GEORGIA | PEACH STATE PATHWAYS

Career, Technical, & Agricultural Education

BUSINESS & COMPUTER SCIENCE

PATHWAY: Computing

COURSE: Intermediate Programming

UNIT: 1-Hardware and Software Components

INTRODUCTION

Annotation:

Grade(s):

	9th
X	10th
	11th
	12th

Time: 15 hours (3 weeks)

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-1 Students will apply knowledge of hardware and software components.

a. Explain how Boolean logic is related to computer hardware.

b. Explain how a computer monitor displays text and images.

c. Explain how a graphical button is displayed and how it knows when it has been pushed.

BCS-IP-2 Students will apply knowledge of high-level program execution.

a. Build an interpreter that executes a simple language.

b. Build a compiler that translates one simple language to another.

GPS Academic Standards:

ELA12W2 The student demonstrates competence in a variety of genres.

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

National Standards:

UNDERSTANDINGS & GOALS

Enduring Understandings:

- After completing this unit, students will be able to apply Boolean logic in relation to computer hardware. Students will also be able to explain how a computer monitor displays text and images. Additionally, students will apply knowledge of high level program execution.

Essential Questions:

- What is a logic gate?
- What are truth tables and how are they solved?
- What is Boolean logic?
- What is an interpreter used for?
- What is a compiler?

Knowledge from this Unit:

- Students will be able to apply knowledge of hardware and software components.

- Students will be able to simulate a logic gate.
- Students will be able to solve truth tables.
- Students will be able to explain how Boolean logic is related to computer hardware.
- Students will code an interpreter that executes a simple language.
- Students will program a compiler that translates one simple language to another.

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
_X_ 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
_____ Subjective assessment/Informal observations
__ Essay tests
__ Observe students working with partners
__ Observe students role playing
_____ Peer-assessment
__ Peer editing & commentary of products/projects/presentations using rubrics
__ Peer editing and/or critiquing
_x_ Dialogue and Discussion
_x_ 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: **Build a Compiler**

Assessment(s) Description/Directions:

Prior to the unit performance task, teachers should monitor student progress and ensure that they are progressing sufficiently. The instructor should conduct short conversations with students to make sure

the use of Boolean logic is understood. For this assessment, students should build a compiler that translates from one simple language to another.

Attachments for Assessment(s):

Web Resource Title: How Stuff Works-Boolean Logic

Web Resource Description: This web resource provides a good introduction to Boolean algebra (a main theme in this unit).

Web Resource: http://www.howstuffworks.com/boolean.htm

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-1 Students will apply knowledge of hardware and software components.

   a. Explain how Boolean logic is related to computer hardware.

   b. Explain how a computer monitor displays text and images.

   c. Explain how a graphical button is displayed and how it knows when it has been pushed.

   BCS-IP-2 Students will apply knowledge of high-level program execution.

   a. Build an interpreter that executes a simple language.

   b. Build a compiler that translates one simple language to another.

2. **Review Essential Questions.**
   - What is a logic gate?
   - What are truth tables and how are they solved?
   - What is Boolean logic?
   - What is an interpreter used for?
   - What is a compiler?
3. **Identify and review the unit vocabulary.**
4. **Assessment Activity.**

Week 1: Boolean algebra, Logic Gates, Truth Tables

Week 2: High Level Program Execution

Week 3: High Level Program Execution, Performance Task

Attachments for Learning Experiences: Please list.

Notes & Reflections:

CULMINATING PERFORMANCE TASK (Optional)

Culminating Unit Performance Task Title: **Complete the Truth Tables and Logic Gates**

Culminating Unit Performance Task Description/Directions/Differentiated Instruction:

A short performance task where students have the opportunity to complete a truth table and work with Boolean algebra and logic gates.

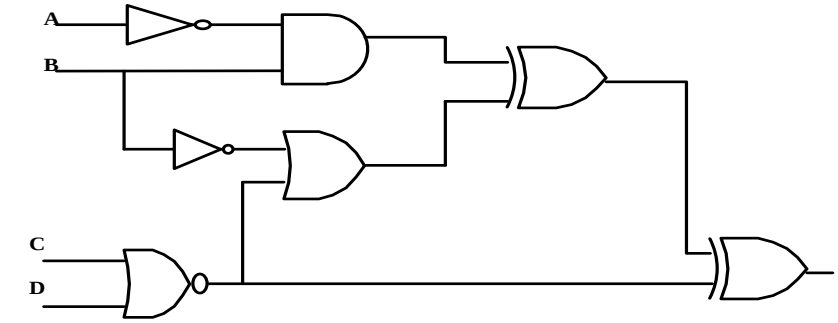
Attachments for Culminating Performance Task:

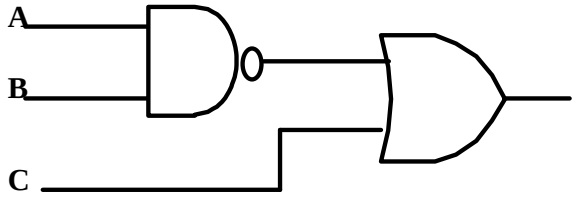
Rubric for Performance Task:

Performance Task

Directions: Complete the following problems. Each question is worth 20 points.

1. Find all ordered 4-tuples (*A, B, C, D*), which make the following circuit **FALSE**:





3. Simplify the following expression as much as possible:

$$\overline{\overline{A}(A+B)+B\overline{A}}$$

4. Find all ordered pairs (A, B) that make the following expression TRUE.

$$\overline{\overline{A+B}+\overline{A}*B}$$

5. Simplify the following expression to one that uses only two operators.

$$(\overline{\overline{A}+\overline{B}}*\overline{C})+(A*\overline{(B+\overline{C})})$$

Grading Rubric

Answers	**Points Earned**
5 questions correct- work is shown	100
5 questions correct – no work shown	90
4 questions correct – work is shown	85
4 questions correct – no work is shown	80
3 questions correct – work is shown	75
3 questions correct – no work is shown	70
2 questions correct – work is shown	60
<2 questions correct	50

Boolean Logic Answer Sheet

1. The circuit translates to the following Boolean expression:

$$(\overline{C+D}+\overline{B})\oplus(\overline{A}B)\oplus(\overline{C+D})$$

The following table has the following headings: H1 is $\overline{(C+D)}$, H2 is H1+ $\overline{B}$, H3 is $\overline{A}B$, H4 is H2⊕H3 and H5 is H4⊕H1, the final expression.

A	B	C	D	H1	H2	H3	H4	H5
0	0	0	0	1	1	0	1	0
0	0	0	1	0	1	0	1	1
0	0	1	0	0	1	0	1	1
0	0	1	1	0	1	0	1	1
0	1	0	0	1	1	1	0	1
0	1	0	1	0	0	1	1	1
0	1	1	0	0	0	1	1	1
0	1	1	1	0	0	1	1	1
1	0	0	0	1	1	0	1	0
1	0	0	1	0	1	0	1	1
1	0	1	0	0	1	0	1	1
1	0	1	1	0	1	0	1	1
1	1	0	0	1	1	0	1	0
1	1	0	1	0	0	0	0	0
1	1	1	0	0	0	0	0	0
1	1	1	1	0	0	0	0	0

Thus, the 4-tuples (0,0,0,0), (1,0,0,0), (1,1,0,0), (1,1,0,1), (1,1,1,0), and (1,1,1,1) all make the circuit **FALSE**.

2. The circuit translates to the following Boolean expression: $\overline{AB}+C$. To find when this is **FALSE** we can equivalently find when the $\overline{\overline{AB}+C}$ is **TRUE**. We can simplify this by applying DeMorgan's Law and canceling the double *not* over *AB* to yield $AB\overline{C}$. This is **TRUE** when all three terms are **TRUE**, which happens for (1, 1, 0).

3. The expression simplifies as follows:

$$\overline{\overline{A(A+B)}+B\overline{A}} = \overline{\overline{A(A+B)}}*\overline{B*\overline{A}}$$
$$= A(A+B)*(\overline{B}+A)$$
$$= (A+AB)(\overline{B}+A)$$
$$= A(1+B)(\overline{B}+A)$$
$$= A(1)(\overline{B}+A)$$
$$= A(\overline{B}+A)$$
$$= A\overline{B}+AA$$

$= A\overline{B} + A$

$= A(\overline{B} + 1)$

$= A(1) = A$

4.

$\overline{A + B} + \overline{A} * B = (\overline{\overline{A + B}})(\overline{\overline{A}B})$

$= (A + B)(A + \overline{B})$

$= AA + A\overline{B} + BA + B\overline{B}$

$= A + A(B + \overline{B}) + 0$

$= A + A(1) = A + A = A$

This yields the solutions (1, 0) and (1, 1). This problem, like most Boolean algebra problems, could also be solved by drawing a truth table with the following seven column headings: A, B, A+B, $\overline{\mathrm{A} + \mathrm{B}}, \overline{\mathrm{A}}\mathrm{B}, \overline{\mathrm{A} + \mathrm{B}} + \overline{\mathrm{A}}\mathrm{B}, \overline{\overline{\mathrm{A} + \mathrm{B}} + \overline{\mathrm{A}}\mathrm{B}}$.

5. The evaluation is as follows:

$(\overline{\overline{A} + \overline{B}} * \overline{C}) + (A * \overline{(B + \overline{C})})$

$= (A * B * \overline{C}) + (A * \overline{B} * C)$

$= A * (B * \overline{C} + \overline{B} * C)$

$= A * (B \oplus C)$

To realize this equation as a circuit, two gates are used: an XOR (input is B and C) and an AND (inputs are A and the output of the XOR gate). The output of the AND is the output of the circuit.

UNIT RESOURCES

Web Resources:

Attachment(s):

Materials & Equipment:

Computer

Internet

Java 5.0 Software Development Kit (SDK)

Java Integrated Development Environment (IDE) Examples: Dr. Java, Blue J, Eclipse

Network storage space

What 21st Century Technology was used in this unit:

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