Theme
Why is selection a necessary part of programming languages?
STEM Innovation Academy Unit 3

Subject: AP Computer Science A Unit Title: Boolean Expressions and if Statements Grade: 11	Teacher: Joyce Okoth Duration: 3 weeks

Summary of Unit

Algorithms are composed of three building blocks: sequencing, selection, and iteration. This unit focuses on selection, which is represented in a program by using conditional statements. Conditional statements give the program the ability to decide and respond appropriately and are a critical aspect of any nontrivial computer program. In addition to learning the syntax and proper use of conditional statements, students will build on the introduction of Boolean variables by writing Boolean expressions with relational and logical operators.

Stage 1 – Desired Results

Big Ideas:
1. **Control (CON)** How can you use different conditional statements to write a pick-your-own-path interactive story?

Enduring Understandings:
CON-1 The way variables and operators are sequenced and combined in an expression determines the computed result.
CON-2 The way variables and operators are sequenced and combined in an expression determines the computed result.

Learning Objectives:
CON-1.E Evaluate Boolean expressions that use relational operators in program code.
CON-1.F Evaluate compound Boolean expressions in program code.
CON-1.G Compare and contrast equivalent Boolean expressions.
CON-1.H Compare object references using Boolean expressions in program code.
CON-2.A Represent branching logical processes by using conditional statements.
CON-2.B Represent branching logical processes by using nested conditional statements.

Essential Knowledge:

Lesson 1: Boolean Expressions
CON-1.E.1 Primitive values and reference values can be compared using relational operators (i.e., == and !=)..
CON-1.E.2 Arithmetic expression values can be compared using relational operators (i.e., <, >, <=, >=).
CON-1.E.3 An expression involving relational operators evaluates to a Boolean value.

Lesson 2: if Statements and Control Flow
CON-2.A.1 Conditional statements interrupt the sequential execution of statements.
CON-2.A.2 if statements affect the flow of control by executing different statements based on the value of a Boolean expression.
CON-2.A.3 A one-way selection (if statement) is written when there is a set of statements to execute under a certain condition. In this case, the body is executed only when the Boolean condition is true.

Lesson 3: `if-else` **Statements**
CON-2.A.4 A two-way selection is written when there are two sets of statements— one to be executed when the Boolean condition is `true`, and another set for when the Boolean condition is `false`. In this case, the body of the "`if`" is executed when the Boolean condition is `true`, and the body of the "`else`" is executed when the Boolean condition is `false`.

Lesson 4: `else if` **Statements**
CON-2.A.5 A multi-way selection is written when there are a series of conditions with different statements for each condition. Multi-way selection is performed using `if-else-if` statements such that exactly one section of code is executed based on the first condition that evaluates to true.

Lesson 5: Compound Boolean Expressions
CON-1.F.1 Logical operators `!`(not), `&&`(and), and `||`(or) are used with Boolean values. This represents the order these operators will be evaluated.
CON-1.F.2 An expression involving logical operators evaluates to a Boolean value.
CON-1.F.3 When the result of a logical expression using `&&` or `||` can be determined by evaluating only the first Boolean operand, the second is not evaluated. This is known as short-circuited evaluation.
CON-2.B.1 Nested `if` statements consist of `if` statements within `if` statements.

Lesson 6: Equivalent Boolean Expressions
CON-1.G.1 De Morgan's Laws can be applied to Boolean expressions.
CON-1.G.2 Truth tables can be used to prove Boolean identities.
CON-1.G.3 Equivalent Boolean expressions will evaluate to the same value in all cases.

Lesson 7: Comparing Objects
CON-1.H.1 Two object references are considered aliases when they both reference the same object.
CON-1.H.2 Object reference values can be compared, using `==` and `!=`, to identify aliases.
CON-1.H.3 A reference value can be compared with `null`, using `==` or `!=`, to determine if the reference actually references an object.
CON-1.H.4 Often classes have their own `equals` method, which can be used to determine whether two objects of the class are equivalent.

Computational Thinking Practices (Skills)
2.B Code Logic Determine the result or output based on statement execution order in a code segment without method calls
3.C Code Implementation Write program code to satisfy method specifications using expressions, conditional statements, and iterative statements.
4.A Code Testing Use test-cases to find errors or validate results.
4.C Code Testing Determine if two or more code segments yield equivalent results.

Stage 2 – Assessment Evidence

Performance Task(s):
Programming assignments:
1. Camp Director
2. Age Conditionals

Authentic Experiences:
codeHS.com assignments and projects
Optional assignments and resources
Lesson 1: Practice-It!: BJP4 Chapter 4: Conditional Execution—Self- Check 4.2
Lesson 2: 2017 AP Computer Science A Exam Free-Response Question #1, Part A (Phrase)
Lesson 3: Runestone Academy: AP CSA—Java Review:5.1—Conditionals
Lesson 4: Runestone Academy: AP CSA—Java Review:5.2—Three or More Options
Lesson 5: Runestone Academy: AP CSA—Java Review:5.3—Complex Conditionals
Lesson 6: Runestone Academy: AP CSA—Java Review:5.5—De Morgan's Laws

Benchmark Assessment:
End of Unit Exam (Selected questions)

Unit Progress checks:
College Board AP classroom
Personal Progress Check 3
Multiple-choice: ~20 questions
Free-response: 2 questions

See link for materials mentioned above: https://tinyurl.com/y5fcc2my

Extensions (Tier I):	**Differentiation (Tiers 2 and 3):**
• Selected assignments from Codingbat.com	• Selective grouping • Extended time • Small groups / Individual instruction • Pair programming with another student • Print out video slides for students to reference

Stage 3 – Learning Plan

Vocabulary
conditional   Block of Statements   Boolean Expression   complex conditional   DeMorgan's Laws
logical and   logical or   negation   short circuit evaluation   if (Boolean expression)   else
else if (Boolean expression)

Lessons

CodeHS Unit 3: Boolean Expressions and if Statements

8 Lessons

Expert/Field Experiences: Computer Science Professor will be invited if available

Literary Connections/Research: NEWSELA Computer Science Articles, Student project presentations