01 Discrete Topics

Content Area: **Math**
Course(s):
Time Period: **Full Year**
Length: **Type Length of Unit**
Status: **Published**

General Overview, Course Description or Course Philosophy

The goal of this course is to expose students to practical mathematics that they can expect to encounter in their world. Students who complete this course will be proficient in gathering, displaying, and interpreting statistics in context. In the later part of the course, students will be exposed to discrete mathematics topics that can be directly applied to a wide variety of fields, including computer science, business, manufacturing, life sciences, and mathematics.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Graph theory and linear programming are branches of mathematics specializing in optimization and organization of graphs and related information.

CONTENT AREA STANDARDS

MA.A-REI.D.10	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
MA.A-REI.D.11	Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.
MA.A-REI.D.12	Graph the solutions to a linear inequality in two variables as a half plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

LA.RI.11-12.7	Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.
LA.11-12.SL.11-12.2	Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP11	Use technology to enhance productivity.
TECH.8.1.12.A.4	Construct a spreadsheet workbook with multiple worksheets, rename tabs to reflect the data on the worksheet, and use mathematical or logical functions, charts and data from all worksheets to convey the results.
TECH.8.1.12.A.5	Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.
TECH.8.1.12.C.CS2	Communicate information and ideas to multiple audiences using a variety of media and formats.
TECH.8.1.12.C.CS4	Contribute to project teams to produce original works or solve problems.
TECH.8.1.12.E.CS2	Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
TECH.8.1.12.E.CS4	Process data and report results.
TECH.8.1.12.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.

STUDENT LEARNING TARGETS

Declarative Knowledge

Students will understand that:

- Each critical value (points of intersections, x-intercepts, y-intercepts, etc.) within the graph of a system of linear inequalities represents a significant moment or combination of variables that is noteworthy relative to the context of the problem.
- The most common application of linear programming is for optimization.
- The four color theorem states that, given any separation of a plane into contiguous regions, producing a figure called a map, no more than four colors are required to color the regions of the map so that no two adjacent regions have the same color.
- The four color theorem can be applied to real world scenarios such as mapping mobile phone base areas.
- Paths and circuits are composed of vertices and edges; the Euler circuit is a circuit that includes all vertices and edges of a graph; a Hamiltonian circuit is a circuit that includes every vertex (except first/last vertex) of a graph exactly once.
- Sorted edges algorithm requires edges to be used in increasing weight order.
- Nearest neighbor algorithm requires edges to be used by always traveling to the nearest unused vertex.
- Kruskal's algorithm requires finding and using an edge of the least possible weight that connects any two trees.
- A spanning tree is a subset of a graph which has all vertices covered with minimum possible number of edges.

Procedural Knowledge

Students will be able to:

- Form linear inequalities based on information from a scenario.
- Determine the coordinates of the feasible region.
- Test coordinates to find the optimal solution.
- Find the optimum solutions to linear programming problems.
- Determine the least amount of color that could be used to color in a design.
- Use color theory to determine the solution to practical problems.
- Determine if an Euler circuit exists and if not, how a graph can be rectified.
- Determine a practical use for Euler circuits.
- Apply the brute force method in order to find the best solution of a Hamiltonian Circuit.
- Express why there is a need for an algorithmn when trying to find a solution to a Hamiltonian circuit problem.
- Determine the amount of possible Hamiltonian circuits from a graph with a fixed number of vertices.
- Apply the sorted edges algorithm to a graph to find a solution.
- Apply Kruskal's algorithm to find spanning trees.
- Create a minimum spanning tree based upon data from a chart.
- Compare and contrast Kruskal's algorithm with the sorted edges algorithmn.

EVIDENCE OF LEARNING

Formative Assessments

Observations

Task completion

Student journals and notebooks

Cooperative team work

Summative Assessments

Project completion

Task completion on unit assessments

RESOURCES (Instructional, Supplemental, Intervention Materials)

Statistics and Probability with Applications (High School) Third Edition, Starnes & Tabor, 2016

Digital Launchpad book companion

INTERDISCIPLINARY CONNECTIONS

Educational tech applications

Current Events

Experimentation

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.