

**PROGRAM CONCENTRATION: Business & Computer Science**  
**CAREER PATHWAY: Computing**  
**COURSE TITLE: Beginning Programming**

The major goal of this course is for students to develop the computer science skills of algorithm development, problem solving, and programming. While the emphasis of the course will be on programming, students will also be introduced to other important topics, such as careers, the limits of computing and the difference between interpreters and compilers.

**CAREERS**

Students will explore careers in the field of computing.

**BCS-BP-1. Students will explore careers in computing.**

- a. Describe the daily tasks and responsibilities of a professional in the field of computing.
- b. Compare and contrast the top jobs in computing.
- c. Explore careers that combine computing with another field.

***Academic Standards:***

*ELA11W2 The student demonstrates competence in a variety of genres.*

*ELA11W3 The student uses research and technology to support writing.*

*ELA11LSV1 The student participates in student-to-teacher, student-to-student, and group verbal interactions.*

**Sample Task**

Job shadow a professional in the field of computing

**HARDWARE AND SOFTWARE COMPONENTS**

Students will demonstrate an understanding of the relationship between hardware and software in program execution.

**BCS-BP-2. Students will describe the major parts of a processor and how the processor handles execution of a machine language program.**

- a. List and describe the function of the major components of the processor (ALU, registers, program counter, etc).
- b. Describe the steps in the execution of a simple assembler program.
- c. Choose an assembler program that is equivalent to a small high-level program.

- d. Solve simple binary arithmetic problems.
- e. Explain the interaction between the operating system and the processor.

**Academic Standards:**

*MM3P4 Students will make connections among mathematical ideas and to other disciplines.*

*ELA11W1 The student produces writing that establishes an appropriate organizational structure, sets a context and engages the reader, maintains a coherent focus throughout, and signals a satisfying closure.*

*ELA11LSV1 The student participates in student-to-teacher, student-to-student, and group verbal interactions.*

**BCS-BP-3. Students will explain the process that turns a high-level language program into something a computer can execute.**

- a. Explain the purpose of a compiler, interpreter, and assembler.
- b. Compare and contrast a compiler and an interpreter and specify languages that use each.
- c. Compare and contrast high-level and low-level languages for different uses.

**BCS-BP-4. Students will explore different representations of images and music in a computer.**

- a. Explain the difference between bitmapped and vector-based representations of images.
- b. Explain the difference between MIDI and sampled sound representations of music.
- c. Write a program to modify a bitmapped image and/or sampled sound.

**Academic Standards:**

*MM4A10 Students will understand and use vectors.*

*ELA11W2 The student demonstrates competence in a variety of genres.*

*ELA11LSV1 The student participates in student-to-teacher, student-to-student, and group verbal interactions.*

Sample Tasks:

- Read <http://computer.howstuffworks.com/microprocessor3.htm> on how microprocessors work. Role-play the parts of a processor and the execution of a simple machine language program.

- Complete the lessons at [http://www97.intel.com/discover/JourneyInside/TJI\\_DigitalInfo\\_lesson4/default.aspx](http://www97.intel.com/discover/JourneyInside/TJI_DigitalInfo_lesson4/default.aspx) on binary numbers and [http://www97.intel.com/discover/JourneyInside/TJI\\_DigitalInfo\\_lesson5/default.aspx](http://www97.intel.com/discover/JourneyInside/TJI_DigitalInfo_lesson5/default.aspx) on adding binary numbers and complete the activity on adding binary numbers.
- Change all positive values in a sound to the maximum positive value and all negative values in a sound to the maximum negative value.
- Reverse a sound.
- Write a program that mirrors the left side of a picture onto the right side.

### **PROBLEM SOLVING**

Students will practice the application of problem-solving strategies to develop and increase logical thinking skills.

#### **BCS-BP-5. Students will design algorithms and programming solutions for a variety of computational problems.**

- a. Apply, test, analyze, and adjust problem-solving algorithms.
- b. Design, test, analyze, and adjust coding solutions based on problem-solving algorithms.
- c. Analyze and discuss coding solutions for elements of thoroughness and correctness.
- d. Describe how recursion can be used to solve a problem.

#### ***Academic Standards:***

*SCSh3 Students will identify and investigate problems scientifically.*

*MM3P1. Students will solve problems (using appropriate technology).*

*ELA11W1 The student produces writing that establishes an appropriate organizational structure, sets a context and engages the reader, maintains a coherent focus throughout, and signals a satisfying closure.*

*ELA11W2 The student demonstrates competence in a variety of genres.*

*ELA11LSV1 The student participates in student-to-teacher, student-to-student, and group verbal interactions.*

### **PROGRAMMING**

Students will use basic programming techniques to design, implement, and solve simple problems using an object-oriented programming language.

**BCS-BP-6. Students will design solutions for simple programs using basic programming techniques and constructs.**

- a. Implement techniques such as conditional statements, iterative statements, and variables to solve simple problems.
- b. Utilize basic mathematical expressions to solve simple problems.
- c. Use arrays and lists where appropriate.
- d. Comment programs to aid program readability.
- e. Test and debug simple programs.
- f. Analyze and explain simple programs involving fundamental programming constructs.

**Academic Standards:**

*ELA11W1 The student produces writing that establishes an appropriate organizational structure, sets a context and engages the reader, maintains a coherent focus throughout, and signals a satisfying closure.*

*ELA11W2 The student demonstrates competence in a variety of genres.*

**BCS-BP-7. Students will use and develop algorithms to solve simple problems.**

- a. Develop algorithms to solve simple problems using psuedocode and/or flowcharts.
- b. Interpret algorithms expressed in psuedocode and/or flowcharts to code solutions to simple problems.
- c. Discuss the importance of algorithms in problem solving.
- d. Identify properties of well-written algorithms in solving problems.
- e. Interpret algorithms to write code that will implement searching and sorting techniques.

**Academic Standards:**

*ELA11W1 The student produces writing that establishes an appropriate organizational structure, sets a context and engages the reader, maintains a coherent focus throughout, and signals a satisfying closure.*

*ELA11LSV1 The student participates in student-to-teacher, student-to-student, and group verbal interactions.*

**BCS-BP-8. Students will demonstrate knowledge of the relationships between classes.**

- a. Utilize Class, Responsibilities, and Collaborator (CRC) in problem analysis.
- b. Create UML diagrams to illustrate relationships between classes.
- c. Describe and explain the implementation of “is-a” and “has-a” relationships.

- d. Describe how using classes implements the ideas of encapsulation and information hiding.

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*ELA11LSV1 The student participates in student-to-teacher, student-to-student, and group verbal interactions.*

**DATA STRUCTURES**

Students will demonstrate the ability to process one-dimensional arrays, two-dimensional arrays, and lists. Students will choose an appropriate data structure for a given situation.

**BCS-BP-9. Students will write programs that process one-dimensional arrays.**

- a. Calculate the average of the contents of an array.
- b. Manipulate each element of an array.
- c. Manipulate a section of an array.

**Academic Standards:**

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*ELA11W2 The student demonstrates competence in a variety of genres.*

**BCS-BP-10. Students will write programs that process two-dimensional arrays.**

- a. Manipulate each element of a two-dimensional array.
- b. Manipulate a section of a two-dimensional array.
- c. Explain the difference between row major and column major two-dimensional arrays.
- d. Explain how to process an array in a row-first or column-first manner.

**Academic Standards:**

*MM3A7 Students will understand and apply matrix representations of vertex-edge graphs.*

*ELA11LSV1 The student participates in student-to-teacher, student-to-student, and group verbal interactions.*

*ELA11W1 The student produces writing that establishes an appropriate organizational structure, sets a context and engages the reader, maintains a coherent focus throughout, and signals a satisfying closure.*

*ELA11W2 The student demonstrates competence in a variety of genres.*

**BCS-BP-11. Students will write programs that process lists.**

- a. Manipulate each element of a list.
- b. Add items to a list.

**Academic Standards:**

*ELA11W1 The student produces writing that establishes an appropriate organizational structure, sets a context and engages the reader, maintains a coherent focus throughout, and signals a satisfying closure.*

*ELA11W2 The student demonstrates competence in a variety of genres.*

**BCS-BP-12. Students will demonstrate knowledge of the basics of stacks and queues.**

- a. Explain the purpose of a call stack.
- b. Describe the purpose of a printer queue.
- c. Compare and contrast stacks and queues.

Sample Tasks:

- Calculate the average of an array of student grades.
- Change the volume of a sound. To reduce the volume, multiply the sound sample by a value less than one. To increase the volume, multiply by a value greater than one.
- Set the blue value to zero for each pixel in a picture.
- Mirror a picture horizontally or vertically.
- Create a program that shows a slide show with the ability to add and remove slides from the show.
- Show the contents of the call stack for a recursive function.
- Show the contents of a printer queue after new jobs have been added and some finished.

## **LIMITS OF COMPUTING**

Students will determine how programming limits can affect business, and will recognize that there is a time hierarchy in programming.

### **BCS-BP-13. Students will discuss limits on computing as a result of programming complexity.**

- a. Determine the number of steps that a program will take to execute.
- b. Compare and contrast the speed of different algorithms.
- c. Identify the possible impact on a business when a computer programmer leaves a company.

#### ***Academic Standards:***

*ELA11W3 The student uses research and technology to support writing.*

*ELA11LSV1 The student participates in student-to-teacher, student-to-student, and group verbal interactions.*

### **BCS-BP-14. Students will identify time-related limits to computing.**

- a. Define polynomial time as it relates to computing.
- b. Define exponential time as it relates to computing.

#### **Sample Tasks:**

- Research *The Human Genome Project* and discuss its efforts to overcome computing limits.

## **CTAE Foundation Skills**

The Foundation Skills for Career, Technical and Agricultural Education (CTAE) are critical competencies that students pursuing any career pathway should exhibit to be successful. As core standards for all career pathways in all program concentrations, these skills link career, technical and agricultural education to the state's academic performance standards.

The CTAE Foundation Skills are aligned to the foundation of the U. S. Department of Education's 16 Career Clusters. Endorsed by the National Career Technical Education Foundation (NCTEF) and the National Association of State Directors of Career Technical Education Consortium (NASDCTEc), the foundation skills were developed from an analysis of all pathways in the sixteen occupational areas. These standards were identified and validated by a national advisory group of employers, secondary and postsecondary educators, labor associations, and other

stakeholders. The Knowledge and Skills provide learners a broad foundation for managing lifelong learning and career transitions in a rapidly changing economy.

**CTAE-FS-1 Technical Skills:** Learners achieve technical content skills necessary to pursue the full range of careers for all pathways in the program concentration.

**CTAE-FS-2 Academic Foundations:** Learners achieve state academic standards at or above grade level.

**CTAE-FS-3 Communications:** Learners use various communication skills in expressing and interpreting information.

**CTAE-FS-4 Problem Solving and Critical Thinking:** Learners define and solve problems, and use problem-solving and improvement methods and tools.

**CTAE-FS-5 Information Technology Applications:** Learners use multiple information technology devices to access, organize, process, transmit, and communicate information.

**CTAE-FS-6 Systems:** Learners understand a variety of organizational structures and functions.

**CTAE-FS-7 Safety, Health and Environment:** Learners employ safety, health and environmental management systems in corporations and comprehend their importance to organizational performance and regulatory compliance.

**CTAE-FS-8 Leadership and Teamwork:** Learners apply leadership and teamwork skills in collaborating with others to accomplish organizational goals and objectives.

**CTAE-FS-9 Ethics and Legal Responsibilities:** Learners commit to work ethics, behavior, and legal responsibilities in the workplace.

**CTAE-FS-10 Career Development:** Learners plan and manage academic-career plans and employment relations.

**CTAE-FS-11 Entrepreneurship:** Learners demonstrate understanding of concepts, processes, and behaviors associated with successful entrepreneurial performance.