West Linn–Wilsonville School District

Mathematics – Course Statement

Course Title: Discrete Mathematics

Length of Course: Year
Number of Credits: 1
Grade Level: 10, 11, 12
Prerequisites: Advanced Algebra

Date of Description/Revision: 2013

Course Overview

This course is an advanced mathematics course designed to explore a variety of topics. Topics include, but are not limited to: optimization, probability, combinations, graph theory and discrete mathematics.

Essential Questions

Concepts providing focus for student learning

- How can you model the physical, political, social etc. world with discrete mathematics?
- How can you use the computer to model the world with a computer?
- What is graph theory and how do we use it to model the world?
- How is probability used to model events in the world?

Common Core Standards For Mathematical Practice

Students will develop the following practices throughout the course:

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision
- Look for make use of structure.
- Look for and express regularity in repeated reasoning.

Proficiency Statements

Upon completion of course, students will be able to:

- Represent problem situations using discrete structures such as finite graphs, matrices, sequences, and recurrence relations.
- Represent and analyze finite graphs using matrices.
- Develop and analyze algorithms.
- Solve enumeration and finite probability problems.
- Represent and solve problems using linear programming and difference equations.
- Investigate problem situations that arise in connection with computer validation and the application of algorithms.
- Use the computer to model various ideas such as traffic flow.
- Compete in the COMAP modeling contest.

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General Course Topics/Units & Timeframes	

A. Election theory
   - Group-ranking methods and algorithms
   - More group-ranking methods and paradoxes
   - Arrow's Conditions and approval voting
   - Weighted voting and voting power
   - Proportional representation

B. Fair division
   - Estate division
   - Apportionment algorithms
   - Fair division algorithms: the continuous case
   - Mathematical induction
   - Envy-free division

C. Matrix operations and applications
   - Addition and Subtraction of Matrices
   - Multiplication of Matrices
   - Population Growth: The Leslie Model 1

D. Probability
   - Multiplication Rule
   - Permutations and combinations with compound events
   - Calculate expected values
   - Evaluate outcomes of decisions

E. Graphs and their applications
   - Critical paths
   - Vocabulary and representations of graphs
   - Euler circuits and paths
   - Hamiltonian circuits and paths
   - Graph coloring
   - Eulerizing graphs
   - Planarity and coloring
   - The Traveling Salesperson Problem
   - Shortest route problems
   - Trees and their properties
   - Minimum spanning trees
   - Binary trees, expression trees, and traversals
   - Steiner Trees
   - Counting and probability
   - Monte Carlo methods

Resources	

- Text: *Thinking Mathematically, Fifth Edition*, Blitzer, Pearson Prentice Hall, 2010