

Unit 1: Linear Programming

Content Area: **Math**
Course(s): **Generic Course, DIS MATH**
Time Period: **Marking Period 1**
Length: **4 weeks**
Status: **Published**

Standards

Math Standards

MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
MA.G-CO.D.12	Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).
MA.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
MA.A-REI.C.6	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
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.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.
MA.A-SSE.A.1a	Interpret parts of an expression, such as terms, factors, and coefficients.
MA.A-SSE.A.1b	Interpret complicated expressions by viewing one or more of their parts as a single entity.

Life Literacies and Key Skills

TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CI.2	Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

Transfer Goals

Transfer Goals

- Students will be able to independently use their learning to find optimal solutions for minimizing cost and maximizing profit for real world problems.

Concepts

Essential Questions

- How would you apply what you have learned in systems of inequalities to linear programming?
- What are some real-world situations that can be solved using linear programming?
- What is the feasible region, and how does it contribute to identifying solutions to a problem?
- What methods can be used to solve systems of equations and inequalities?
- What process would you use to optimize the objective function?

Understandings

- Systems of equations and/or inequalities are used to model and solve real-world problems involving two or more variables.

Critical Knowledge and Skills

Knowledge

Students will know:

- ☐ How to graph a linear equation
- ☐ How to graph a linear inequality
- ☐ How to maximize profit and/or minimize cost
- ☐ How to solve linear inequalities graphically
- ☐ How to solve systems of linear equations algebraically and graphically

Skills

Students will be able to:

- ☐ Evaluate the profit or cost function at each corner point to determine the optimal solution.
- ☐ Graph a system of inequalities, shade the feasible region, and determine any points of intersection.
- ☐ Read an optimization problem and set up an appropriate table from which constraints can be derived.

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

- Classwork
- Homework
- Quizzes
- IXL
- Kahoot
- Performance Assessment: Arrange students in groups of 4. Each group will be given a set of constraints. Work as a group to:
 - Determine the x- and y-intercepts of the inequalities below.
 - Determine how to number your x-axis and y-axis.
 - Use the graph on this sheet to plan out your work.
 - Graph and label each of the inequalities on the large graph paper.
 - Shade the feasible region.
 - List the corner points.
 - Hang up your group's graph and this sheet showing your work.Groups then will be given a second set of constraints to graph, determine feasible region and corner points. They will then find the chart paper hanging around the room and find the problem that they completed. They will then determine whether they agree or disagree with posted solution. If they agree they will put a post-it note with a star on it. If they disagree, they will use their post-it notes to show where the mistake is and correct it.

School Summative Assessment Plan

Test - Linear Programming

Primary Resources

- For All Practical Purposes: Mathematical Literacy for Today's World (COMAP, 5th Edition, 2001)

Supplementary Resources

- Video: "What is OR - the Movie?" http://www.learnaboutor.co.uk/flash/16_plus_movie.htm
- IXL
- Teacher created resources

Technology Integration and Differentiated Instruction

Technology Integration

- **Google Products**
 - Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
 - GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.
- **One to One Student's laptop**
 - All students within the West Deptford School District are given a computer, allowing for 21st century learning to occur within every lesson/topic.

Differentiated Instruction

Gifted Students (N.J.A.C.6A:8-3.1)

- Within each lesson, the Gifted Students are to be given the Advanced/Challenge Questions.
- These questions are to push the knowledge of each portion of the lesson. In the text, Advanced/Challenge questions are indicated by a square next to the problem number in the Exercises section.

English Language Learners (N.J.A.C.6A:15)

- Work with ELL Teacher to allow for all assignments to be completed with extra time.

At-Risk Students (N.J.A.C.6A:8-4.3c)

- Encourage student to seek extra help.
- Work with Guidance Counselor and I&RS Team to create an intervention plan.

Special Education Students (N.J.A.C.6A:8-3.1)

- Allow for extra time (if needed)
- Hard copy of notes
- Chunking of problems
- Preferential seating
- Work with contact teacher to assist with additional accommodations noted in IEP/504 plans.

Interdisciplinary Connections

MATH -

SCIENCE - Students will use linear programming to determine the number of plants that should be planted in order to fit in a given budget, maximize area and carbon dioxide rates

SOCIAL STUDIES -

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS -

APPLIED TECHNOLOGY/BUSINESS - Students will solve production/manufacturing problems using Linear Programming – determine the number of each type of product to produce to satisfy given resource constraints.

GLOBAL AWARENESS - Discuss how operations research is used to address global issues such as manufacturing, government, transportation, supply chains, sport, and as a career.

Learning Plan / Pacing Guide

Week 1

What is Operational Research?

Create and present Venn Diagrams of OR information

Graph Linear equations using x- and y-intercepts

Graph linear equations in slope-intercept form

Solving systems of equations by graphing

Week 2

Solve systems of equations graphically and algebraically

Review - IXL, Kahoot, Putting It All Together

Quiz

Week 3

Graph linear inequalities

Google Poll – Feasible Regions

Graph constraints and corner points

Use objective functions to maximize or minimize functions

Linear programming group activity

Quiz

Week 4

Linear Programming - writing constraints

Review

Test

Unit 2: Voting and Social Choice

Content Area: **Math**
Course(s): **Generic Course, DIS MATH**
Time Period: **Marking Period 1**
Length: **2.5 weeks**
Status: **Published**

Standards

Math Standards

MA.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
MA.N-VM.C.6	Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.

Life Literacies and Key Skills

TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CI.2	Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

Transfer Goals

Transfer Goals

- Students will be able to combine individual opinions so as to best reflect the “will of the group.”

Concepts

Essential Questions

- How does the method chosen to count votes in an election impact the outcome of the election?

Understandings

- The method used to count votes may change the outcome of an election.

Critical Knowledge and Skills

Knowledge

Students will know:

- ☐ Arrow's Impossibility Theorem
- ☐ Insincere Voting
- ☐ Preference Schedule
- ☐ The Borda Method
- ☐ The Condorcet Method
- ☐ The Method of Averages
- ☐ The Plurality Method
- ☐ The Run-Off Method
- ☐ The Sequential Run-Off Method

Skills

Students will be able to:

- ☐ Show that the method used to count votes often changes the outcome of an election.

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

- Classwork
- Homework
- Quizzes
- Kahoot
- Ordinal Ballot Activity: Students will choose a survey topic with 3 choices. Students will survey a minimum of 20 students and display the results of survey in a preference schedule table. The table should include the number of results for each option. Students will summarize the results of your survey including the number of first place votes for each choice as well as the percentage of votes received. Students will state the Plurality winner as well as whether or not he/she agrees with the result and why or why not.
- Voting Methods Flip Book: Students will create a flip-book to summarize voting election procedures. Flip book may be used on assessment.

School Summative Assessment Plan

Test Voting & Social Choice – students may use their Flip Book on their assessment

Primary Resources

- For All Practical Purposes: Mathematical Literacy for Today's World (COMAP, 5th Edition, 2001)

Supplementary Resources

- Is Democracy Fair? (Key Curriculum Press, 1996)
- Resources from Rutgers DIMACS Conference
- Teacher created resources

Technology Integration and Differentiated Instruction

Technology Integration

- Google Products
 - Google Classroom - Used for daily interactions with the students covering a vast majority of

different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)

- GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.

- **One to One Student's laptop**

- All students within the West Deptford School District are given a computer, allowing for 21st century learning to occur within every lesson/topic.

Differentiated Instruction

Gifted Students (N.J.A.C.6A:8-3.1)

- Within each lesson, the Gifted Students are to be given the Advanced/Challenge Questions.
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English Language Learners (N.J.A.C.6A:15)

- Work with ELL Teacher to allow for all assignments to be completed with extra time.

At-Risk Students (N.J.A.C.6A:8-4.3c)

- Encourage student to seek extra help.
- Work with Guidance Counselor and I&RS Team to create an intervention plan.

Special Education Students (N.J.A.C.6A:8-3.1)

- Allow for extra time (if needed)
- Hard copy of notes
- Chunking of problems
- Preferential seating
- Work with contact teacher to assist with additional accommodations noted in IEP/504 plans.

Interdisciplinary Connections

MATH -

SCIENCE -

SOCIAL STUDIES - The method used to count votes may change the outcome of an election.

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS -

APPLIED TECHNOLOGY/BUSINESS - Students use Google Docs to display results of Ordinal Ballot activity.

GLOBAL AWARENESS - Discuss how different voting methods are used around the world.

Learning Plan / Pacing Guide

Week 1

Apply Plurality decision making procedure

Compare standard and ordinal ballots

Ordinal Ballot Activity - students will design an ordinal ballot for a survey on a topic of your choice. Your ballot should give voters 3 choices. Collect responses from 20 or more people. Summarize the results of your survey. Save the ballots for use in a later activity.

Week 2

Run-Off election procedure

Sequential Run-Off election procedure

Method of Averages

Condorcet Method

Week 3

Discuss Fairness Criteria and Arrow's Impossibility Theorem

Create Voting Methods flip book - to be used on Assessment

Review

Voting & Social Choice Assessment - students may use Flip Book on assessment

Unit 3: Paths, Circuits, and Networks

Content Area: **Math**
Course(s): **Generic Course, DIS MATH**
Time Period: **Marking Period 1**
Length: **5 weeks**
Status: **Published**

Standards

Math Standards

MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
MA.G-MG.A.1	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
MA.G-MG.A.3	Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

Life Literacies and Key Skills

TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CI.2	Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

Transfer Goals

Transfer Goals

- Students will be able to independently use their learning to use Euler Circuits and Hamiltonian Circuits to model everyday situations and provide solutions to problems.

Concepts

Essential Questions

- Can all circuits be Eulerized? Explain.
- Is there an algorithm that will always yield an optimal solution to a Hamiltonian Circuit? Explain.
- What is the difference between Euler Circuits & Hamiltonian Circuits?
- What situations can be best modeled using an Euler Circuit? A Hamiltonian Circuit? A minimum cost spanning tree?

Understandings

- Euler Circuits trace each edge exactly once and start and end at the same vertex.
- Hamiltonian Circuits visit each vertex exactly once and start and end at the same vertex.
- No algorithm will yield an optimal solution for a Hamiltonian Circuit.

Critical Knowledge and Skills

Knowledge

Students will know:

- Graph
- Vertex
- Edge
- Path
- Circuit
- Complete
- Connected
- Digraph
- Valence/Degree
- Euler Circuits
- Fundamental Principle of Counting
- Hamiltonian Circuits
- Brute Force Algorithm
- Nearest Neighbor Algorithm
- Sorted Edges Algorithm
- Minimum Cost Spanning Tree
- Kruskal's Algorithm

Skills

Students will be able to:

- ☐ Eulerize a graph and complete an Euler circuit
- ☐ Complete a Hamiltonian circuit using the Nearest Neighbor and Sorted Edges Algorithms
- ☐ Complete a Minimum Cost spanning tree

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

- Classwork
- Homework
- Quizzes
- Kahoot Review
- Interactive Euler Circuit Review: smart notebook document
- Euler Circuit Letter Writing Project: Write a letter to anyone in charge of devising routes in which you suggest that management science techniques, like the ones we studied in class, be used to plan routes. Assume that the person to whom you are writing is not extensively trained in mathematics, but is willing to read through some technical material, provided you make it seem worth the trouble. Include why the audience would want to use an Euler Circuit and how it will make their job more efficient. You must provide a graph of your proposed route that has been properly Eulerized. The letter must be typed, but the graph may be drawn by hand or computer generated, however it must be included with your document.
- • Salmon Cannon Video: https://www.youtube.com/watch?v=fn6_6N_KDYw - CBS video about Whoosh Technologies and the "Salmon Cannon." Discussed with students how this technology originally created to make apple picking industry more efficient was adapted to improve salmon spawning in the Pacific Northwest.
- Video: Interview with Airline
- Critical Path Group Activity: Each member of the group is to share their list of activities/hobbies and prerequisites.
As a group, decide on the activity that your group will use to create an order requirement digraph. Once you have made your decision, get your idea approved by Mrs. Yeager.
As a group, brainstorm a list of at least 6 tasks (no more than two tasks can have no prerequisite) which can be used to complete your activity. Be sure to include prerequisite tasks and appropriate task times. Get your list approved by Mrs. Yeager.
Display your group's work on chart paper. Your display should include: Names of group members, the Activity you chose (ex. Creating a Survey, Constructing a Prefab House), task table with prerequisite tasks and task times, Order-Requirement Digraph, paths and their lengths, critical path, a question, and a solution to the problem in a complete sentence.

School Summative Assessment Plan

Test - Euler Circuits

Test - Hamiltonian Circuits

Primary Resources

- For All Practical Purposes: Mathematical Literacy for Today's World (COMAP, 5th Edition, 2001)

Supplementary Resources

- COMAP Videos: Band on the Run and Interview with an Airline
- CBS Video: Salmon Cannon https://www.youtube.com/watch?v=fn6_6N_KDYw
- Teacher created resources

Technology Integration and Differentiated Instruction

Technology Integration

- **Google Products**
 - Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
 - GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.
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Differentiated Instruction

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English Language Learners (N.J.A.C.6A:15)

- Work with ELL Teacher to allow for all assignments to be completed with extra time.

At-Risk Students (N.J.A.C.6A:8-4.3c)

- Encourage student to seek extra help.
- Work with Guidance Counselor and I&RS Team to create an intervention plan.

Special Education Students (N.J.A.C.6A:8-3.1)

- Allow for extra time (if needed)
- Hard copy of notes
- Chunking of problems
- Preferential seating
- Work with contact teacher to assist with additional accommodations noted in IEP/504 plans.

Interdisciplinary Connections

MATH -

ELA - Students will write a letter to anyone in charge of devising routes in which they suggest that management science techniques, like the ones we studied in class, can be used to plan routes.

SCIENCE - After watching Salmon Cannon video, discuss with students how this technology originally created to make apple picking industry more efficient was adapted to improve salmon spawning in the Pacific Northwest.

SOCIAL STUDIES - Through their study of The Konigsberg Bridge Problem, students learn about Leonard Euler. Euler was a Swiss mathematician who wrote the first paper ever on graph theory and thus became the originator of the theory of graphs as the rest of topology.

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS -

APPLIED TECHNOLOGY/BUSINESS - Students use Euler Circuits to find efficient routes for trash collection, street sweeping, delivering mail, and other urban services. Students use Hamiltonian Circuits to find efficient routes for the Traveling Salesman problem.

Students use Minimum-Cost Spanning Trees to find efficient networks for evacuation, snow removal, etc.

GLOBAL AWARENESS - Students study the Konigsberg Bridge Problem, perhaps the best known example in graph theory.

Learning Plan / Pacing Guide

Week 1

Apply Plurality decision making procedure

Compare standard and ordinal ballots

Ordinal Ballot Activity - students will design an ordinal ballot for a survey on a topic of your choice. Your ballot should give voters 3 choices. Collect responses from 20 or more people. Summarize the results of your survey. Save the ballots for use in a later activity.

Week 2

Run-Off election procedure

Sequential Run-Off election procedure

Method of Averages

Condorcet Method

Week 3

Discuss Fairness Criteria and Arrow's Impossibility Theorem

Create Voting Methods flip book - to be used on Assessment

Review

Voting & Social Choice Assessment - students may use Flip Book on assessment

Unit 4: Planning, Scheduling, Bin Packing, & Vertex Coloring

Content Area: **Math**
Course(s): **Generic Course, DIS MATH**
Time Period: **Marking Period 2**
Length: **5 weeks**
Status: **Published**

Standards

Math Standards

MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
MA.G-MG.A.1	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
MA.G-MG.A.3	Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

Life Literacies and Key Skills

TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CI.2	Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

Transfer Goals

Transfer Goals

- Algorithms for scheduling, bin packing, and vertex coloring can be utilized to optimize time and efficiency in planning.

Concepts

Essential Questions

- Will increasing the number of processors decrease completion time? Explain.
- How can the vertex coloring algorithm be applied to resolve conflict?
- What situations can be best modeled using order-requirement digraphs? A machine scheduling problem?
- Will the decreasing time list algorithm guarantee an optimal solution?

Understandings

- Increasing the number of processors will not always decrease completion time. Sometimes it increases it.
- Decreasing time list algorithm does not guarantee an optimal solution.
- The maximum number of colors required to color any plane map is four.

Critical Knowledge and Skills

Knowledge

Students will know:

- List Processing Algorithm
- Decreasing Time List Algorithm
- Critical Path Scheduling
- First-Fit, Next-Fit and Worst-Fit Bin Packing Algorithms
- Vertex Edge Graph
- Vertex Coloring Algorithm
- Chromatic Number

Skills

Students will be able to:

- ☐ Determine the critical path from an order-requirement digraph
- ☐ Use the list-processing algorithm and order-requirement digraphs to complete a machine scheduling problem
- ☐ Use the First-Fit, Next-Fit and Worst-Fit bin-packing algorithms to schedule independent tasks into a minimal number of bins
- ☐ Color regions of maps with minimal colors so that no two adjacent states have the same color. They should be able to employ Brooke's Theorem that says the maximum chromatic number is four.
- ☐ Take an existing vertex graph, create a priority coloring list based on descending order of vertex valences, use the vertex coloring algorithm to color the vertices and arrive at an optimal solution for compatibility.
- ☐ Read a conflict resolution problem, display the conflicts in a conflict chart and draw a vertex graph based on the information in the conflict chart.

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

- Classwork
- Homework
- Quizzes
- Four Color Problem Worksheet
- Performance Tasks: Create and solve your own unique problem that can be solved using a conflict chart and the Vertex Coloring Algorithm. Your problem must include a minimum of six vertices, a matrix with different row and column labels, a conflict chart, a colored and labeled vertex graph, a priority list, and groups.
- Spider Web Game (if time permits)
- Two-Colorable Map Activity (if time permits)

School Summative Assessment Plan

Test - Planning, Scheduling, and Bin Packing

Test - Vertex Coloring

Primary Resources

- For All Practical Purposes: Mathematical Literacy for Today's World (COMAP, 5th Edition, 2001)

Supplementary Resources

- COMAP Videos: Copies Quicker
- Teacher created resources

Technology Integration and Differentiated Instruction

Technology Integration

- **Google Products**

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- **One to One Student's laptop**

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Differentiated Instruction

Gifted Students (N.J.A.C.6A:8-3.1)

- Within each lesson, the Gifted Students are to be given the Advanced/Challenge Questions.
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- Work with ELL Teacher to allow for all assignments to be completed with extra time.

At-Risk Students (N.J.A.C.6A:8-4.3c)

- Encourage student to seek extra help.
- Work with Guidance Counselor and I&RS Team to create an intervention plan.

Special Education Students (N.J.A.C.6A:8-3.1)

- Allow for extra time (if needed)
- Hard copy of notes
- Chunking of problems
- Preferential seating
- Work with contact teacher to assist with additional accommodations noted in IEP/504 plans.

Interdisciplinary Connections

MATH -

ELA -

SCIENCE -

SOCIAL STUDIES - The Four Color Problem discusses how mathematician and map-makers only need to use a maximum of four colors to color a map. Discuss history of the problem and well as the process of (dis)proving this theorem from the 1800's-2000's.

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS -

APPLIED TECHNOLOGY/BUSINESS -Students use machine scheduling algorithms to determine the minimum number of processors/workers necessary to complete tasks efficiently.
Students use bin packing to determine the most efficient ways to seat ticketholders, schedule advertising time, cut shelving for a wall unit.

GLOBAL AWARENESS -

Learning Plan / Pacing Guide

Planning, Scheduling, & Bin Packing

Week 1

Schedule independent tasks on two processors using First Come, First serve list-processing algorithm & Decreasing List algorithm

Review
Independent Tasks Quiz

Week 2

Schedule dependent tasks on two or three processors using First Come, First serve list-processing algorithm & Decreasing List algorithm
Schedule dependent tasks on processors using Critical Path Scheduling
Copies Quicker Video
Review
Dependent Tasks Quiz

Week 3

Use bin packing methods of Next-Fit, First-Fit, Worst-Fit, Next-Fit Decreasing, First-Fit Decreasing, and Worst-Fit Decreasing to solve problems
Review
Test Planning, Scheduling, and Bin Packing

Vertex Coloring & Conflict Resolution

Week 4

4 Color Theorem and its history
Applications of the Vertex Coloring Algorithm
Quiz Vertex Coloring

Week 5

Conflict Charts
Create your own problem which can be solved using a Conflict Chart and the Vertex Coloring Algorithm
Spider Web Coloring Game
Two-Colorable Map Activity
Test Vertex Coloring & Conflict Resolution

Unit 5: Number Systems

Content Area:	Math
Course(s):	Generic Course, DIS MATH
Time Period:	Marking Period 2
Length:	2.5 weeks
Status:	Published

Standards

Math Standards

MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
MA.F-BF.A.1a	Determine an explicit expression, a recursive process, or steps for calculation from a context.
MA.F-BF.A.1b	Combine standard function types using arithmetic operations.
MA.F-BF.A.1c	Compose functions.

Life Literacies and Key Skills

TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CI.2	Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

Transfer Goals

Transfer Goals

- Students will be able to independently use their learning to convert between number bases.

Concepts

Essential Questions

- What is a specific example of a situation where binary numbers are used?
- What is a specific example of when hexadecimal numbers are used?

Understandings

- There are number systems other than base 10.
- Binary, Octal, and Hexadecimal number systems are the bases for writing computer code

Critical Knowledge and Skills

Knowledge

Students will know:

- ☐ Binary
- ☐ Decimal
- ☐ Hexadecimal
- ☐ Octal

Skills

Students will be able to:

- ☐ Convert between binary and decimal systems.
- ☐ Add, subtract, multiply, and divide numbers in binary form.
- ☐ Convert between octal-decimal and octal-binary.
- ☐ Convert between hexadecimal-decimal, hexadecimal-binary and hexadecimal-octal systems.

Assessment and Resources

School Formative Assessment Plan (Other Evidence)

- Classwork
- Homework
- Quizzes
- Cisco Binary Game
- Kahoot on Binary-Decimal Conversion
- "A Quick Scan on Bar Codes" Article and Questions

School Summative Assessment Plan

Test - Number Systems (may use note card)

Primary Resources

- For All Practical Purposes: Mathematical Literacy for Today's World (COMAP, 5th Edition, 2001)

Supplementary Resources

- Discovery Education videos: It's Electric and Digital Sound
- MATH BYTES VIDEO: Binary Numbers with Danica McKellar
<https://www.youtube.com/watch?v=TD6lcII0eic>
- Tutorial on how to convert between binary-decimal <https://www.youtube.com/watch?v=tfKe8PPI2zs>
- Cisco Binary Game - http://forums.cisco.com/CertCom/game/binary_game_page.htm
- Kahoot on Binary-Decimal Conversion <https://play.kahoot.it/#/k/cde57f5c-5337-4933-bcbc-5e74d1ee9403>
- Teacher created resources

Technology Integration and Differentiated Instruction

Technology Integration

- **Google Products**

- Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
- GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.

- **One to One Student's laptop**

- All students within the West Deptford School District are given a computer, allowing for 21st century learning to occur within every lesson/topic.

Differentiated Instruction

Gifted Students (N.J.A.C.6A:8-3.1)

- Within each lesson, the Gifted Students are to be given the Advanced/Challenge Questions.
- These questions are to push the knowledge of each portion of the lesson. In the text, Advanced/Challenge questions are indicated by a square next to the problem number in the Exercises section.

English Language Learners (N.J.A.C.6A:15)

- Work with ELL Teacher to allow for all assignments to be completed with extra time.

At-Risk Students (N.J.A.C.6A:8-4.3c)

- Encourage student to seek extra help.
- Work with Guidance Counselor and I&RS Team to create an intervention plan.

Special Education Students (N.J.A.C.6A:8-3.1)

- Allow for extra time (if needed)
- Hard copy of notes
- Chunking of problems
- Preferential seating
- Work with contact teacher to assist with additional accommodations noted in IEP/504 plans.

Interdisciplinary Connections

MATH -

ELA - Students will read “A Quick Scan on Bar Codes” article, answer questions, and provide examples of current and future uses of bar code technology.

SCIENCE -

SOCIAL STUDIES -

WORLD LANGUAGES -

VISUAL/PERFORMING ARTS -

APPLIED TECHNOLOGY/BUSINESS - In Digital Sound video, students see how laser discs store information using binary code.

In It’s Electric video, students see how the process of relaying information is like a binary multiplication problem.

GLOBAL AWARENESS - Students will read about how bar code technology is used around the world.

Learning Plan / Pacing Guide

Week 1

Convert between binary and decimal systems

Math Bytes video with Danica McKellar

Perform Binary addition, multiplication, subtraction, and division

Review

Quiz Binary Numbers & Operations

Week 2

Convert between octal-decimal and octal-binary systems

Convert between Hexadecimal-decimal and Hexadecimal-binary systems

Create a note-card to be used on Number Systems Test

Week 3

Review

A Quick Scan on Bar Codes article and questions

Test Number Systems – may use note card

