ALGORITHEM TASK

Task number: 8

Task name: Maximal Subarray

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For the non Recursive code

pseudocode :

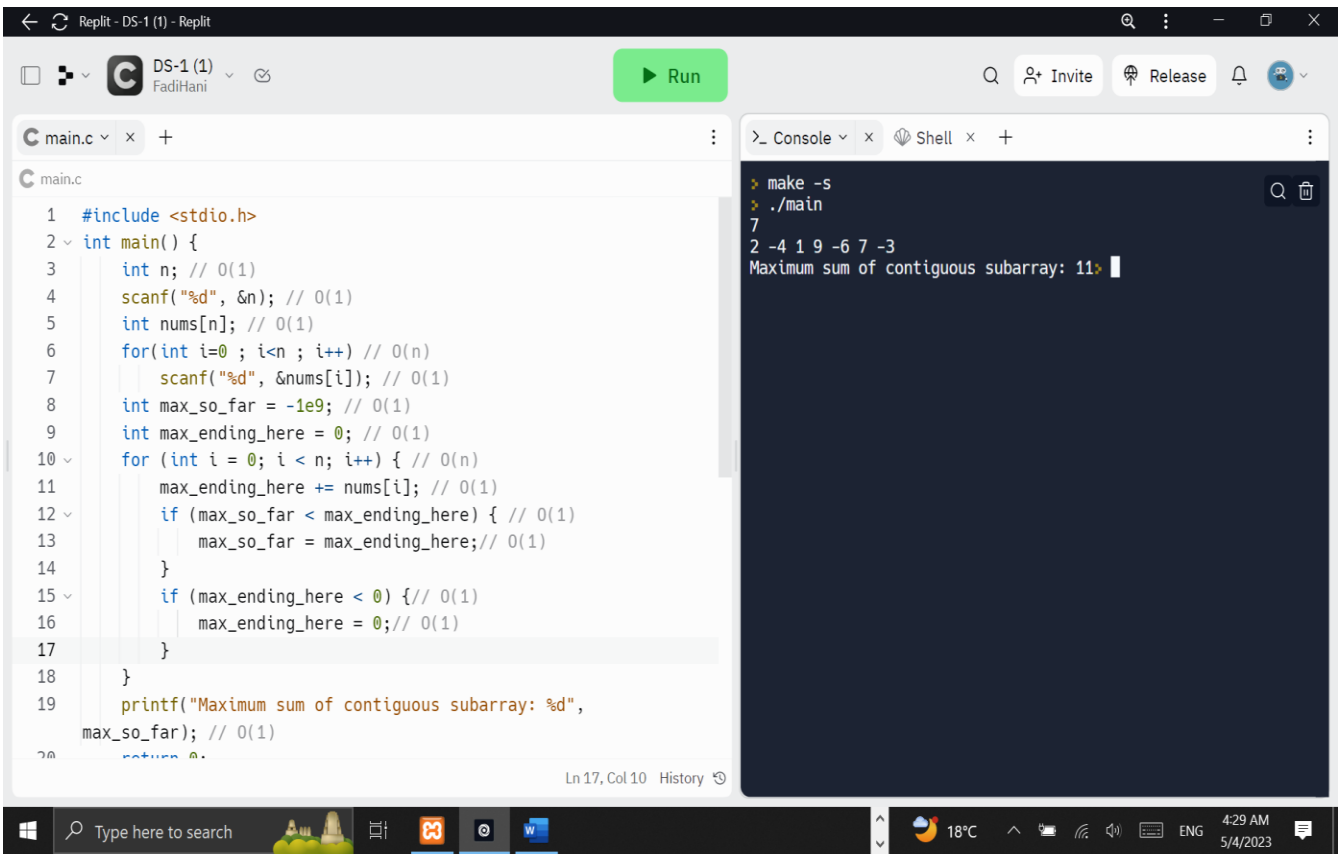
1. Declare an integer variable n (Array size).
2. Read an integer value into n using scanf.
3. Declare an integer array nums of size n.
4. Read n integer values into the array nums using a for loop and scanf.
5. Declare two integer variables max_so_far and max_ending_here, both initialized to 0.
6. Set max_so_far to -1e9.
7. Iterate over the elements of the array nums using a for loop:
8. {
9. Add the current element of the array to max_ending_here.
10. If max_so_far is less than max_ending_here, set max_so_far to max_ending_here.
11. If max_ending_here is less than 0, set it to 0.
12. }
13. Print the value of max_so_far using printf.
14. End the program.

Time complexity analysis:

1. Initializing variables n, nums[n], max_so_far, and max_ending_here takes O(1) time.
2. The first for loop iterates over n elements of the array, taking O(n) time.
3. Inside the first for loop, each operation takes O(1) time, which includes taking input from the user using scanf, and adding elements to nums.
4. The second for loop also iterates over n elements of the array, taking O(n) time.
5. Inside the second for loop, each operation takes O(1) time, which includes adding elements to max_ending_here, comparing max_so_far and max_ending_here, and resetting max_ending_here if it becomes negative.
6. The printf statement takes O(1) time.
7. Therefore, the time complexity of the code is O(n).

Space complexity analysis:

1. The code declares an integer variable n, which takes O(1) space.
2. The array nums[n] takes O(n) space.
3. The other integer variables max_so_far and max_ending_here take O(1) space.
4. Therefore, the space complexity of the code is O(n) due to the array.



For the Recursive code

pseudocode :

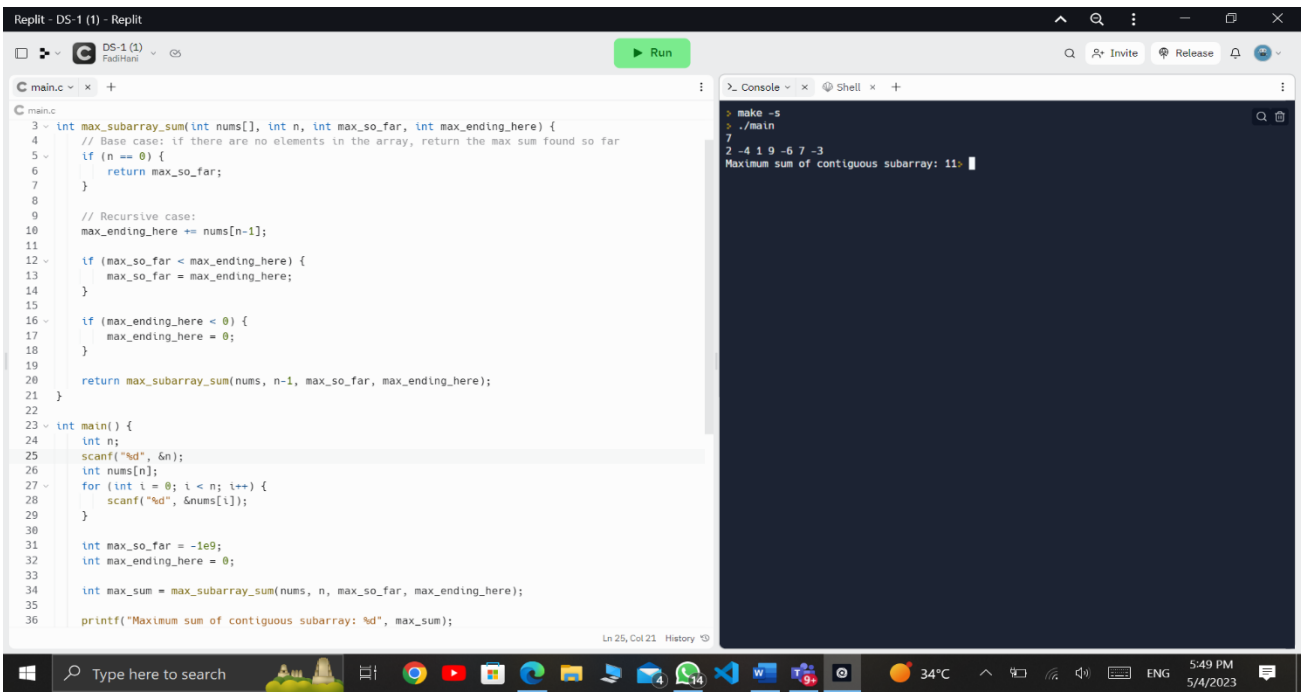
1. Declare an integer variable n (Array size).
2. Read an integer value into n using scanf.
3. Declare an integer array nums of size n.
4. Read n integer values into the array nums using a for loop and scanf.
5. Declare two integer variables (max_so_far) and (max_ending_here), both initialized to 0.
6. Set max_so_far to -1e9.
7. Declare (max_sum) as a variable to store the return value of our function (max_subarray_sum)
8. Calling the function (max_subarray_sum) that takes the array ,his size , (max_so_far), (max_ending_here)
9. If the array size equal to zero return (max_so_far)
10. Add the current element of the array to max_ending_here without the last array's element
11. If (max_so_far) is less than (max_ending_here), set (max_so_far) to (max_ending_here).
12. If max_ending_here is less than 0, set it to 0.
13. Return the function by calling it again (recursive function) but with (N-1) (array size-1)
14. After the code finish the array will find that (array size(n)=o)
15. return (max_so_far)
16. set max_so_far(function's return) to max_sum
17. Print the value of max_sum using printf.
18. End the program.

Time complexity analysis:

1. The time complexity of the given code is O(n), where n is the number of elements in the array. The function `max_subarray_sum` is called recursively n times, each time reducing the size of the array by The operations inside the function `max_subarray_sum` are all constant time operations, so the total time complexity of the code is O(n).

Space complexity analysis:

1. The space complexity of the code is O(1) because the amount of space used does not depend on the size of the input array. The only variables used are `n`, `nums`, `max_so_far`, `max_ending_here`, and `max_sum`, all of which take constant space. The recursive calls to the `max_subarray_sum` function do not use any additional space on the stack because the arguments are passed by value and not by reference.



Comparison Table:

	Non recursive	recursive
Time complexity	the time complexity of the this code is O(n).	the total time complexity of the code is O(n)
Space complexity	the space complexity of the code is O(n)	The space complexity of the code is O(1)

- Time complexity: both are the same.
- Space complexity: non-recursive algorithm consumes less space.