20CYS312 – PRINCIPLES OF PROGRAMMING LANGUAGES

LAB EXERCISE 11

Name: Naren S
Roll No: CH.EN.U4CYS22034
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Lab Exercise 11: Custom Iterator Implementation
Create a custom iterator named `EvenNumbers` that generates even numbers starting from 2 up to a given limit.

- Implement the `Iterator` trait for the struct.
- Use the `next()` method to return even numbers sequentially.
- Demonstrate the iterator in `main()` by printing the first 10 even numbers

Objective

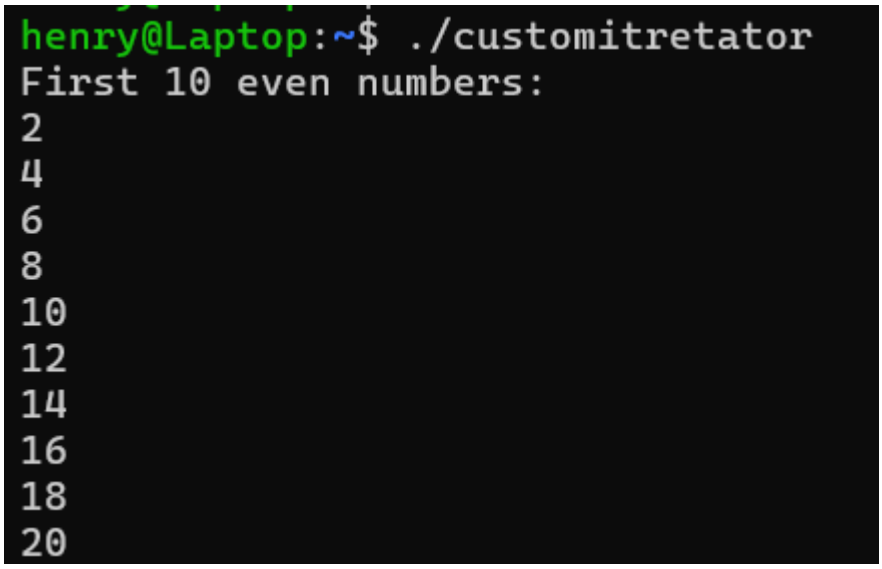
The objective of this lab exercise is to learn how to **implement a custom iterator** in Rust by defining a struct (EvenNumbers), implementing the **Iterator** trait, and using the **next()** method to generate even numbers. You will also practice using this iterator to print the first **10 even numbers** in the main() function.

Code

```
// Define a custom iterator for even numbers
struct EvenNumbers {
    current: u32,
    limit: u32,
}

// Implement the Iterator trait for EvenNumbers
impl Iterator for EvenNumbers {
    type Item = u32;

    fn next(&mut self) -> Option<Self::Item> {
```

```
        if self.current > self.limit {
            return None; // Stop when the limit is reached
        }
        let next_even = self.current;
        self.current += 2; // Move to the next even number
        Some(next_even)
    }
}

// Function to create a new EvenNumbers iterator
fn even_numbers(limit: u32) -> EvenNumbers {
    EvenNumbers { current: 2, limit }
}

fn main() {
    println!("First 10 even numbers:");

    // Create an EvenNumbers iterator up to 20
    let even_iter = even_numbers(20);

    // Print the first 10 even numbers
    for num in even_iter.take(10) {
        println!("{}", num);
    }
}
```

Output



Explanation

1. **Define the EvenNumbers Struct:**
    - This struct holds two fields:
        - current: Tracks the current even number.
        - limit: Specifies the maximum value the iterator will produce.
2. **Implement the Iterator Trait:**
    - **type Item = u32;** defines the type of values the iterator yields.
    - **next()**:
        - If current exceeds limit, return None (stopping condition).
        - Otherwise:
            - Store the current value.
            - Increment by 2 to get the next even number.
            - Return Some(next_even).
3. **Create the even_numbers() Function:**
    - This function initializes and returns an **EvenNumbers** iterator.

4. **Demonstrate the Iterator in main():**
    - Create an iterator that generates even numbers up to 20.
    - Use .take(10) to limit the output to the **first 10 even numbers**.
    - Print each value using a for loop.

Conclusion

This program successfully implements a **custom iterator** in Rust. You learned how to:

1. Define a **struct** to track iterator state.
2. Implement the **Iterator** trait and its next() method.
3. Use the .take() method to **limit** the output from the iterator.
4. Generate and print the **first 10 even numbers** sequentially.