Algorithms

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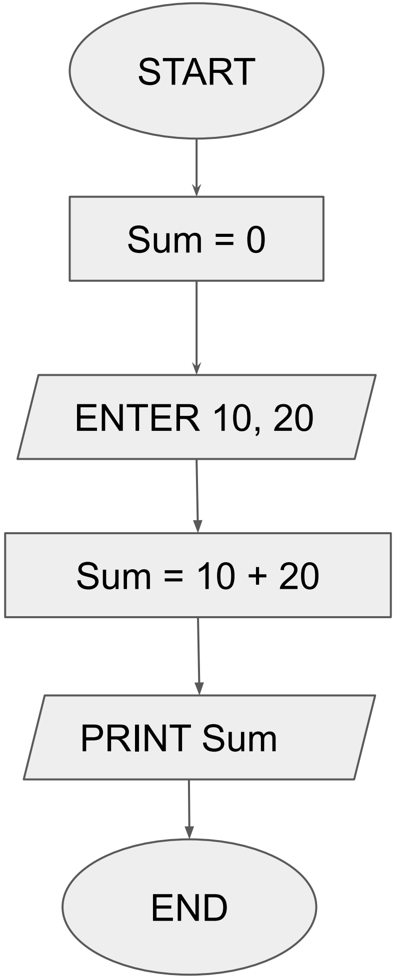
Problems

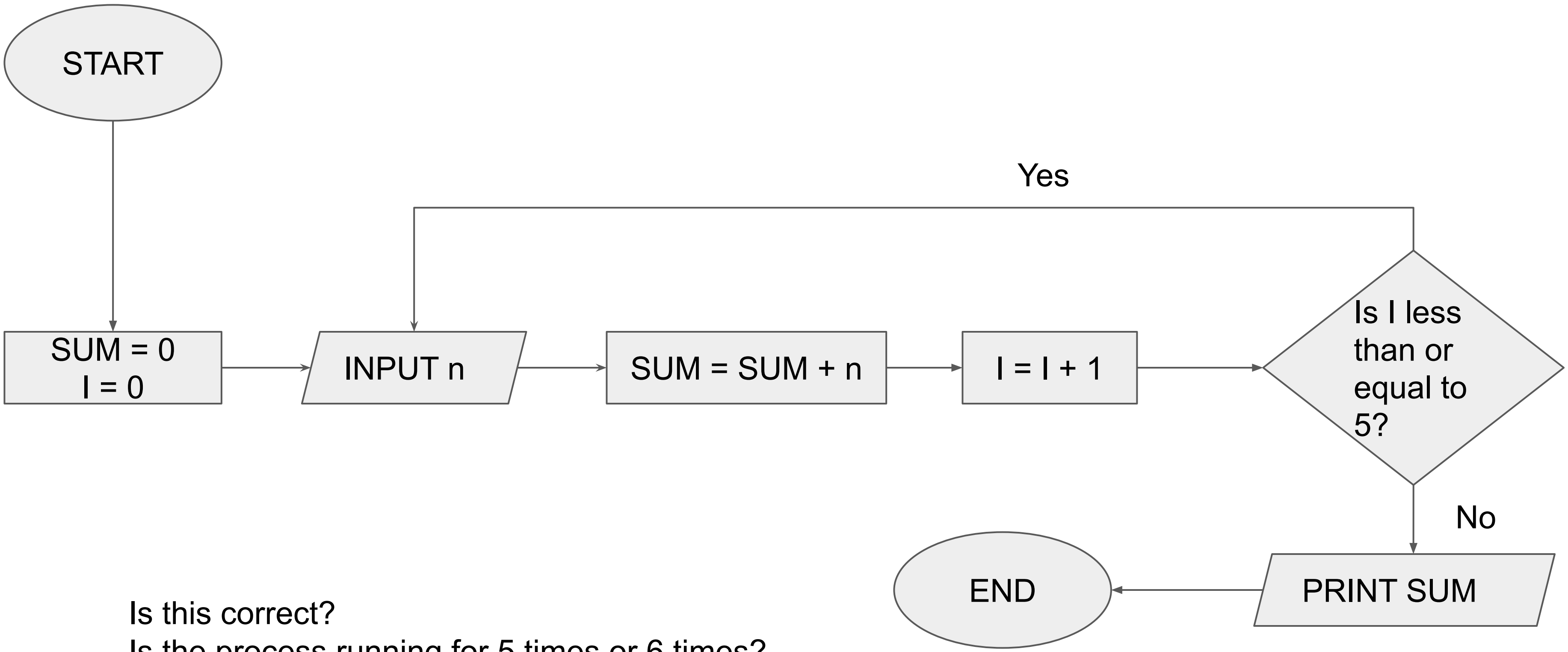
Q1. Add 10 and 20

Q2. Find the sum of 5 numbers

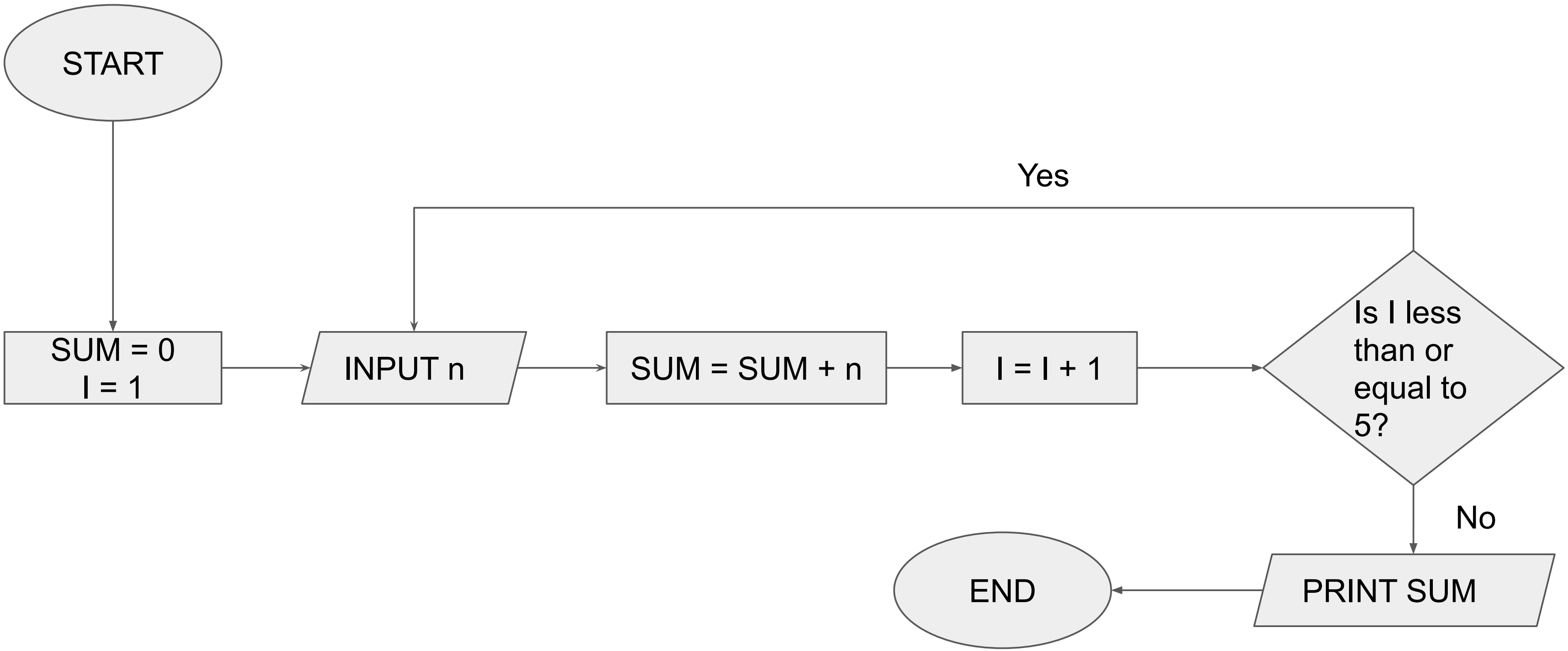
Q3. Print Hello World 10 times

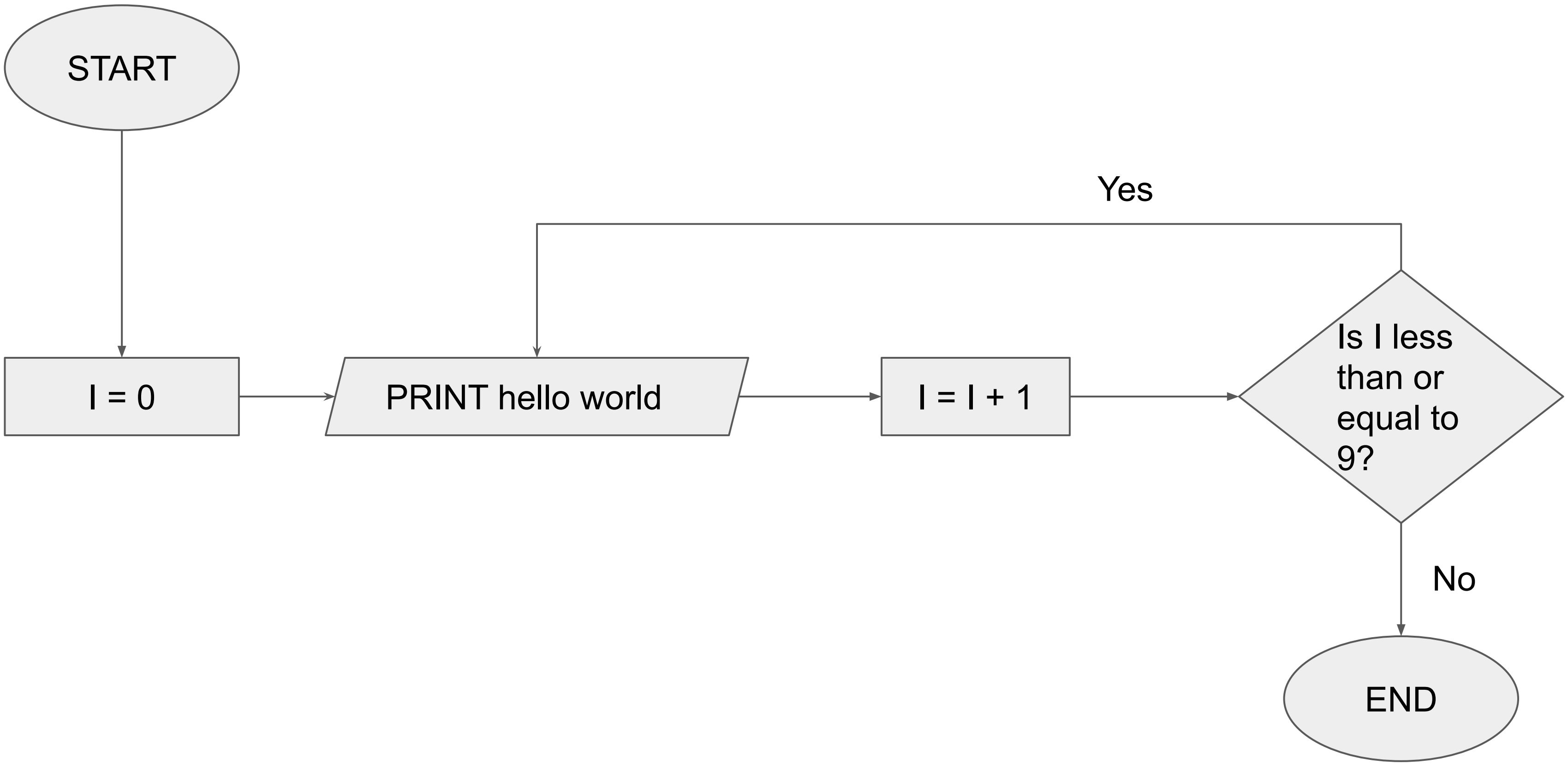
Q4. Draw a flowchart to log in to facebook account

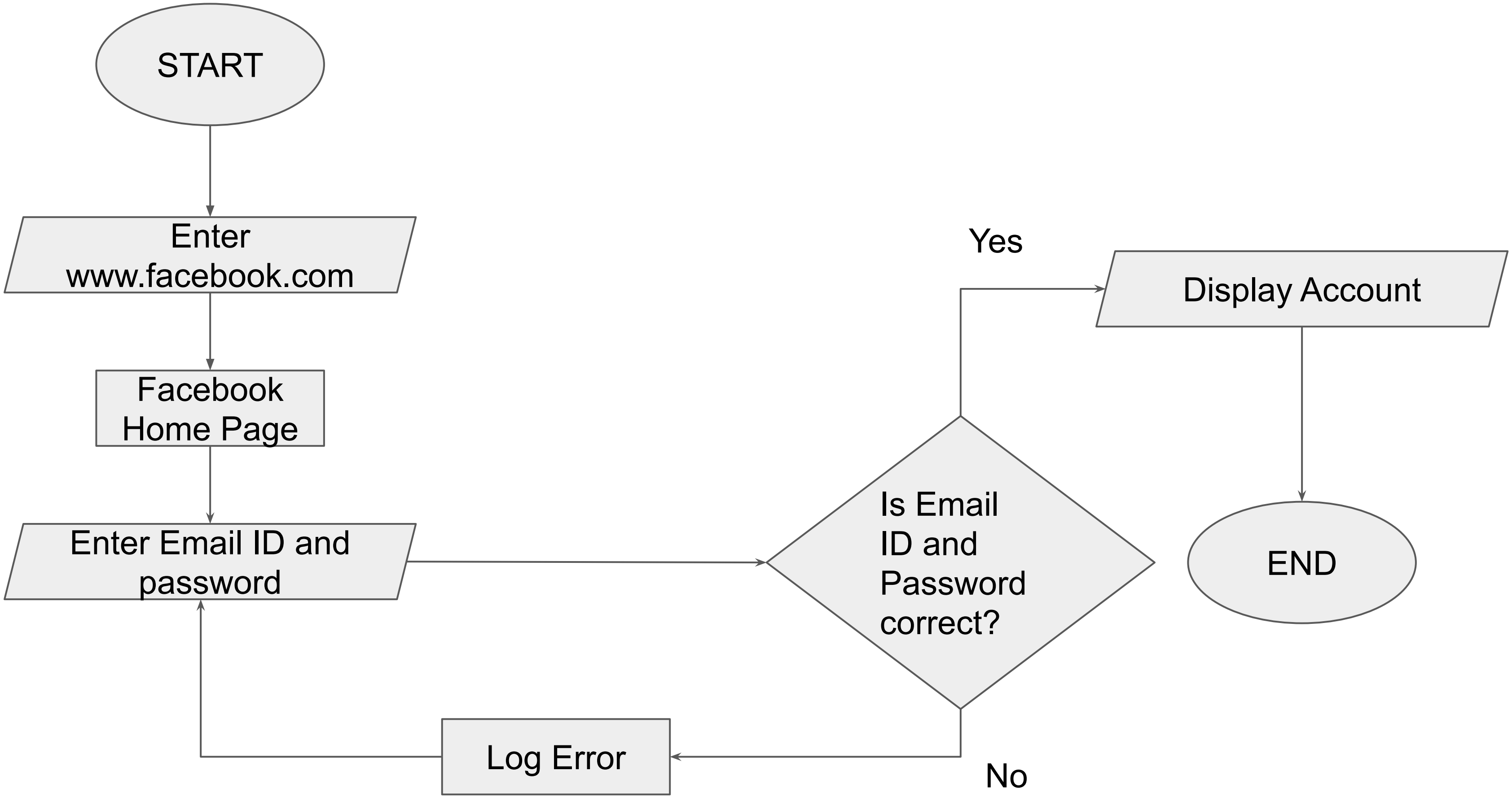

START
Sum = 0
ENTER 10, 20
Sum = 10 + 20
PRINT Sum
END



Is this correct?
Is the process running for 5 times or 6 times?


START
SUM = 0
I = 1
INPUT n
SUM = SUM + n
I = I + 1
Is I less than or equal to 5?
Yes
No
PRINT SUM
END


START
Yes
I = 0
PRINT hello world
I = I + 1
Is I less than or equal to 9?
No
END


START
Enter www.facebook.com
Facebook Home Page
Enter Email ID and password
Is Email ID and Password correct?
Yes
Display Account
END
No
Log Error

What is algorithm?

An algorithm is a finite and clear step-by-step procedure to solve your problem.

Sum_of_10_and_20:

1. Initialize sum = 0
2. Enter the numbers 10 and 20
3. Add them and store the result in sum
4. Print sum

Contd.

Sum_of_5_Numbers:

1. Initialize sum = 0 and count = 0
2. Enter n
3. Find sum + n and assign it to sum and then increment count by 1
4. Is count < 5
5. if YES go to step 2
   else
   Print sum

Contd.

Print_Hello_World_10_Times:

1. Initialize count = 0
2. Print Hello World
3. Increment count by 1
4. Is count < 10
5. if YES go to step 2
   else Stop

Contd.

Log_in_to_Facebook:

1. Enter www.facebook.com in your browser.
2. facebook Home page loads
3. Enter your Email ID and Password
4. Is Email ID and Password Valid
   if NO then
   Log in error
   go to step 3
   else
   Display facebook Account
   Stop

Let's try to solve some real problems

GCD: Greatest Common Divisor

An algorithm to find the greatest common divisor of two positive integers m and n, m >= n.

An initial solution, described informally as:

Gratest_Common_Divisor:

1. Take the smallest number n.
2. For each number k, n>=k>=1, in descending order do the following
   a. If k divides m and n, then k is the gcd of m and n

Draw a flowchart for the initial solution.

Based on the previous discussion, can you draw the flowchart for the initial solution.

Consider the following situation

What if you take two large consecutive numbers? Say 100 and 99.

99 GCD of 100, 99

98 GCD of 100, 99

97 GCD of 100, 99

…

1 GCD of 100, 99 Yes!!

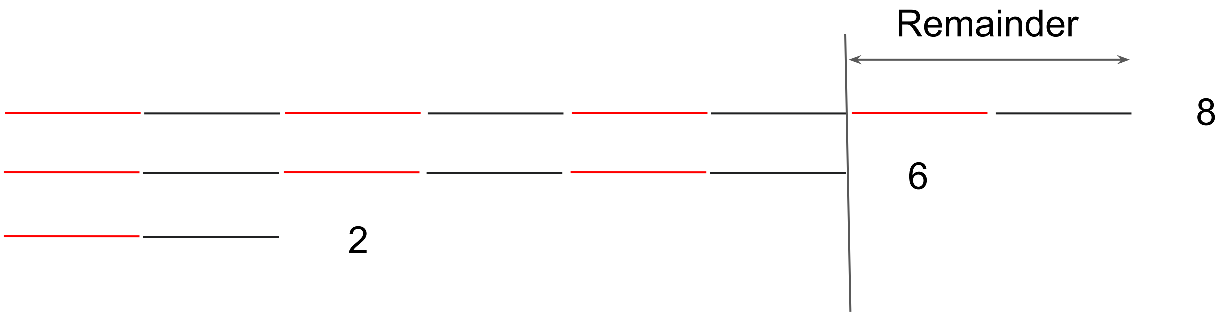
This algorithm will compute the GCD correctly, but it is very slow.

Euclid’s Algorithm: Intuition

Find GCD of 8 and 6.

- Consider rods of length 8 and 6.
- Measure the longer rod with the shorter rod.
- Take the remainder **if any**.
- **Repeat** the process until the longer rod can be exactly measured as an integer multiple of the shorter rod.

Euclid’s Algorithm: Intuition



GCD(8, 6) = 2

Euclid’s Algorithm

Suppose a > b. Then GCD of a and b is the same as the GCD of b and the remainder of a when divided by b.

GCD(a, b) = GCD(a, a % b)

Euclid_Algorithm:
Data: Integers m and n
If n > m, then interchange m and n;
while n≠0 do

- g←m%n;
- m←n;
- n←g;

end
return m;

Draw a flowchart for the Euclid’s algorithm.

Based on the previous discussion, can you draw the flowchart for the Euclid’s algorithm.

Can you write algorithm to find LCM of two numbers?

LCM (Least Common Multiple) of two numbers is the smallest number which can be divided by both numbers.

For example, LCM of 15 and 20 is 60, and LCM of 5 and 7 is 35.

A simple solution is to find all prime factors of both numbers, then find union of all factors present in both numbers. Finally, return the product of elements in union.

Efficient Algorithm

You can use the formula $m * n = LCM(m, n) * GCD(m, n)$

Thank You!!