GAVILAN COLLEGE
5055 Santa Teresa Blvd
Gilroy, CA 95023

Course Outline

COURSE: CSIS 26 DIVISION: 50 ALSO LISTED AS:

TERM EFFECTIVE: Spring 2019 CURRICULUM APPROVAL DATE: 10/9/2018

SHORT TITLE: DISCRETE STRUCTURES

LONG TITLE: Discrete Structures

Units	Number of Weeks		Contact Hours/Week		Total Contact Hours
3	18	Lecture:	3	Lecture:	54
		Lab:	0	Lab:	0
		Other:	0	Other:	0
		Total:	3	Total:	54

COURSE DESCRIPTION:

Topics covered include set theory, logic, relations and functions, mathematical induction and recursion, combinatorics, discrete probability, trees and graphs, analysis of algorithms, algebraic structures. Emphasis on topics of interest to computer science majors. This course has the option of a letter grade or pass/no pass. (C-ID: COMP 152) PREREQUISITE: CSIS 5 or CSIS 45 or CSIS 46 or CSIS 24 with a grade of 'C' or better.

PREREQUISITES:

Completion of CSIS 5, as UG, with a grade of C or better.
OR
Completion of CSIS 45, as UG, with a grade of C or better.
OR
Completion of CSIS 46, as UG, with a grade of C or better.
OR
Completion of CSIS 24, as UG, with a grade of C or better.

COREQUISITES:

CREDIT STATUS: D - Credit - Degree Applicable

GRADING MODES

L - Standard Letter Grade
P - Pass/No Pass

REPEATABILITY: N - Course may not be repeated

SCHEDULE TYPES:

02 - Lecture and/or discussion

05 - Hybrid

72 - Dist. Ed Internet Delayed

STUDENT LEARNING OUTCOMES:

1. Student uses logically valid forms of argument and avoids common logical errors

Measure: homework, exam, problem sets

PLO: 1

ILO: 2, 7

GE-LO: B3, B7, B8 Year assessed or anticipated year of assessment: 2015

2. Student can provide examples of recurrence relations that give rise to formulas that are verified by induction.

Measure: homework, exam, problem sets.

PLO: 1

ILO: 7, 2

GE-LO:

Year assessed or anticipated year of assessment: 2015

3. Student can describe different traversals of trees and graphs.

Measure: homework, exam, problem sets

PLO: 2,1

ILO: 7,2

GE-LO:

Year assessed or anticipated year of assessment: 2015

4. Student can apply the binomial theorem and Bayes' theorem as appropriate.

Measure: homework, exam, problem sets

PLO:

ILO7,2,3 GE-LO: B3, B7, B8 Year assessed or anticipated year of assessment: 2015

CONTENT, STUDENT PERFORMANCE OBJECTIVES, OUT-OF-CLASS ASSIGNMENTS

Curriculum Approval Date: 10/9/2018

WEEK 1

(3 hours)

Topics:

Variables

Using Variables in Mathematical Discourse;

Introduction to Universal, Existential, and Conditional Statements

The Language of Sets

Set-Roster and Set-Builder Notations;

Subsets;

Cartesian Products

Homework: Read assigned pages in text, work assigned problems.

WEEK 2

(3 hours)

Topics:

Relations and Functions

Definition of a Relation from One Set to Another;

Arrow Diagram of a Relation;

Definition of Function;

Function Machines;

Equality of Functions

The Logic of Compound Statements

Logical Form and Logical Equivalence

Statements;

Compound Statements;

Truth Values;

Evaluating the Truth of More General Compound Statements;

Logical Equivalence;

Tautologies and Contradictions;

Interpret truth tables to determine whether a compound statement is a tautology, contradiction or neither, and whether two logical statements are equivalent

WEEK 3

(3 hours)

Topics:

Conditional Statements

Negation of a Conditional Statement;

The Contrapositive of a Conditional Statement;

The Converse and Inverse of a Conditional Statement;

Only If and the Biconditional;

Necessary and Sufficient Conditions;

Student Performance Objectives:

State the converse, inverse, contrapositive and negation of a conditional statement

Valid and Invalid Arguments

Modus Ponens and Modus Tollens;

Additional Valid Argument Forms: Rules of Inference;

Fallacies; Contradictions and Valid Arguments;

Student Performance Objectives:

Explain whether a given argument form is valid or invalid

WEEK 4

(3 hours)

Topics:

The Logic of Quantified Statements

Predicates and Quantified Statements

The Universal Quantifier

The Existential Quantifier

Formal Versus Informal Language;

Universal Conditional Statements;

Equivalent Forms of Universal and Existential Statements;

Implicit Quantification;

Statements with Multiple Quantifiers

Translating from Informal to Formal Language;

Ambiguous Language;
Negations of Multiply-Quantified Statements;
Order of Quantifiers;
Formal Logical Notation;
Student Performance Objectives:
State the converse, inverse, contrapositive and negation of a quantified statement
WEEK 5
(3 hours)
Topics:
Arguments with Quantified Statements
Universal Modus Ponens;
Use of Universal Modus Ponens in a Proof;
Universal Modus Tollens;
Proving Validity of Arguments with Quantified Statements;
Using Diagrams to Test for Validity;
Creating Additional Forms of Argument;
Remark on the Converse and Inverse Errors
Methods of Proof
Direct Proof and Counterexample
Definitions;
Proving Existential Statements;
Disproving Universal Statements by Counterexample;
Proving Universal Statements;
Directions for Writing Proofs of Universal Statements;
Variations among Proofs;
Common Mistakes;
Student Performance Objective:
Student writes direct proofs
WEEK 6
(3 hours)
Topics:
Methods of Proof
Showing That an Existential Statement Is False;
Conjecture, Proof, and Disproof
Indirect Argument: Contradiction and Contraposition
Proof by Contradiction; Argument by Contraposition;
Relation between Proof by Contradiction and Proof by Contraposition;
Student Performance Objective:
Construct a counterexample to disprove a statement
Mathematical Induction
Principle of Mathematical Induction
Comparison of Mathematical Induction and Inductive Reasoning;
Student Performance Objective:
Write inductive proofs

WEEK 7
(3 hours)
Topics:
Strong Mathematical Induction and the Well-Ordering Principle for the Integers
Defining Sequences Recursively
Definition of Recurrence Relation:
Examples of Recursively Defined Sequences;
Recursive Definitions of Sum and Product
Solving Recurrence Relations by Iteration
The Method of Iteration;
Using Formulas to Simplify Solutions Obtained by Iteration;
Checking the Correctness of a Formula by Mathematical Induction;
WEEK 8
(3 hours)
Topics:
Set Theory
Definitions and the Element Method of Proof
Subsets;
Proof and Disproof;
Set Equality;
Venn Diagrams;
Operations on Sets;
The Empty Set;
Partitions of Sets;
Power Sets;
Cartesian Products;
Properties of Sets
Set Identities;
Proving that a set is empty
Student Performance Objectives:
Student proves simple set identities.
Student finds complements, unions, intersections and differences of sets
WEEK 9
(3 hours)
Topics:
Disproofs, Algebraic Proofs and Boolean Algebras
Functions
Functions defined on General Sets
One-to-One and Onto,
Student Performance Objective:
Student will determine whether a function is one-to-one and onto or not.

WEEK 10
(3 hours)
Topics:
Inverse Functions
One-to-One Correspondences and Inverse Functions
Composition of Functions
    Composition of One-to-One Functions;
    Composition of Onto Functions
Cardinality with Applications to Computability
Definition of Cardinal Equivalence; Countable Sets;
The Search for Larger Infinities
Student Performance Objective:
    Student will determine the inverses of functions.
WEEK 11
(4 hours)
Topics:
Relations on Sets
    The Inverse of a Relation;
    Directed Graph of a Relation;
Reflexivity, Symmetry, and Transitivity
Equivalence Relations
Student Performance Objective:
    Student will identify relations and functions
    Student will determine whether a relation is reflexive, symmetric or transitive
WEEK 12
(3 hours)
Topics:
Counting and Probability
    Definition of Sample Space and Event;
    Probability in the Equally Likely Case;
    Counting
Possibility Trees and the Multiplication Rule
Counting Elements of Disjoint Sets
    The Addition Rule;
    The Difference Rule;
    The Inclusion/Exclusion Rule
Student Performance Objective:
    Student will apply the rules to solve problems.
    Student will apply counting techniques to calculate the probabilities.

WEEK 13
(3 hours)
Topics:
The Pigeonhole Principle
Statement and Discussion of the Principle;
Applications;
Decimal Expansions of Fractions;
Generalized Pigeonhole Principle;
Proof of the Pigeonhole Principle
Counting Subsets of a Set: Combinations
WEEK 14
(3 hours)
Topics:
Pascal's Formula and the Binomial Theorem
Combinatorial Formulas;
Pascal's Triangle;
Algebraic and Combinatorial Proofs of
Pascal's Formula;
Binomial Theorem and Algebraic and Combinatorial Proofs for It;
WEEK 15
(3 hours)
Topics:
Probability Axioms and Expected Value
Conditional Probability. Bayes' Formula, and Independent Events
Student Performance Objective:
Student can apply the binomial theorem and Bayes' theorem as appropriate.
WEEK 16
(3 hours)
Topics:
Graphs: Definitions and Basic Properties
Matrix Representations of Graphs
Directed Graphs;
Undirected Graphs;
Counting Walks of Length N
WEEK 17
(3 hours)
Topics:
Isomorphisms of Graphs
Trees
Rooted Trees
Binary Trees
Spanning Trees and Shortest Paths
Minimum Spanning Trees
Student Performance Objective:
Student can describe several different traversals of trees or graphs.
Homework for all weeks: read the assigned material and work the assigned problems.

WEEK 18
(2 hours)
Final Exam

METHODS OF INSTRUCTION:
Lecture, demonstrations.

METHODS OF EVALUATION:
The types of writing assignments required:
Written homework
Reading reports
The problem-solving assignments required:
Homework problems
Quizzes
Exams
The types of skill demonstrations required:
None
The types of objective examinations used in the course:
Multiple choice
True/false
Matching items
Completion
Other category:
Group project/homework and computer and lab activities
The basis for assigning students grades in the course:
Writing assignments: 10% - 20%
Problem-solving demonstrations: 65% - 85%
Skill demonstrations: 0% - 0%
Objective examinations: 10% - 20%
Other methods of evaluation: 5% - 15%

REPRESENTATIVE TEXTBOOKS:
Required:
Epp, Discrete Mathematics with Applications (most recent edition), Brooks/Cole, 2011, or other appropriate college level text.
Reading level of text, Grade: 12+ Verified by: ev
Other textbooks or materials to be purchased by the student: none

ARTICULATION and CERTIFICATE INFORMATION

Associate Degree:

GAV B4, effective 201770

CSU GE:

CSU B4, effective 201670

IGETC:

IGETC 2A, effective 201670

CSU TRANSFER:

Transferable CSU, effective 201770

UC TRANSFER:

Transferable UC, effective 201770

SUPPLEMENTAL DATA:
Basic Skills: N
Classification: Y
Noncredit Category: Y
Cooperative Education:
Program Status: 1 Program Applicable
Special Class Status: N
CAN:
CAN Sequence:
CSU Crosswalk Course Department: CSIS
CSU Crosswalk Course Number: 26
Prior to College Level: Y
Non Credit Enhanced Funding: N
Funding Agency Code: Y
In-Service: N
Occupational Course: C
Maximum Hours: 3
Minimum Hours: 3
Course Control Number: CCC000564662
Sports/Physical Education Course: N
Taxonomy of Program: 070100