COURSE SYLLABUS

LAST REVIEW	Spring 2021
COURSE TITLE	Discrete Structures I
COURSE NUMBER	CIST-0191
DIVISION	Career and Technical Education
DEPARTMENT	CIST
CIP CODE	11.0901
CREDIT HOURS	3
CONTACT HOURS/WEEK	Class: 3 Lab: 0
PREREQUISITES	CIST-0120 Elements of Programming
COREQUISITES	None

COURSE DESCRIPTION

Logic and discrete computing are essential in computer science and they also can be utilized in many other disciplines. This course provides the fundamentals of this topic where the student will learn how to use discrete mathematics as it relates to computers and computer applications. The student will experiment with a variety of fundamental mathematical principles including but not limited to: Sets, Functions, Mathematics Induction, Graphs, Tress and Combinatorial Circuits.

PROGRAM ALIGNMENT

This course is part of a program aligned through the Kansas Board of Regents and Technical Education Authority. For more information, please visit: https://kansasregents.org/workforce_development/program-alignment

PROGRAM LEARNING OUTCOMES

1. Develop Applications: Develop a list processing software application.

INSTITUTIONAL LEARNING OUTCOMES

☐ Communication
☒ Computation and Financial Literacy
☐ Critical Reasoning
☒ Technology and Information Literacy
☐ Community and Civic Responsibility
☐ Personal and Interpersonal Skills

TEXTBOOKS

http://kckccbookstore.com/

METHOD OF INSTRUCTION

A variety of instructional methods may be used depending on content area. These include but are not limited to lecture, multimedia, cooperative/collaborative learning, labs and demonstrations, projects and presentations, speeches, debates, panels, conferencing, performances, and learning experiences outside the classroom. Methodology will be selected to best meet student needs.

COURSE OUTLINE

I. Introduction
   - A. Determine whether a solution is possible in a variety of circumstances
   - B. Count the number of solutions in a variety of circumstances
   - C. Optimize a solution in a variety of circumstances

II. Sets
   - A. Define a set and related properties
   - B. Use operations with sets
   - C. Use Venn Diagrams with sets
   - D. Use DeMorgan's Law
   - E. Use the Cartesian Product

III. Equivalence Relations
   - A. Define an equivalence relation
   - B. Find if a relation has the reflexive property
   - C. Find if a relation has the symmetric property
   - D. Find if a relation has the transitive property
   - E. Define and use partitions

IV. Congruence Classes
   - A. Define a congruence class and related properties
   - B. Do arithmetic operations using congruence classes

V. Functions
   - A. Define a function and related properties
   - B. Define one-to-one and related properties
   - C. Define onto and related properties
   - D. Define composition and related properties
   - E. Define and use the concepts of Mathematics Induction

VI. Graphs
   - A. Define a graph and related properties
   - B. Define a matrix and related properties
   - C. Add & Subtract matrices
   - D. Do scalar multiplication & Do matrix multiplication
   - E. Represent a graph as a graph, an adjacency list, and a matrix
   - F. Change from any representation of a graph to another form
   - G. Define and use the concept of isomorphisms
   - H. Define a path and related properties for a graph
   - I. Define a circuit and related properties for a graph

J. Find Euler paths and circuits for a graph
K. Find Hamiltonian paths and cycles for a graph
L. Find the shortest path between any two points in a graph
M. Find the graph of a map
N. Define a digraph and related properties
O. Represent a digraph as a graph, an adjacency list, and a matrix
P. Find the Euler paths and circuits for a digraph
Q. Find Hamiltonian paths and cycles for a digraph

VII. Trees
A. Define a tree and related properties
B. Create a spanning tree, minimum spanning, and maximum spanning for a graph
C. Create a depth-first & breadth-first search spanning tree for a graph
D. Define a rooted tree, binary tree, and related properties
E. Create an expression tree for a preorder, postorder, and inorder expression
F. Evaluate a preorder, postorder, and inorder expression
G. From a tree, write the preorder, postorder, and inorder expression
H. Develop an optimal tree using Huffman Code
I. Develop and use a binary search tree

VIII. Matching Problems
A. Use systems of distinct representations to solve a variety of problems
B. Apply the algorithms of maximal independent sets to solve a variety of problems

IX. Network Flows
A. Define a transportation network and related properties
B. Maximize a transportation network
C. Find a cut for an optimal transportation network

X. Counting Techniques
A. Use the product rule
B. Use the sum rule
C. Use the Pigeonhole Principle
D. Use the notation for permutations and combinations
E. Use combinations
F. Use permutations
G. Use the principle of inclusion-exclusion

XI. Combinatorial Circuits
A. Define AND, OR, and NOT gates and their related properties
B. Use logical gates to create circuits
C. Find the Boolean expression of a circuit
D. Find the truth table for a Boolean expression
E. Use Karnaugh maps to optimize a circuit or a logical expression

COURSE LEARNING OUTCOMES AND COMPETENCIES

Upon completion of the course, the student will:

A. Use the mathematical tools and techniques basic to and needed for most courses in computer science.
   1. Develop the ability to reason precisely using discrete mathematics models.
   2. Apply the relationship between discrete mathematics and computer science.
   3. Apply the elements of logic to computer science.
   4. Determine whether a solution is possible in a variety of circumstances.
   5. Count the number of solutions in a variety of circumstances.
   6. Optimize a solution in a variety of circumstances.

B. Use sets and apply set operations.
   7. Demonstrate sets and apply set operations.
   8. Demonstrate the cartesian product.

C. Use Venn diagrams with sets and apply Demorgan's law.
   9. Demonstrate Venn diagrams with sets.
   10. Demonstrate Demorgan's law.

D. Use equivalence relations.
   11. Demonstrate equivalence relation.
   12. Define and use partitions.

E. Apply reflexive, symmetric, transitive properties.
   13. Demonstrate reflexive properties of relations.
   14. Demonstrate symmetric properties of relations.
   15. Demonstrate transitive properties of relations.

F. Use congruence classes.
   16. Demonstrate congruence class and related properties.
   17. Demonstrate arithmetic operations using congruence classes.

G. Use functions.
   18. Demonstrate functions and related properties.

H. Use one-to-one, onto and composition functions and their related properties.
   19. Demonstrate one-to-one functions and their related properties.
   20. Demonstrate onto functions and their related properties.
   21. Demonstrate composition functions and their related properties.

I. Use the principles of graph theory.
   22. Demonstrate graphs and related properties.

J. Apply graphs representation transformation.
   23. Demonstrate graphs representation.
   24. Demonstrate graphs representation transformation.

K. Use counting techniques.
   25. Demonstrate counting techniques.

L. Use the product and sum rules.
   26. Demonstrate the product rules
   27. Demonstrate the sum rules.

M. Apply pigeonhole principle.
   28. Demonstrate pigeonhole principle.

ASSESSMENT OF COURSE LEARNING OUTCOMES AND COMPETENCIES

Student progress is evaluated through both formative and summative assessment methods. Specific details may be found in the instructor's course information document.

COLLEGE POLICIES AND PROCEDURES

Student Handbook
https://www.kckcc.edu/files/docs/student-resources/student-handbook-and-code-of-conduct.pdf

College Catalog
https://www.kckcc.edu/academics/catalog/index.html

College Policies and Statements
https://www.kckcc.edu/about/policies-statements/index.html

Accessibility and Accommodations
https://www.kckcc.edu/academics/resources/student-accessibility-support-services/index.html.