

# **Fair Lawn Public Schools**

**Fair Lawn, NJ**

# **Visual Computer Programming**

**Adopted August**

# **2017**

**Revised August 2017  
Developed August 2012**

The Visual Computer Programming course is a one semester elective that is linked to the Personal Financial Literacy course. It has been designed for all students in grades 9 through 12 who have met the Algebra 1 prerequisite.

# **VCP**

# **Fair Lawn School District**

## **Committee Credits Visual Computer Programming Team**

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## I. Course Synopsis

This semester course serves as an introduction to computer science via the use of the Visual Basic programming language. Students design and debug interactive programs that allow them to improve their problem-solving skills and deductive reasoning skills.

Students learn about project design, the Visual Basic toolbox, and many elements of the Visual Basic language, using examples and several detailed computer projects the student will build, debug, and run. No prior programming experience is necessary, but familiarity with doing common tasks using Microsoft Windows is helpful.

## II. Philosophy & Rationale

The purpose of Visual Computer Programming is to introduce the student to computer programming using the Visual Basic programming language. Students will be given the opportunity to create graphical user interfaces (GUI's) that resemble Microsoft applications. Students will also be able to develop and solve different types of mathematical and non-mathematical problems. Students will be exposed to a wide variety of ways to approach problem solving using the computer. Students will learn about the basic functions and foundations of the computer.

*The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important “processes and proficiencies” with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council’s report Adding It Up: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one’s own efficacy).*

### **MATH.PRACTICE.MP1 - Make sense of problems and persevere in solving them.**

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between

equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**MATH.PRACTICE.MP2 - Reason abstractly and quantitatively.**

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to *decontextualize*—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to *contextualize*, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

**MATH.PRACTICE.MP3 - Construct viable arguments and critique the reasoning of others.**

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**MATH.PRACTICE.MP4 - Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe

how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**MATH.PRACTICE.MP5 - Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

**MATH.PRACTICE.MP6 - Attend to precision.**

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

**MATH.PRACTICE.MP7 - Look for and make use of structure.**

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well-remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for

solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

**MATH.PRACTICE.MP8 - Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through  $(1, 2)$  with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

### III. Scope & Sequence

#### **Unit 1: Intro to Computer Programming and Coding in Visual Basic (5 days):**

What is a Computer Program?  
Types of Programming Languages  
High, Low, and Machine Level Languages  
Procedural, Object Oriented, and Event Driven Languages  
Coding Equations in Visual Basic  
Using Arithmetic Operators  
Using Relational Operators  
Order of Operations using Mathematical Operators and Methods  
Parentheses, ^, abs, sqrt, \* / \ mod, + -

#### **Unit 2: Creating a Visual Basic Program, using Input, Output, Variables, and Datatypes (10 days):**

Basic components of a Visual Basic program  
Documentation  
Toolbox/Controls  
Creating a Visual Basic program  
Properties of Controls  
Input Statements  
Output Statements  
Assignment statements  
Editing  
Checking syntax  
Running  
Datatypes and their Uses  
Inputboxes  
Messagesboxes  
Textboxes  
Labels  
Output formatting

#### **Unit 3: Conditional Statements (15 Days):**

What are conditional statements?  
What are conditional statements used for?  
If/then Structures  
If/then/else Structures  
If/then/elseif/else Structures

#### **Unit 4: Definite and Indefinite Loops (30 Days):**

For Next Loops  
Do Until Loops

Using Loops for Reprompting  
Do While Loops  
Pretest and Posttest Loops  
Nested Loops

**Unit 5: Arrays (10 Days):**

Definitions and Purpose  
Single Array Input Using Loops  
Basic Operations on Arrays Using Loops  
Single Array Output Using Loops

**Unit 6: Timers/Movement (10 Days):**

Definitions and Purpose  
Properties of Timers  
Applications of Timers to Create Movement  
Additional Uses of Timers

## IV. Unit Descriptions

### Unit 1: Intro to Computer Programming and Coding in Visual Basic

#### Enduring Understanding

1. Coding is what makes it possible for us to create computer software, apps and websites.
2. Computational thinking provides an organizational means of approaching life and its tasks.
3. Computational thinking can build knowledge and control technology.

#### Essential Question(s)

1. What are the different types of computer programming languages?
2. What are the differences between high, low, and machine level languages?
3. What are the differences between procedural, object oriented, and event driven languages?
4. How do you translate algebraic expressions to Visual Basic?
5. How do you compare values in Visual Basic?
6. Why do we need an order of operations and what is it?
7. What is integer division and modular arithmetic and how and when would we use them?
8. How can expressions and equations be used to solve real-world problems?

#### Learning Objectives

Students will be able to:

1. Identify the different types of computer programming languages.
2. Identify the differences between high, low, and machine level languages.
3. Identify the differences between procedural, object oriented, and event driven languages.
4. Code any mathematical equation in visual basic.
5. Apply order of operations to arithmetic, logical, and relational operators.
6. Use integer division and modular arithmetic in appropriate coding situations.
7. Mathematical expressions and equations to solve real world coding problems.

#### New Jersey Student Learning Standards

- **HSF.LE.A.1** - Distinguish between situations that can be modeled with linear functions and with exponential functions.
- **HSF.LE.A.2** - Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- **HSF.LE.A.3** - Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
- **HSF.LE.B.5** - Interpret the parameters in a linear or exponential function in terms of a context.

### Suggested Activities/Modifications

*All lab assignments can be enhanced and/or modified. For example, the Four Buttons lab, which asks students to change the visible property of four buttons via the properties menu and via code, can be enhanced for gifted and talented students to include a user option for also changing the background color, font, and text of each of the four buttons. The same lab can be modified for at risk students, students with disabilities, and ELL students, to be done in stages. First, change the visible property of one button only, and then write additional code to address the properties of the second, third, and fourth buttons.*

1. Hello World Lab
2. Four Buttons Lab
3. Traffic Light Lab

### New Jersey Student Learning Standards - Technology

- 8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.
  - 8.1.8.E.1 - Gather and analyze findings using data collection technology to produce a possible solution for a content-related or real-world problem.
  - 8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.
    - 8.2.12.E.2 Analyze the relationships between internal and external computer components.
    - 8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
    - 8.2.12.E.4 Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).

### Career Readiness Practices

- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.

### 9.2 Career Awareness, Exploration, and Preparation Content Area: 21<sup>st</sup> Century Life and Careers Strand C: Career Preparation

- See Technology & Career Readiness & 21st Century Skills Standards Curriculum Appendix

### Career & Technical Education Content Area: 21<sup>st</sup> Century Life and Careers Standards

- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
- 9.3.12.ED.1 - Apply communication skills with students, parents and other groups to enhance learning and a commitment to learning.

- 9.3.12.AR.4 Analyze the legal and ethical responsibilities required in the arts, audio/visual technology and communications workplace.
- 9.3.12.AR.5 Describe the career opportunities and means to achieve those opportunities in each of the Arts, A/V Technology & Communications Career Pathways.
- 9.3.12.AR.6 Evaluate technological advancements and tools that are essential to occupations within the Arts, A/V Technology & Communications Career Cluster.

## **Unit 2: Creating a Visual Basic Program, using Input, Output, Variables, and Datatypes**

### Enduring Understanding

1. Explore the use of flowcharts and pseudocode for the purpose of planning and organization.
2. Explore the basic concept of a control by documenting properties and behaviors of some real world objects.
3. Making user friendly applications by making appropriate input and output.
4. Using variables to accept information from the user by selecting appropriate datatypes.

### Essential Question(s)

1. How can pseudocode be used to help write a program?
2. Why is documentation helpful and how do you document a program?
3. How do you create a new program in Visual Studio?
4. How do you run a program?
5. How do you use the compiler to help check the syntax?
6. How do you drag items from the toolbox onto the form?
7. How do you change the properties of a control via the properties menu and via code?
8. How do you write input and output statements?
9. How do you write an assignment statement that performs a mathematical calculation?
10. How do you use variables to accept information from the user?

### Learning Objectives

1. Outline an algorithm using a flowchart and pseudocode.
2. Use documentation throughout their code to help with organization.
3. Create and run a new program using the visual studio software.
4. Change the properties of a control through both the properties window and through code.
5. Write input, output, and assignment statements to perform specific tasks involving mathematical calculations.
6. Use variables to accept information from the user by choosing appropriate datatypes.

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- **HSF.LE.A.1** - Distinguish between situations that can be modeled with linear functions and with exponential functions.

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- **HSF.LE.A.3** - Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
- **HSF.LE.B.5** - Interpret the parameters in a linear or exponential function in terms of a context.

### Suggested Activities/Modifications

*All lab assignments can be enhanced and/or modified. For example, the Tip Calculator lab, which asks students to calculate the tip given a total price and tip percent, can be enhanced for gifted and talented students to include a user option for splitting the bill amongst a given amount of people. The same lab can be modified for at risk students, students with disabilities, and ELL students, to be done in stages. First, calculate the total price using 15% tip, and then write a second code segment to ask the user what tip percent they would like to use.*

1. Circle Program
3. QB Rating Lab
4. Feet and Inches Conversion Lab
5. Tip Calculator Program

### New Jersey Student Learning Standards - Technology

- 8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.
  - 8.1.8.E.1 - Gather and analyze findings using data collection technology to produce a possible solution for a content-related or real-world problem.
- 8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.
  - 8.2.12.E.2 Analyze the relationships between internal and external computer components.
  - 8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
  - 8.2.12.E.4 Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).

### Career Readiness Practices

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9.2 Career Awareness, Exploration, and Preparation Content Area: 21<sup>st</sup> Century Life and Careers  
Strand C: Career Preparation

- See Technology & Career Readiness & 21st Century Skills Standards Curriculum Appendix

Career & Technical Education Content Area: 21<sup>st</sup> Century Life and Careers Standards

- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
- 9.3.12.ED.1 - Apply communication skills with students, parents and other groups to enhance learning and a commitment to learning.
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- 9.3.12.AR.5 Describe the career opportunities and means to achieve those opportunities in each of the Arts, A/V Technology & Communications Career Pathways.
- 9.3.12.AR.6 Evaluate technological advancements and tools that are essential to occupations within the Arts, A/V Technology & Communications Career Cluster.

**Unit 3: Conditional Statements**

Enduring Understanding

1. Decision making skills in computer programming can relate to decision making skills in the real world.
2. Comparisons can be made between variables of the same datatype using Boolean expressions and compound Boolean expressions.
3. Boolean Algebra used in computer programming applies similar axioms to Algebra used in mathematics.

Essential Question(s)

1. What is a conditional statement and how does it apply to computer programming?
2. How does the compiler know which segment of a conditional statement to execute?
3. What is the order of operations for Boolean Algebra?
3. How is the validity of a statement determined in a computer program?
4. How do nested conditional statements work and what are the different syntax for coding them?

Learning Objectives

1. Write programs using if/then/elseif/else
2. Write programs using nested conditional statements
3. Use compound boolean expressions to write conditional and nested conditional statements.

New Jersey Student Learning Standards

- **HSF.LE.A.1** - Distinguish between situations that can be modeled with linear functions and with exponential functions.

- **HSF.LE.A.2** - Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- **HSF.LE.A.3** - Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
- **HSF.LE.B.5** - Interpret the parameters in a linear or exponential function in terms of a context.

### Suggested Activities/Modifications

*All lab assignments can be enhanced and/or modified. For example, the Babysitter lab, which asks students to calculate a babysitter's daily pay and weekly total, can be enhanced for gifted and talented students to include a user option for also calculating a monthly or yearly pay. The same lab can be modified for at risk students, students with disabilities, and ELL students, to be done in stages. First, calculate the babysitter's pay for one day, and then write the appropriate summing statement that will find the pay for all five days of the work week .*

1. Rectangle Lab – Area and Perimeter Comparison
2. Babysitter Lab
3. Flowchart Lab
4. Techno Computer College Lab
5. Taxing Campaign Lab

### New Jersey Student Learning Standards - Technology

- 8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.
- 8.1.8.E.1 - Gather and analyze findings using data collection technology to produce a possible solution for a content-related or real-world problem.
- 8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.
- 8.2.12.E.2 Analyze the relationships between internal and external computer components.
- 8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
- 8.2.12.E.4 Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).

### Career Readiness Practices

- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
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- CRP11. Use technology to enhance productivity.

## 9.2 Career Awareness, Exploration, and Preparation Content Area: 21<sup>st</sup> Century Life and Careers Strand C: Career Preparation

- See Technology & Career Readiness & 21st Century Skills Standards Curriculum Appendix

### Career & Technical Education Content Area: 21<sup>st</sup> Century Life and Careers Standards

- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
- 9.3.12.ED.1 - Apply communication skills with students, parents and other groups to enhance learning and a commitment to learning.
- 9.3.12.AR.4 Analyze the legal and ethical responsibilities required in the arts, audio/visual technology and communications workplace.
- 9.3.12.AR.5 Describe the career opportunities and means to achieve those opportunities in each of the Arts, A/V Technology & Communications Career Pathways.
- 9.3.12.AR.6 Evaluate technological advancements and tools that are essential to occupations within the Arts, A/V Technology & Communications Career Cluster.

### **Unit 4: Definite and Indefinite Loops**

#### Enduring Understanding

1. Repetition of valuable code is important for efficiency and organization.
2. Using loops and repetition in coding is important for writing programs with real world applications.
3. Knowing when to use a definite loop and when to use an indefinite loop is an important skill in computer programming.

#### Essential Question(s)

1. What is the proper format when writing a For Next Loop?
2. How do you calculate the number of iterations?
3. How can you make a user controlled loop?
4. Why are For Next Loops called definite loops?
5. What are indefinite loops and how are they helpful for re-prompting the user?
6. What are the differences between Do Until loops and Do While loops?
7. What are the differences between a pre-test loop and a post-test loop?
8. What is the proper syntax and what are applications for nested loops?

#### Learning Objectives

1. To use appropriate and proper syntax for For Next loops.
2. Create user controlled loops that involve a user determined number of iterations.
3. Use both Do Until loops and Do While loops for appropriate re-prompting situations.
4. Use both Do Until loops and Do While loops for programming projects that involve indefinite situations.
5. Know the difference and the usefulness of both pre-test and post-test loops.
6. Write programs that involve nested definite and indefinite loops.

### New Jersey Student Learning Standards

- **HSF.LE.A.1** - Distinguish between situations that can be modeled with linear functions and with exponential functions.
- **HSF.LE.A.2** - Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- **HSF.LE.A.3** - Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
- **HSF.LE.B.5** - Interpret the parameters in a linear or exponential function in terms of a context.

### Suggested Activities/Modifications

*All lab assignments can be enhanced and/or modified. For example, the ABC Plumbing lab, which asks students to pay as many employees based on a requested number of hours and hourly pay rate until the given budget is exceeded, can be enhanced for gifted and talented students to include a user option prompting the user for a requested monthly budget. The same lab can be modified for at risk students, students with disabilities, and ELL students, to be done in stages. First, compute only the regular pay and overtime pay for each employee, and then write additional code to find the gross pay for each employee, followed by a comparison to see if the budget has been exceeded.*

1. For Next Loop Mini Labs #1-5
2. Nested For Next Loop Mini Labs #1-3
3. Do Until Mini Labs #1-5
4. ABC Plumbing Lab
5. Digital Sum and Product Lab
6. Do While Mini Labs #1-8

### New Jersey Student Learning Standards - Technology

- 8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.
  - 8.1.8.E.1 - Gather and analyze findings using data collection technology to produce a possible solution for a content-related or real-world problem.
- 8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.
  - 8.2.12.E.2 Analyze the relationships between internal and external computer components.
  - 8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
  - 8.2.12.E.4 Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).

### Career Readiness Practices

- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.

## 9.2 Career Awareness, Exploration, and Preparation Content Area: 21<sup>st</sup> Century Life and Careers

### Strand C: Career Preparation

- See Technology & Career Readiness & 21st Century Skills Standards Curriculum Appendix

### Career & Technical Education Content Area: 21<sup>st</sup> Century Life and Careers Standards

- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
- 9.3.12.ED.1 - Apply communication skills with students, parents and other groups to enhance learning and a commitment to learning.
- 9.3.12.AR.4 Analyze the legal and ethical responsibilities required in the arts, audio/visual technology and communications workplace.
- 9.3.12.AR.5 Describe the career opportunities and means to achieve those opportunities in each of the Arts, A/V Technology & Communications Career Pathways.
- 9.3.12.AR.6 Evaluate technological advancements and tools that are essential to occupations within the Arts, A/V Technology & Communications Career Cluster.

## **Unit 5: Arrays**

### Enduring Understanding

1. Arrays allow code to be more efficient and reduce the number of variables used.
2. Using arrays in coding is important for writing programs with real world applications.
3. Arrays have many similarities to concepts students have learned in their math classes, such as matrices and subscripted variables.

### Essential Question(s)

1. What is an array and how is it used in programming?
2. Why is an array an efficient programming tool?
3. How do you access the entire array using loops?
4. How can arrays be used to solve real-world problems?

### Learning Objectives

1. Define one dimensional array.
2. Write the code that declares an array.
3. Write the code that allows user input into each element of the array using loops.
4. Use loops to perform manipulate or perform calculations on each element of the array.
5. Write the code that outputs each element of an array to a textbox by using loops.

6. Use arrays in code to solve real world problems.

#### New Jersey Student Learning Standards

- **HSF.LE.A.1** - Distinguish between situations that can be modeled with linear functions and with exponential functions.
- **HSF.LE.A.2** - Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- **HSF.LE.A.3** - Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
- **HSF.LE.B.5** - Interpret the parameters in a linear or exponential function in terms of a context.

#### Suggested Activities/Modifications

*All lab assignments can be enhanced and/or modified. For example, the Gradebook program, which asks students to calculate the class average and to find the class minimum and maximum scores, can be enhanced for gifted and talented students to include a user option for computing additional statistics such as median, mode, and standard deviation. The same lab can be modified for at risk students, students with disabilities, and ELL students, to be done in stages. First, compute only the class average for a small class size, and then write additional code to find the class average based on a user given class size, followed by the code to find the class minimum and maximum scores excluding non-present students.*

1. Gradebook Program
2. Single Array Lab Mini Labs #1-3

#### New Jersey Student Learning Standards - Technology

- 8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.
  - 8.1.8.E.1 - Gather and analyze findings using data collection technology to produce a possible solution for a content-related or real-world problem.
  - 8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.
    - 8.2.12.E.2 Analyze the relationships between internal and external computer components.
      - 8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
      - 8.2.12.E.4 Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).

#### Career Readiness Practices

- CRP2. Apply appropriate academic and technical skills.

- CRP4. Communicate clearly and effectively and with reason.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.

## 9.2 Career Awareness, Exploration, and Preparation Content Area: 21<sup>st</sup> Century Life and Careers Strand C: Career Preparation

- See Technology & Career Readiness & 21st Century Skills Standards Curriculum Appendix

### Career & Technical Education Content Area: 21<sup>st</sup> Century Life and Careers Standards

- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
- 9.3.12.ED.1 - Apply communication skills with students, parents and other groups to enhance learning and a commitment to learning.
- 9.3.12.AR.4 Analyze the legal and ethical responsibilities required in the arts, audio/visual technology and communications workplace.
- 9.3.12.AR.5 Describe the career opportunities and means to achieve those opportunities in each of the Arts, A/V Technology & Communications Career Pathways.
- 9.3.12.AR.6 Evaluate technological advancements and tools that are essential to occupations within the Arts, A/V Technology & Communications Career Cluster.

## **Unit 6: Timers/Movement**

### Enduring Understanding

1. Timers allow students to create realistic applications that resemble games, stopwatches and screen savers.
2. Using timers in coding is important for writing programs with real world applications.
3. Timers have many similarities to programming concepts students have learned earlier in the semester, such as definite and indefinite loops.

### Essential Question(s)

1. What are timers and what is their purpose?
2. How do we use the enabled and interval properties of timers?
3. How can timers be used to create movement of various controls?
4. What are some additional uses for timers and how can they be used in real world applications?

### Learning Objectives

1. Define timer and identify properties of timers.
2. Write the code that enables a timer.
3. Write the code that uses timers to create movement of various controls.
4. Use timers to create a primitive game-like application.
5. Identify how timers can be used in other real-world applications.

### New Jersey Student Learning Standards

- **HSF.LE.A.1** - Distinguish between situations that can be modeled with linear functions and with exponential functions.
- **HSF.LE.A.2** - Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- **HSF.LE.A.3** - Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
- **HSF.LE.B.5** - Interpret the parameters in a linear or exponential function in terms of a context.

### Suggested Activities/Modifications

*All lab assignments can be enhanced and/or modified. For example, the Game lab, which allows students to create a primitive game application, can be enhanced for gifted and talented students by asking students to incorporate all five timer/movement concept into one program. The same lab can be modified for at risk students, students with disabilities, and ELL students, to be done in stages by asking students to create the code for five separate smaller applications, one for each concept learned.*

1. Timers/Movement Mini Labs #1-5
2. Timers/Movement Game Lab

### New Jersey Student Learning Standards - Technology

- 8.1.8.A.5 - Select and use appropriate tools and digital resources to accomplish a variety of tasks and to solve problems.
  - 8.1.8.E.1 - Gather and analyze findings using data collection technology to produce a possible solution for a content-related or real-world problem.
  - 8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.
  - 8.2.12.E.2 Analyze the relationships between internal and external computer components.
  - 8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
  - 8.2.12.E.4 Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).

### Career Readiness Practices

- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.

- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.

## 9.2 Career Awareness, Exploration, and Preparation Content Area: 21<sup>st</sup> Century Life and Careers

### Strand C: Career Preparation

- See Technology & Career Readiness & 21st Century Skills Standards Curriculum Appendix

### Career & Technical Education Content Area: 21<sup>st</sup> Century Life and Careers Standards

- 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
- 9.3.12.ED.1 - Apply communication skills with students, parents and other groups to enhance learning and a commitment to learning.
  - 9.3.12.AR.4 Analyze the legal and ethical responsibilities required in the arts, audio/visual technology and communications workplace.
  - 9.3.12.AR.5 Describe the career opportunities and means to achieve those opportunities in each of the Arts, A/V Technology & Communications Career Pathways.
  - 9.3.12.AR.6 Evaluate technological advancements and tools that are essential to occupations within the Arts, A/V Technology & Communications Career Cluster.

## **V. Course Materials**

Microsoft Visual Studio CD

Microsoft Visual Studio Tutorial

Various Online Resources/Websites

The Visual Basic.Net Coach – by Jeff Salvage

An Introduction to Programming Using Visual Basic.Net – Fifth Edition by David I. Schneider

## **VI. Assessments**

Labs

Quizzes

Programming Projects

Final Exam

## **VII. Cross Curricular Aspects**

Programming problems relate to many different real world topics. Students can integrate concepts from math, science, business, art, and many other subjects they are interested in. Many programs students write use concepts and topics they have learned in their Algebra 1 course, as well as math topics they are currently learning in their subsequent math courses. In addition, programming projects that are developed in this course can be discussed further in the Personal Financial Literacy course. Students can discuss the business and marketing aspects of creating using friendly and useful applications.