learning Hours

216

Course Objectives

1. Create mathematical proofs directly, indirectly, and by contradiction;
2. Use mathematical induction to create a mathematical proof;
3. Create a mathematical proof with truth tables and logical equivalences;
4. Translate mathematical statements using universal and existential quantifiers;
5. Use sets to organize and quantify data;
6. Create an algorithm using pseudocode;
7. Evaluate a series;
8. Model using permutations and combinations and numerically evaluate appropriate applied problems;
9. Model using probabilities, including conditional probabilities;
10. Solve counting problems using a generating function;
11. Assess that a relation is an equivalence relation;
12. Create a graph and a tree to describe the structure of a system;
13. Use Boolean algebra to mathematically model electronic circuits;
14. Verify functions are one-to-one and onto;
15. Use matrices to solve applied problems.

General Education Information

- Approved College Associate Degree GE Applicability
  - AA/AS - Comm & Analyt Thinking
  - AA/AS - Mathematical Skills
- CSU GE Applicability (Recommended-requires CSU approval)
  - CSUGE - B4 Math/Quantitative Reasoning
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)
  - IGETC - 2A Math/Quan Reasoning

Articulation Information

- CSU Transferable
- UC Transferable

Methods of Evaluation

- Classroom Discussions
  - Example: A classroom discussion will be employed upon the completion of a presentation from a student, particularly with an example of proof writing. The instructor will assess the rigor, clarity, and correctness of the proof. In addition, the instructor will assess the level of understanding of the student presenting such a proof through that student's answers to questions from other students and from the instructor.
- Objective Examinations
  - Example: Exams will determine a student's ability to independently construct a mathematical proof. For example, a student might be asked to write a formal proof that sqr(2) is irrational. The instructor will assess the success of the proof by determining if the appropriate proof format is used (i.e., proof by contradiction), that the guidelines of such a proof are being employed (i.e., the negation of the conclusion of the conditional statement in the theorem is stated), and that the remaining body of the proof meets college level rigor and clarity.

Repeatable

No

Methods of Instruction

- Lecture/Discussion
- Distance Learning

Lecture:

1. The instructor will provide through a lecture format mathematical proofs of various types, including proof by contradiction. The instructor will then ask the student to construct a proof of this type. An example is: prove that sqr(2) is irrational. Typically, a student will provide his/her proof to the class and both students and instructor will evaluate the correctness, the level of rigor, and the clarity of presentation. (Objective 1)
2. The instructor will provide through a lecture format mathematical proofs of various types, including mathematical induction. The instructor will then ask the student to construct a proof of this type. An example is: prove that the sum of the first n integers is n(n+1)/

3. Typically, a student will provide his/her proof to the class and both students and instructor will evaluate the correctness, the level of rigor, and the clarity of presentation. (Objective 2)

Distance Learning

1. The instructor will provide through a lecture format mathematical proofs of various types, including proof by contradiction. The instructor will then assign the student to construct a proof of this type. An example is: prove that sqr(2) is irrational. Typically, a student will post his/her proof to the class discussion board and both students and instructor will evaluate the correctness, the level of rigor, and the clarity of presentation. (Objective 1)
2. The instructor will provide through a lecture format mathematical proofs of various types, including mathematical induction. The instructor will then assign the student to construct a proof of this type. An example is: prove that the sum of the first n integers is n(n +1)/
3. Typically, a student will post his/her proof to the class discussion board and both students and instructor will evaluate the correctness, the level of rigor, and the clarity of presentation. (Objective 2)

Typical Out of Class Assignments
Reading Assignments

1. Throughout the course, read assigned topics from text. For example, how to verify the validity of a mathematical formula by mathematical induction. Students should be prepared to discuss in class. 2. Search the library or the internet for applications of the golden ratio and the Fibonacci sequence and be prepared to discuss in class.

Writing, Problem Solving or Performance

1. Write mathematical proofs. For example, given a function f, prove that the image of the intersection of two sets is a subset of the intersection of the images of those two sets. 2. Prove that the limit of the ratio of a Fibonacci number to its predecessor is the golden ratio.

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

- Discrete Mathematics and Its Applications
  - Author: Kenneth Rosen
  - Publisher: McGraw Hill
  - Publication Date: 2019
  - Text Edition: 8th
  - Classic Textbook?: No
  - OER Link:
  - OER:
- Discrete Mathematics with Applications
  - Author: Susanna Epp
  - Publisher: Cengage
  - Publication Date: 2020
  - Text Edition: 5th
  - Classic Textbook?: No
  - OER Link:
  - OER:

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