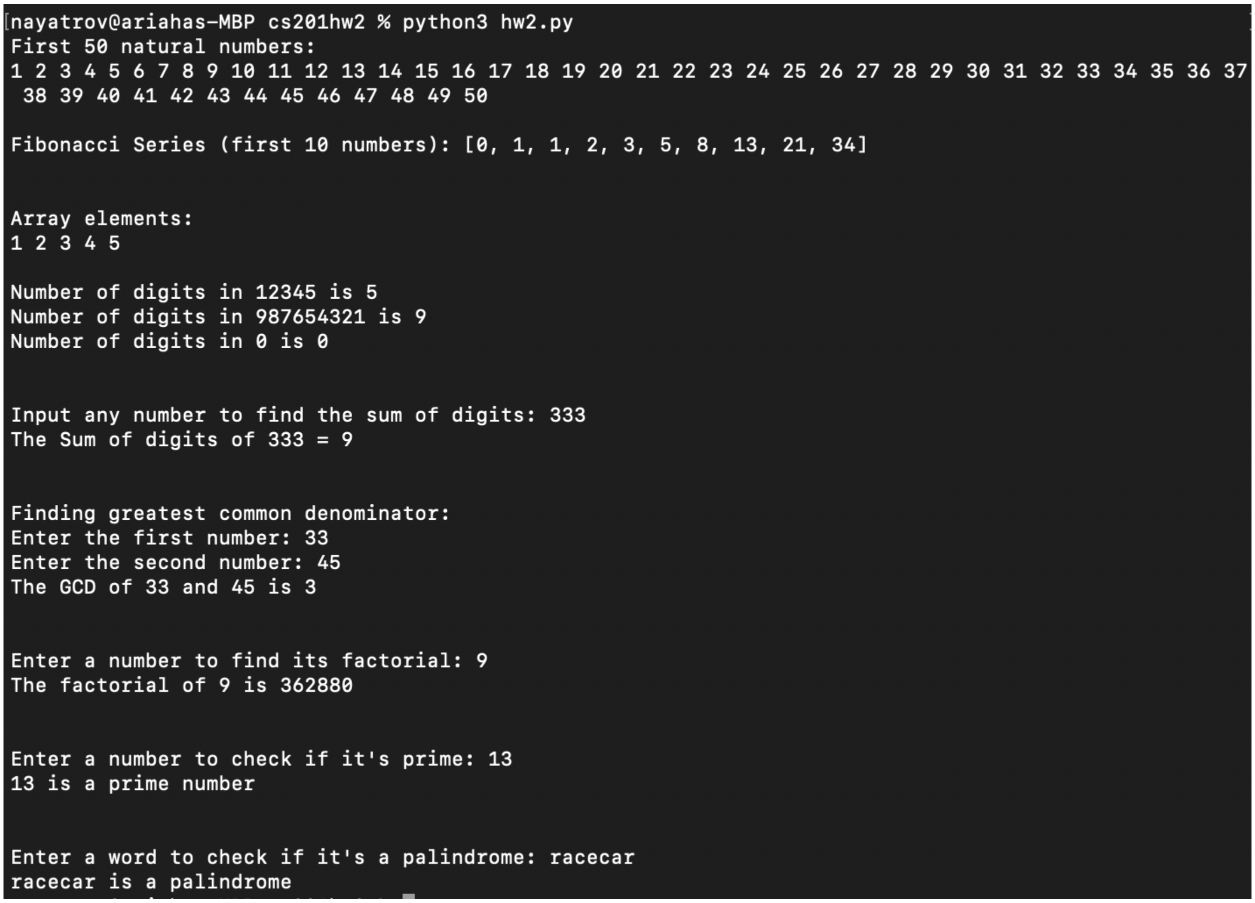
1)

Recursion is a programming concept that allows a function to call itself from the middle of itself, enabling the solution of complex problems by breaking them down into identical sub-problems. It is a fundamental technique in computer science and is particularly useful for tasks that can be divided into smaller, self-similar instances. One key aspect of recursion is the definition of a base case, which serves as the exit condition for the recursive calls, preventing infinite recursion. The base case provides a way to stop the recursion and return results that can be combined to solve the original, larger problem. Recursion can be an elegant and intuitive way to solve problems, but it requires careful design to ensure that it converges to the base case and doesn't lead to infinite recursion.

A classic example of recursion is the calculation of the factorial of a non-negative integer. The recursion continues until the base case is reached, and then the results are combined to calculate the final factorial value. This recursive approach elegantly breaks down the problem of computing a factorial into smaller, simpler instances. Another illustrative example of recursion is the binary search algorithm. Binary search efficiently finds a target element in a sorted array by repeatedly dividing the search space in half. The algorithm defines a base case when the search space becomes empty or the target is found, and in each step, it recursively searches either the left or right half of the remaining elements based on comparisons with the target value. This recursive strategy enables binary search to quickly locate a desired element in a sorted list by eliminating half of the remaining elements at each step, making it much faster than linear search for large datasets.

Output for Questions 2 through 10:



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[nayatrov@ariahas-MBP cs201hw2 % python3 hw2.py
First 50 natural numbers:
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
 38 39 40 41 42 43 44 45 46 47 48 49 50

Fibonacci Series (first 10 numbers): [0, 1, 1, 2, 3, 5, 8, 13, 21, 34]


Array elements:
1 2 3 4 5

Number of digits in 12345 is 5
Number of digits in 987654321 is 9
Number of digits in 0 is 0


Input any number to find the sum of digits: 333
The Sum of digits of 333 = 9


Finding greatest common denominator:
Enter the first number: 33
Enter the second number: 45
The GCD of 33 and 45 is 3


Enter a number to find its factorial: 9
The factorial of 9 is 362880


Enter a number to check if it's prime: 13
13 is a prime number


Enter a word to check if it's a palindrome: racecar
racecar is a palindrome
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