

Lesson 9: String Algorithms

45 minutes

Overview

How can I apply standard algorithms to `String`s?

Students combine their knowledge of standard algorithms and `String`s to write an algorithm to check if a `String` is a palindrome. Students implement their algorithm in Java, then apply standard algorithms to traverse `String`s find if one or more substrings has a particular property or to determine the number of substrings that meet specific criteria.

Standards

Full Course Alignment

CSA Conceptual Framework

- **CON-2** - Programmers incorporate iteration and selection into code as a way of providing instructions for the computer to process each of the many possible input values

Agenda

Warm Up (5 minutes)

Palindromic Dates

Activity (35 minutes)

Palindromes

String Algorithms

Wrap Up (5 minutes)

Glows, Grows, Want-to-Knows

Assessment: Check for Understanding

AP Classroom Topic Questions

Objectives

Students will be able to:

- Write standard algorithms to traverse `String`s

Preparation

- Create code review groups if you are not reusing the same groups
- Check the **Teacher's Lounge** for verified teachers on the CSA Forum to find additional strategies or resources shared by fellow teachers

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the students

- **U6L9 Extra Practice** - Handout

Vocabulary

- **Palindrome** - A word or phrase that reads the same backward as it does forward

Teaching Guide


Warm Up (5 minutes)

Palindromic Dates

 **Discuss:** Use the Hold That Thought strategy to discuss the prompt.

- *What do you notice about these dates?*

Discussion Goal: Students notice the dates are the same when reading forwards and backward. Students also realize that these dates are in a row.

 **Discuss:** Click through the animated slide to define palindrome and display the prompt. Use the Hold That Thought strategy to discuss the prompt.

- *Every year from 2011 to 2021 has ten consecutive palindromic dates. Can you figure those out?*

Discussion Goal: Students notice that 1-10-11 to 1-19-11 are palindromic dates, along with 2-10-12 to 2-19-21, etc.

💡 Teaching Tip

To guide students to the dates, have students think about the dates from the previous slide (1-10-11, 8-10-18, and 9-19-19). Ask students how many consecutive dates after those are also palindromes. Students should notice that from 1-10-11 to 1-19-11, only the third digit is changing. They should focus on one year before trying to do all the years to notice the pattern. Ask guiding questions, such as:


- *What is the rule for the first number? (matches the last)*
- *What is the rule for the second number? (matches the 2nd to last)*
- *What is the rule for the third number? (it can be anything because it's in the middle)*

Activity (35 minutes)

Palindromes (15 minutes)

Remarks

Now that we have seen palindromic dates, let's programmatically check if a `String` is a palindrome.


 **Do This:** Review the lesson objectives.

 **Discuss:** Use the Retrieve-Pair-Share strategy to discuss the prompts.

- *What are some different ways we can check if a `String` is a palindrome?*

Discussion Goal: Students suggest checking if the `String` is equal to the reverse of the `String`. Students may suggest comparing the first character to the last character, then the second to the second to last, etc.

Group: Place students in pairs.


 **Do This:** Have students write an algorithm to check if a `String` is equal to the reverse of the `String`.

 **Do This:** Have students compare their algorithms with another group and make revisions as needed.

String Algorithms

Remarks


In natural language processing, named entity recognition is used to identify people's name, places, or dates from text. Let's implement our algorithms to reverse a `String`, then apply other standard algorithms with `String` class methods to implement named entity recognition algorithms.

 **Do This:** Direct students to Level 1 on Code Studio to complete Levels 1, 2, and 3. Students complete a Check for Understanding on Level 1, then implement an algorithm to create a new `String` with the characters reversed and compare it to the original `String` on Level 2. On Level 3, students complete a choice level to implement an algorithm to find if one or more substrings has a particular property or to determine the number of substrings that meet specific criteria.

 1-3

String Algorithms



 **Do This:** Click through the animated slide to have students participate in the Code Review Call and Response.

 **Do This:** Direct students to complete a code review on Level 4.

 4

Code Review: String Algorithms

Wrap Up (5 minutes)

Glows, Grows, Want-to-Knows

Remarks

You have used your software engineering skills to write algorithms using natural language processing techniques.

 **Discuss:** Click through the animated slide to display the prompts.

- *What was awesome about writing your code?*
- *What is one action you can take to improve your code?*
- *What questions do you have about today?*

Discussion Goal: Students share aspects of their program they enjoyed or strengths of writing algorithms and identify areas of improvement to strengthen their programming skills. Students also share any questions or misconceptions they may have.

 **Do This:** Review the concepts covered in this lesson.

 **Display:** Key Vocabulary

Assessment: Check for Understanding

Check For Understanding Question(s) and solutions can be found in each lesson on Code Studio. These questions can be used for an exit ticket.

 5

Check for Understanding

AP Classroom Topic Questions

To assign questions from the AP Classroom Question Bank that align with this lesson, create a custom quiz in AP Classroom by searching the Question Bank for the Essential Knowledge statements listed at the top of this lesson plan. You can find instructions and video demonstrations to do this on **AP Central**.

The following Topic Questions in AP Classroom can be assigned as a formative assessment for this lesson:

- Topic Questions 4.3

Note: *Some Learning Objectives and Essential Knowledge statements in the suggested Topic Questions are covered in later units.*



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