Davenport University
Department of Computer Information Science

1. MATH250, Discrete Structures

2. 3 credits

3. Course coordinator: Tim Pennings/Gabriela Ziegler

4. Textbook
   Inseat Courses
   9781429215107
   Mathematical Structures for Computer Science
   Judith Gersting
   7th / Freeman / Required / Used is OK

   Online Courses
   9781429215107
   Mathematical Structures for Computer Science
   Judith Gersting
   7th / Freeman

5. Specific course information
   a. Catalog description: This course applies fundamental ideas in discrete structures and mathematical reasoning. Topics include elementary logic and set theory, functions and relations, induction and recursion, elementary algorithm analysis, counting techniques, and introduction to computability. Fundamental techniques include graph theory, Boolean algebra, and trees. Techniques and topics will form the foundation for subsequent programming language courses.
   b. Prerequisites: CISP111 or CISP112 and MATH130 or MATH135

   c. Required course

6. a. Course Learning Outcomes:

1. Translate and interpret symbolic logic and apply to language and mathematical proof.
2. Describe sets and set operations, identify properties of functions, categorize sequences, and compute values of summations.
3. Identify various growth rates of functions and categorize algorithms using Big-O notation.

4. Apply concepts of congruence to such things as modular arithmetic, number theory, and cryptography.
5. Apply methods of counting to problems involving permutations and combinations.
6. Apply concepts of graph theory including optimization of paths and circuits and applications with trees.
7. Apply concepts of Boolean algebra to construct logic gates and minimize circuits.

b. Student Outcomes assessed by MATH250

1. To analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.

c. Mapping of Course Learning Outcomes to Student Outcomes

Course Learning Outcomes 1, 2, 3, 4, 6 and 7 → ABET SO 1

7 Course Content:

Topic or Subtopic (Number of hours devoted to a topic are shown in parenthesis)

1. Statements, connectives, truth values, tautologies, propositional logic, valid arguments, derivation rules for propositional logic, deduction method, verbal arguments (3)
2. Quantifiers and predicates, translation, derivation rules for predicate logic, universal and existential instantiation and generalization (3)
3. Theorems and informal proofs, exhaustive and direct proofs, contraposition, contradiction, induction (3)
4. Number theory, fundamental theorem of arithmetic, prime numbers, Euler Phi Function, recursion, recursively defined sequences (3)
5. Sets, summation notation (3)
6. Counting, multiplication principal, addition principle, decision trees, principle of inclusion and exclusion, pigeonhole principle (3)
7. Permutations and combinations (3)
8. Relations, binary relations, properties, closures, partial orderings, equivalence relations, functions, properties, composition of functions, inverse functions (3)
9. Function growth, analysis of algorithms, hashing, cryptography, encryption, applications (3)
10. Graphs: definitions, applications, terminology; isomorphic graphs, planar graphs, computer representation, adjacency matrix, trees: terminology, applications, representation, traversal (3)
11. Decision trees, directed graphs, Warshall's Algorithm (3)

12. Euler path and Hamiltonian circuit, shortest path problem, minimal spanning tree problem (3)
13. Boolean algebra structure, logic networks (3)