Distinct Palindromic Subsequences

Use Case

Design a **PalindromicSubsequenceCounter** class that analyzes a given string and identifies all **distinct palindromic subsequences** present in it.

Objective

To implement a solution using **Object-Oriented Programming (OOP)** concepts that:

- Generates all possible non-empty subsequences of a string
- Checks which subsequences are palindromes
- Counts and displays **distinct palindromic subsequences**
- Validates input constraints safely

Class Description

The **PalindromicSubsequenceCounter** class acts as a blueprint for processing a string and performing palindrome-related operations.
It encapsulates input validation, subsequence generation, palindrome checking, counting, and displaying results.

Properties (Data Members)

1. **s**
   Stores the input string provided by the user.

2. **n**
   Stores the length of the input string.

Behaviors (Member Functions)

1. `validate_input()`

- Checks whether the length of the input string is between **2 and 9**.
- Raises an error if the condition is not satisfied.
- Ensures the algorithm runs within safe limits.

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2. `is_palindrome(text)`

- Accepts a string as input.
- Compares the string with its reverse.
- Returns `True` if it is a palindrome, otherwise `False`.

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3. `generate_subsequences()`

- Generates all **non-empty subsequences** of the input string.
- Uses **bit masking** to explore every possible character combination.
- Returns a list containing all subsequences.

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4. `count_distinct_palindromic_subsequences()`

- Validates the input string.
- Iterates through all generated subsequences.
- Checks each subsequence for the palindrome property.
- Stores palindromic subsequences in a **set** to ensure uniqueness.
- Returns the total count of distinct palindromic subsequences.

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5. `display_palindromes()`

- Identifies all distinct palindromic subsequences.
- Sorts them alphabetically.
- Displays each palindrome clearly to the user.

Working Process

1. The user enters a string.
2. A **PalindromicSubsequenceCounter** object is created using the input string.
3. The input string is validated for length constraints.
4. All possible non-empty subsequences are generated.
5. Each subsequence is checked to determine if it is a palindrome.
6. Distinct palindromic subsequences are stored using a set.
7. The total count of distinct palindromic subsequences is calculated.
8. All distinct palindromic subsequences are displayed in sorted order.

9. Errors are handled gracefully using exception handling.

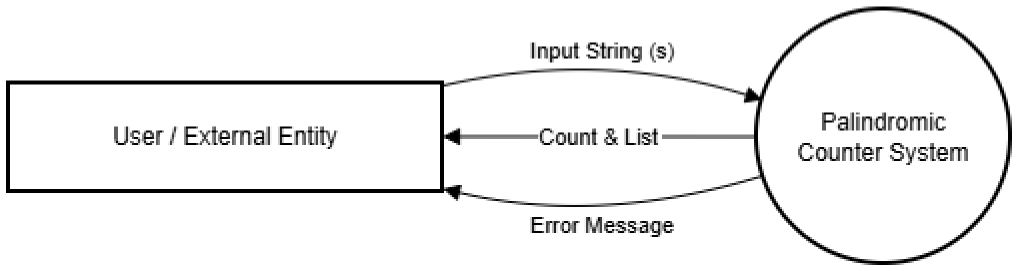
Conclusion

The **PalindromicSubsequenceCounter** class provides a **structured and reliable approach** to identifying palindromic patterns within a string.
By combining input validation, bitwise logic, and set-based uniqueness, it demonstrates effective use of **Object-Oriented Programming principles**, including **encapsulation, modularity, and data safety**.

DFD

0 level DATA FLOW DIAGRAM

Level 0 (Context): The user provides a raw string, and the system transforms it into statistical data (the count) and structured data (the list).

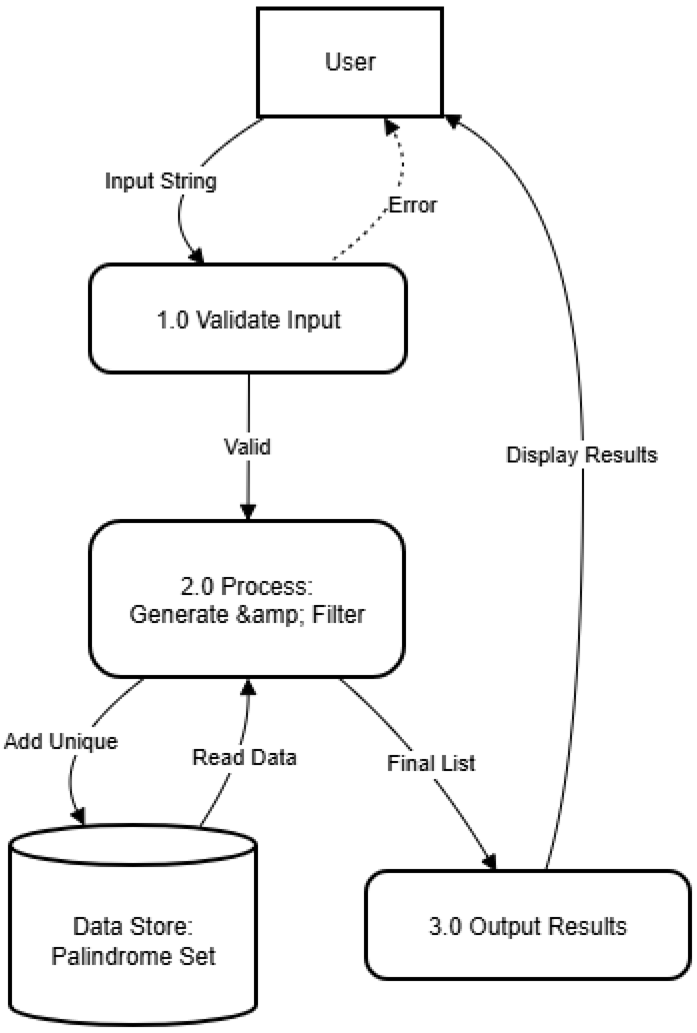


1 LEVEL DATA FLOW DIAGRAM

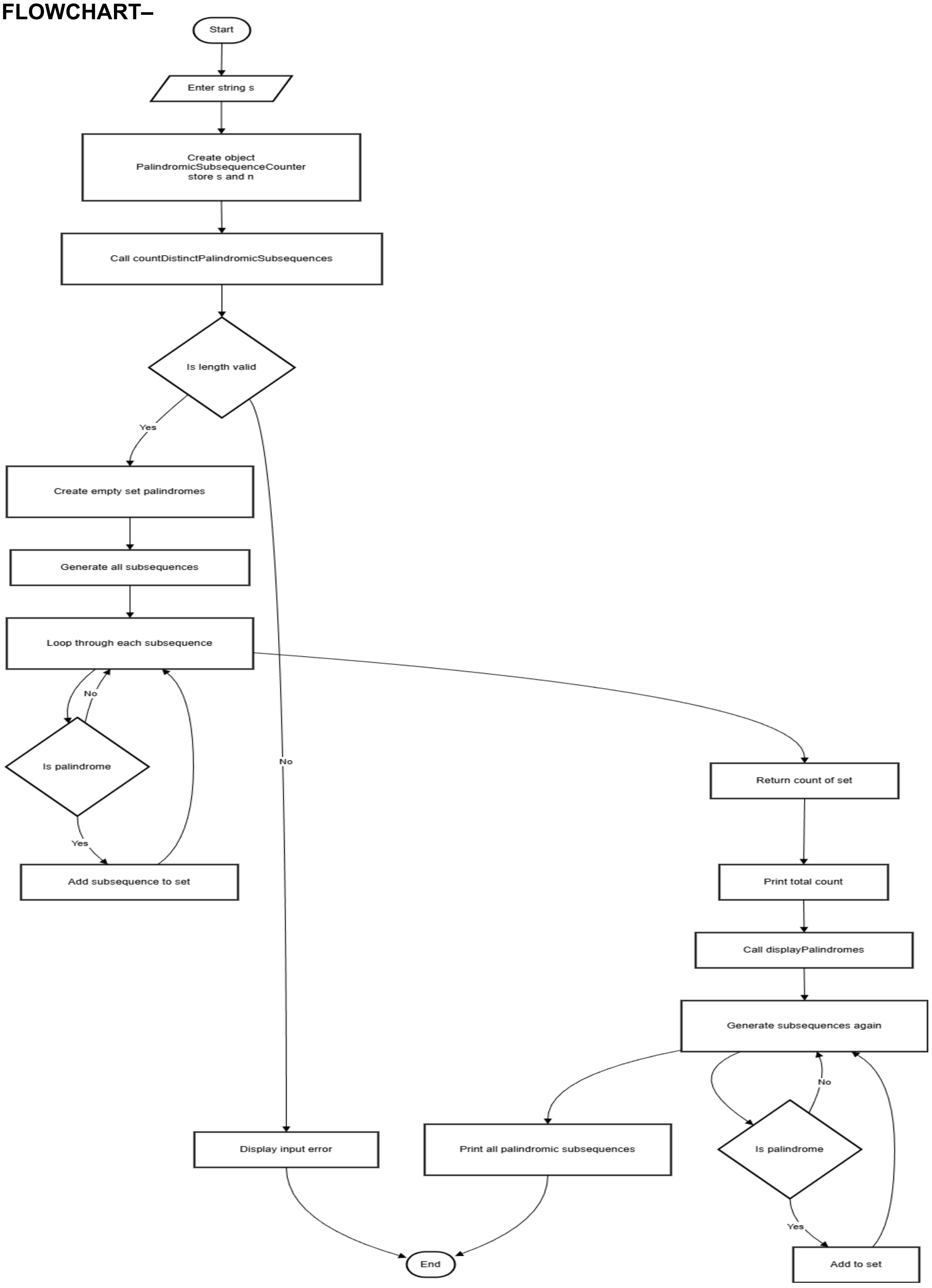
Level 1 :The logic is split into linear stages:

1. **Sanitization: Ensuring the data is safe to process (Validation).**
2. **Transformation: Converting the single string into a multitude of potential substrings (Generation).**
3. **Selection: Keeping only the data that satisfies the condition (Palindrome Check).**
4. **Reduction: Removing redundancy (Set operation)**

DIAGRAM–


User
Input String
Error
1.0 Validate Input
Valid
Display Results
2.0 Process:
Generate &amp; Filter
Add Unique
Read Data
Final List
Data Store:
Palindrome Set
3.0 Output Results

FLOWCHART–


Start
Enter string s
Create object PalindromicSubsequenceCounter store s and n
Call countDistinctPalindromicSubsequences
Is length valid
Yes
No
Create empty set palindromes
Generate all subsequences
Loop through each subsequence
No
Is palindrome
Yes
Add subsequence to set
Return count of set
Print total count
Call displayPalindromes
Generate subsequences again
No
Is palindrome
Yes
Add to set
Display input error
Print all palindromic subsequences
End