GEORGIA | PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

BUSINESS & COMPUTER SCIENCE

PATHWAY: Computing

COURSE: Intermediate Programming

UNIT: 4-Data Structures (Arrays, Lists, Stacks, Queues)

# INTRODUCTION

**Annotation:** The purpose of this unit is to introduce students to using data structures in programming. The focus is to build skills that enable students to choose the appropriate data structures given a problem specification. Methods will include demonstration, lecture, discussion, and independent work time.

**Grade(s):**

| | |
|---|---|
| X | 9th |
| X | 10th |
| X | 11th |
| X | 12th |

**Time:** 6 weeks (based on a 50 minute class period)

**Author:** Jason Naile

**Additional Author(s):**

**Students with Disabilities:**

For students with disabilities, the instructor should refer to the student's IEP to be sure that the accommodations specified are being provided. Instructors should also familiarize themselves with the provisions of Behavior Intervention Plans that may be part of a student's IEP. Frequent consultation with a student's special education instructor will be beneficial in providing appropriate differentiation.

# FOCUS STANDARDS

## GPS Focus Standards:

**BCS-IP-9** Students will apply their knowledge of arrays and lists.

a. Choose between an array and a list for representing data in a variety of contexts.

b. Create one- and two-dimensional arrays of the correct size for a variety of problems.

c. Describe how elements are removed and added to a list.

d. Implement common searching and sorting algorithms for arrays.

**BCS-IP-10** Students will demonstrate an understanding of stacks and queues.

a. Use stacks and queues to solve a variety of problems.

b. List common uses of stacks and queues.

c. Explain the function of an event queue.

## GPS Academic Standards:

**ELA12W1** 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.

**ELA12W2** The student demonstrates competence in a variety of genres.

**ELA12W3** The student uses research and technology to support writing.

**ELA12LSV1** The student participates in student-to-teacher, student-to-student, and group verbal interactions.

## National Standards:

# UNDERSTANDINGS & GOALS

**Enduring Understandings:**

- At the conclusion of this unit, students will be familiar with and able to identify data structure use in programming. Given a problem specification, students will be able to choose the appropriate data structure to use. Also, students will be able to implement sorting and searching techniques on arrays. Finally, students will be able to recognize, create, and explain the purpose of using stacks and queues.

**Essential Questions:**

- What are stacks and queues?
- What are the common uses of stacks and queues?
- What are one and two-dimensional arrays?
- How is the appropriate data structure chosen to represent a list?
- How are items added to arrays and lists?
- What are searching and sorting algorithms?

**Knowledge from this Unit:**

- Students will use stacks and queues to solve problems.
- Students will list the common uses of stacks and queues.
- Students will implement one and two-dimensional arrays in programs.
- Students will choose the appropriate data structure to represent a list.
- Students will compare and contrast the process for adding items to arrays and lists.
- Students will implement searching and sorting algorithms.

**Skills from this Unit:**

# ASSESSMENT(S)

**Assessment Method Type:** Select one or more of the following. Please consider the type(s) of differentiated instruction you will be using in the classroom.

_____ Pre-test
_____ Objective assessment - multiple-choice, true- false, etc.
__ Quizzes/Tests
__ Unit test
_____ Group project
_____ Individual project
_____ Self-assessment - May include practice quizzes, games, simulations, checklists, etc.
__ Self-check rubrics
__ Self-check during writing/planning process
__ Journal reflections on concepts, personal experiences and impact on one's life
__ Reflect on evaluations of work from teachers, business partners, and competition judges
__ Academic prompts
__ Practice quizzes/tests
_X_ Subjective assessment/Informal observations
__ Essay tests
__ Observe students working with partners
_x_ Observe students role playing
_____ Peer-assessment
__ Peer editing & commentary of products/projects/presentations using rubrics
__ Peer editing and/or critiquing
_____ Dialogue and Discussion
__ Student/teacher conferences
__ Partner and small group discussions
__ Whole group discussions
__ Interaction with/feedback from community members/speakers and business partners
_____ Constructed Responses
__ Chart good reading/writing/listening/speaking habits
__ Application of skills to real-life situations/scenarios
_____ Post-test

**Assessment(s) Title:** **Student observation**

**Assessment(s) Description/Directions:**

Throughout the unit the teachers should observe students on a daily basis to ensure mastery of concepts. Quizzes can also be used as needed.

**Attachments for Assessment(s):**

# LEARNING EXPERIENCES

**Instructional planning: Include lessons, activities and other learning experiences in this section with a brief description of the activities to ensure student acquisition of the knowledge and skills addressed in the standards. Complete the sequence of instruction for each lesson/task in the unit.**

## Sequence of Instruction

1. **Identify the Standards. Standards should be posted in the classroom for each lesson.**

   **BCS-IP-9** Students will apply their knowledge of arrays and lists.

   **BCS-IP-10** Students will demonstrate an understanding of stacks and queues.

2. **Review Essential Questions.**

   - What are stacks and queues?
   - What are the common uses of stacks and queues?
   - What are one and two-dimensional arrays?
   - How is the appropriate data structure chosen to represent a list?
   - How are items added to arrays and lists?
   - What are searching and sorting algorithms?

3. **Identify and review the unit vocabulary.**

4. **Assessment Activity.**

**Sequence of Instruction and Learning:**

Week 1: Arrays
Week 2: Two-Dimensional Arrays & Lists
Week 3: Sorting and Searching Algorithms
Week 4: Sorting and Searching Algorithms
Week 5: Stacks and Queues
Week 6: Stacks and Queues, Unit Performance Task

**Attachments for Learning Experiences:** Please list.

## Notes & Reflections:

- Students should be provided with sufficient practice on using data structures prior to the unit performance task. If Unified Modeling Language (UML) diagrams were not covered prior to the unit, it should be embedded within this unit.

# CULMINATING PERFORMANCE TASK (Optional)

**Culminating Unit Performance Task Title:** **Rentals R' Us Video Rental System**

**Culminating Unit Performance Task Description/Directions/Differentiated Instruction:**

Students will use their programming and design skills to build a system that will rent, sell, and manage movies at a local movie rental store. Students will be responsible for designing and programming the system. The program's focus should be on the proper use of data structures.

**Attachments for Culminating Performance Task:**

**Rubric for Performance Task:**

**Name:**_____

## Rentals R' Us Video Rental System

You have been hired as a consultant to create a system for small movie rental store in the area *Rentals R' Us*. Currently the business tracks their movies using a spreadsheet in Microsoft Excel. As a consultant you have complete and total control over the design decisions. Thus, your task is to create a prototype of a program that uses multiple classes to track the rentals and sales of the movie. A few guidelines are below.

- For the purposes of this project you do not have to link the program do a database.
- The user should be allowed perform four major functions.
  - 1) Add movies to the collection
  - 2) Rent movies
  - 3) Check in movies
  - 4) Sell movies
- Before programming create a UML diagram to show the relationships between the classes.
- The user interface should be a GUI.

| Task/Point Value | Incomplete | Needs Improvement | Satisfactory | Excellent | Points Earned |
|---|---|---|---|---|---|
| **Documentation/ Comments** | No documented or comments are used (0) | Documentation or comments are not present (.5) | Documentation/comments are present but do not explain code (1) | Document ation and comments are used properly (1) | |
| **Program accomplishes four main functions** | No main functions are included (0) | Only one main function can be performed (1) | Two main functions can be performed (2) | All functions can be performed (4) | |
| **Movies are stored using an appropriate Data Structure** | No data structure is included (0) | Data structure is used but may or may not be appropriate (2) | | Appropriat e data structure is used (4) | |
| **UML Diagram** | No UML diagram is provided (0) | UML is provided but does not reflect design of system (1) | UML is provided and mostly reflects design of the system (2) | UML is provide and reflects design of the system (4) | |
| **Proper style/convention s used** | Proper style/conven tions are not used(0) | Proper style/conventions are used most of the time (1) | | All style/conv entions are followed (2) | |
| | | | | **Total Points** | |

**Web Resource Title:** Gliffy.com

**Web Resource Description:** A website will be used to create collaborate and design flowcharts. This is a Web 2.0 tool that is free.

**Web Resource:** http://www.gliffy.com/

# UNIT RESOURCES

## Web Resources:

## Attachment(s):

## Materials & Equipment:

Computer

Internet connection

Microsoft PowerPoint

Gliffy.com (for UML Diagram)

Java Software Development Kit (SDK)

Java Integrated Development Environment (Blue J, Eclipse, Dr. Java, etc.)

Network storage space

Projector

## What 21st Century Technology was used in this unit:

| | | | | | |
|---|---|---|---|---|---|
| X | Slide Show Software | | Graphing Software | | Audio File(s) |
| | Interactive Whiteboard | | Calculator | | Graphic Organizer |
| X | Student Response System | X | Desktop Publishing | X | Image File(s) |
| | Web Design Software | | Blog | X | Video |
| | Animation Software | | Wiki | | Electronic Game or Puzzle Maker |
| | Email | X | Website | | |