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

<table>
<thead>
<tr>
<th>Units</th>
<th>Number of Weeks</th>
<th>Contact Hours/Week</th>
<th>Total Contact Hours</th>
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<tbody>
<tr>
<td>3</td>
<td>18</td>
<td>Lecture: 3</td>
<td>Lecture: 54</td>
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<td>Lab: 0</td>
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<td>Other: 0</td>
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<td>Total: 3</td>
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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: 1
   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 Infinites
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