Algorithm Design
(Our First Simple Algorithm)
Video 6.3d

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Algorithm is Cool. Learn Algorithms.

Outline

Overview:

❑ **Definition of Algorithm**

❑ **Algorithms in Everyday Life**

❑ **Some Old Algorithms**

❑ **Some Simple Algorithms**

First Simple Problem:

Problem-1: Algorithm to Compute the sum of
(1 + 2 + 3 + … + 99 + 100)

This is a simple problem.
But… our goal here is
to get an algorithm.

No brainer "calculator method"

Problem-1: Compute (1 + 2 +… + 99 + 100)
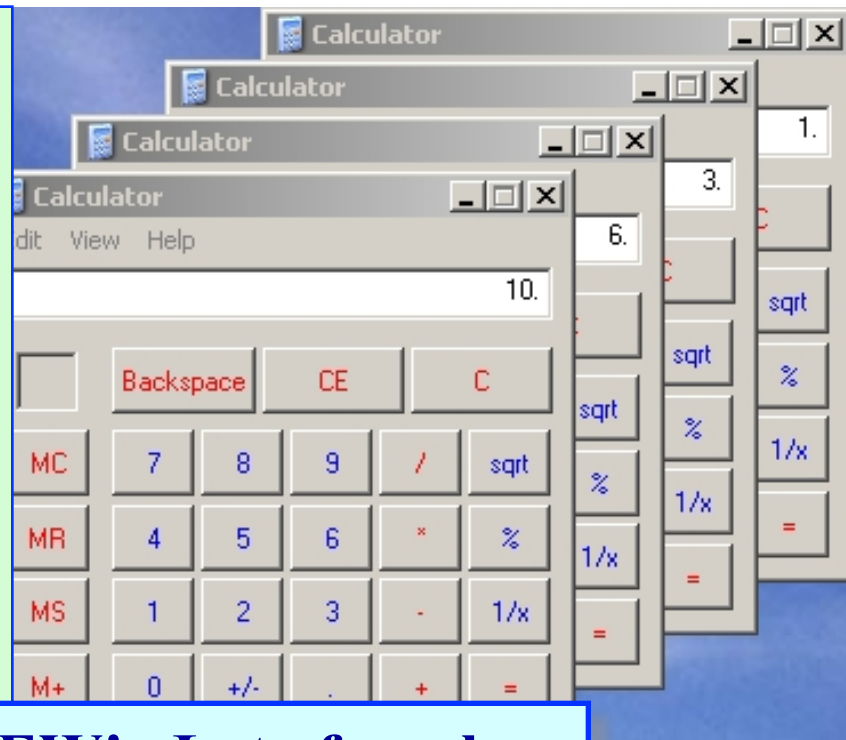
The "Calculator" Method:

Turn on. Clear.

$$0$$

$$+ 1 = 1$$

$$+ 2 = 3$$

$$+ 3 = 6$$

$$+ 4 = 10$$

… …

$$+ 100 = 5050$$

PHEW!   Lot of work;
Very easy to slip up…
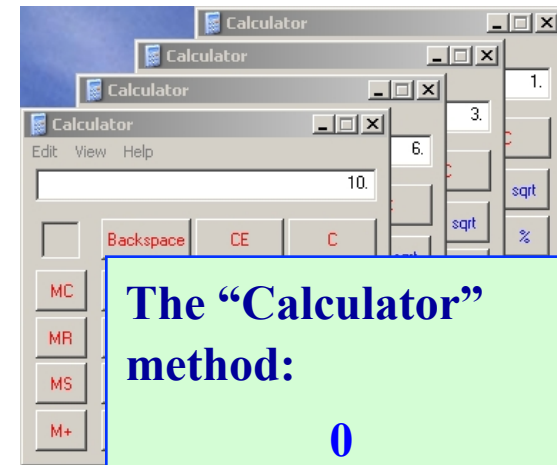
Expressing method as an *algorithm*

Problem-1: Algorithm to Compute the sum of
(1 + 2 + 3 + … + 99 + 100)

Now, to express "Calculator method" as *an algorithm*.

(Write a sequence of step-by-step instruction – *fit for a robot to execute autonomously*)

Remember: Steps must be CLEAR. Computers (and other devices) are fast but they are **TOI**s.

TOI = **T**otally **O**bedient **I**diot.

The "Calculator" method:

    0
  +1=1
  +2=3
  +3=6
  +4=10
  … …
  +100=**5050**

First attempt at an *algorithm*

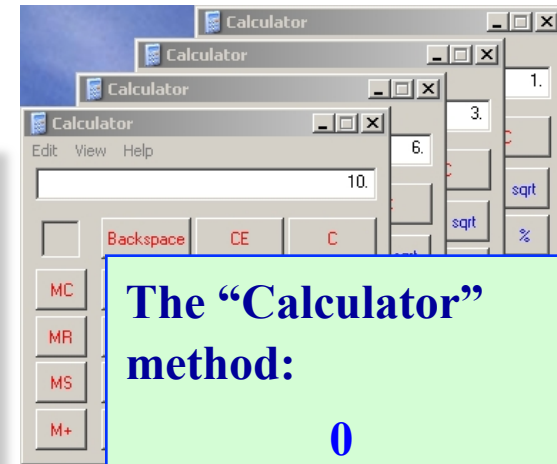## Problem-1: Algorithm to Compute the sum of (1 + 2 + 3 + … + 99 + 100)

ALGORITHM BAD-Sum-to-Hundred;

1. Let Sum ← 0 ;
2. Sum ← Sum + 1
3. Sum ← Sum + 2
4. Sum ← Sum + 3

 …   …   …

100. Sum ← Sum + 99
101. Sum ← Sum + 100
102. Return value of Sum as result
103. End

Is this an algorithm?

YES
Check all the 5 keywords.

The "Calculator" method:

  0
 +1=1
 +2=3
 +3=6
 +4=10
… …
+100=**5050**

(Q-Module: CT, Algorit

What's not good about the algorithm?

Problem-1: Algorithm to Compute the sum of (1 + 2 + 3 + … + 99 + 100)

ALGORITHM BAD-Sum-to-Hundred;

1. Let Sum ← 0
2. Sum ← Sum + 1
3. Sum ← Sum + 2
4. Sum ← Sum + 3
   …   …   …
100. Sum ← Sum + 99
101. Sum ← Sum + 100
102. Return value of Sum as r
103. End

1. **Cannot scale:**
   What if sum-to-million?
2. **How to handle repetitive work?**
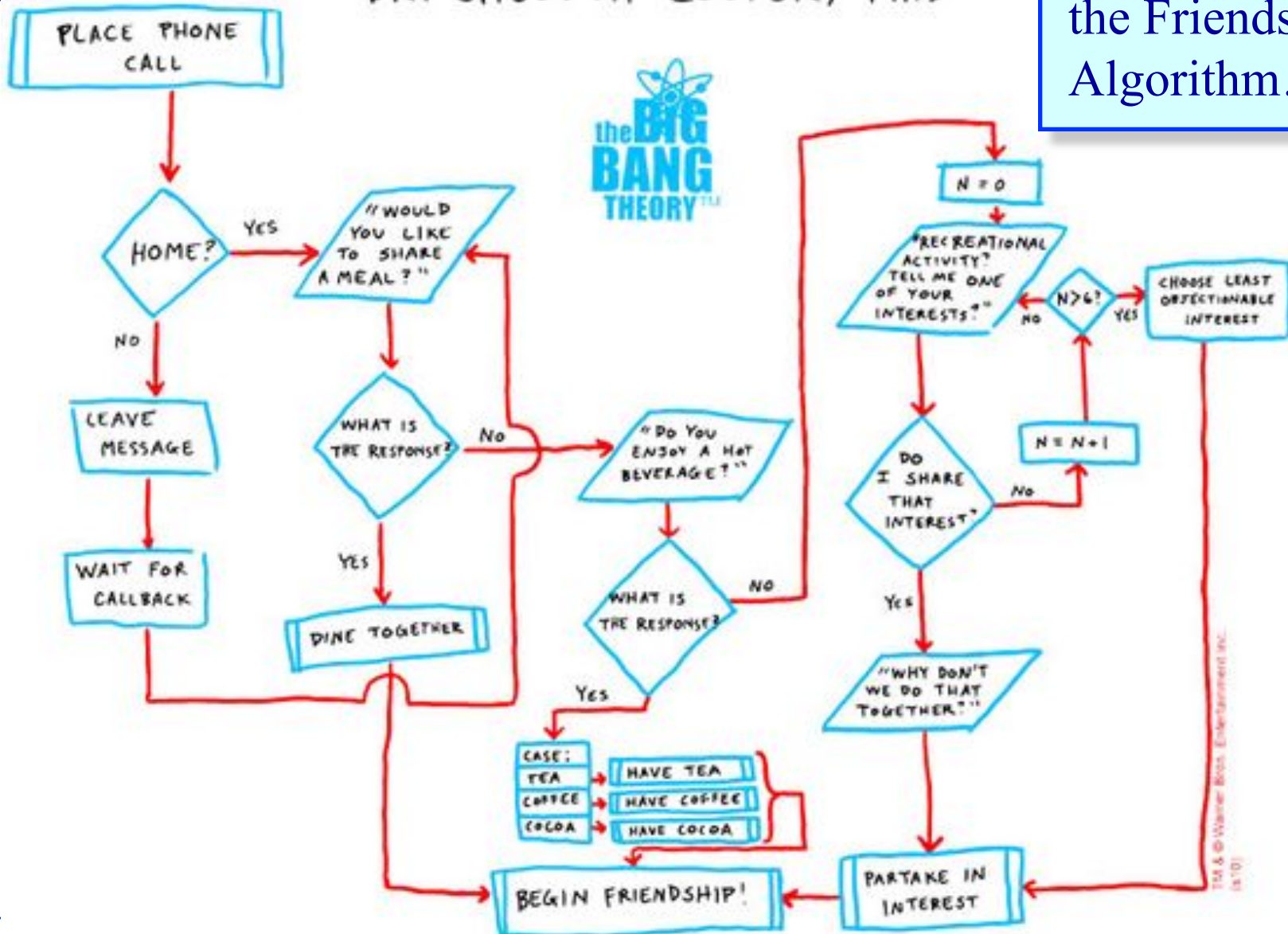   "**Sum ← Sum + ??**" is repeated…
   IDEA: Need to use a loop
3. **Remember the ?? I am adding**
   Use a new variable, let's say k
   Use "**Sum ← Sum + k**" and keep incrementing k
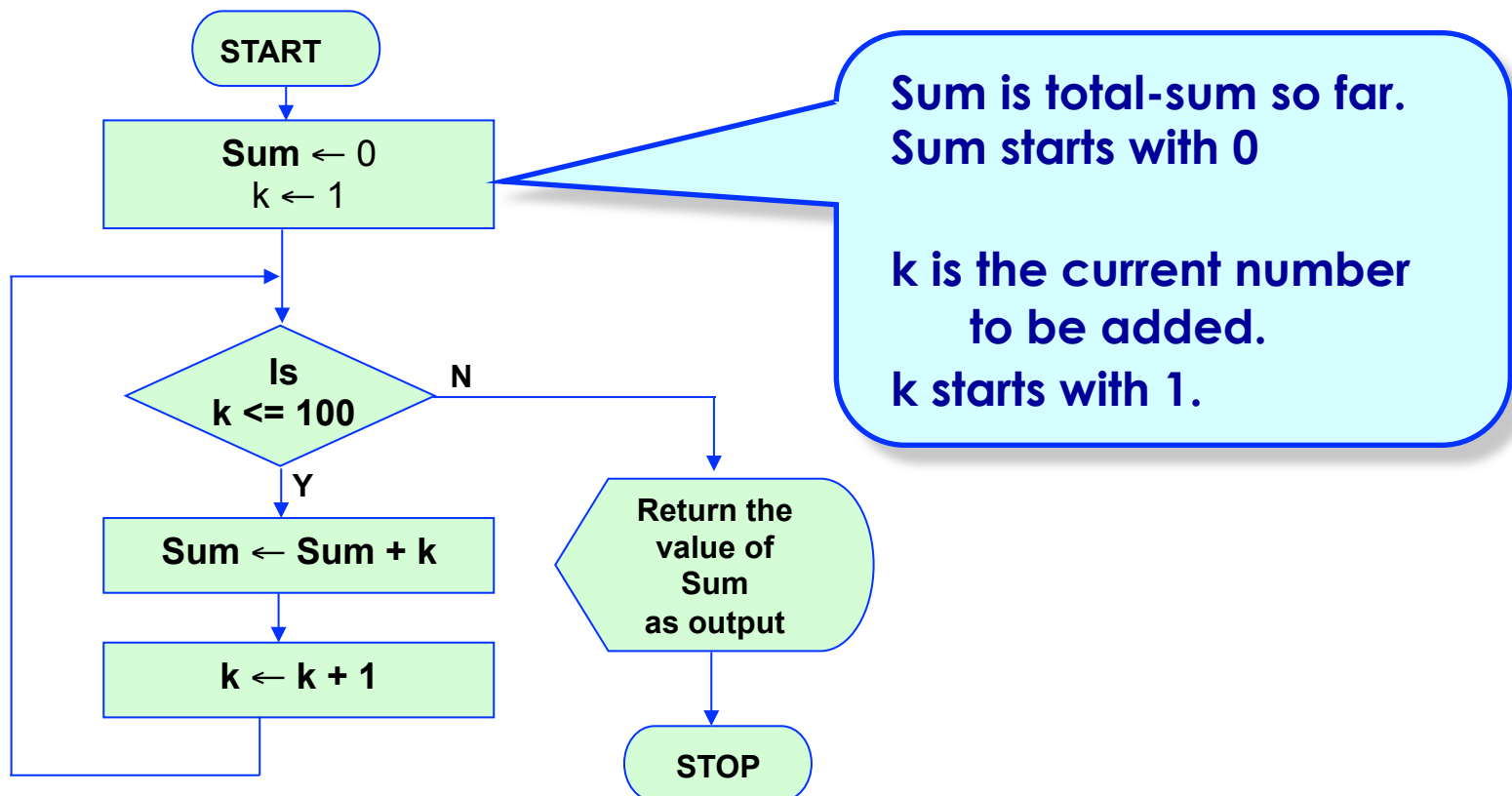
THE FRIENDSHIP ALGORITHM

DR. SHELDON COOPER, Ph.D

Find and check out *the loop* in the Friendship Algorithm…

First algorithm with a loop.

Algorithm Sum-1-to-100
(in a flowchart)

Flowchart:

START → Sum ← 0, k ← 1 → Is k <= 100 ?
- Y: Sum ← Sum + k → k ← k + 1 → (loop back to Is k <= 100)
- N: Return the value of Sum as output → STOP

Sum is total-sum so far.
Sum starts with 0

k is the current number to be added.
k starts with 1.

(Q-Module: CT, Algorithm Design) Page 9

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First algorithm with a loop…

Algorithm Sum-1-to-100
(in a flowchart)

START

Sum ← 0
k ← 1

Is
k <= 100

N

Y

Sum ← Sum + k

k ← k + 1

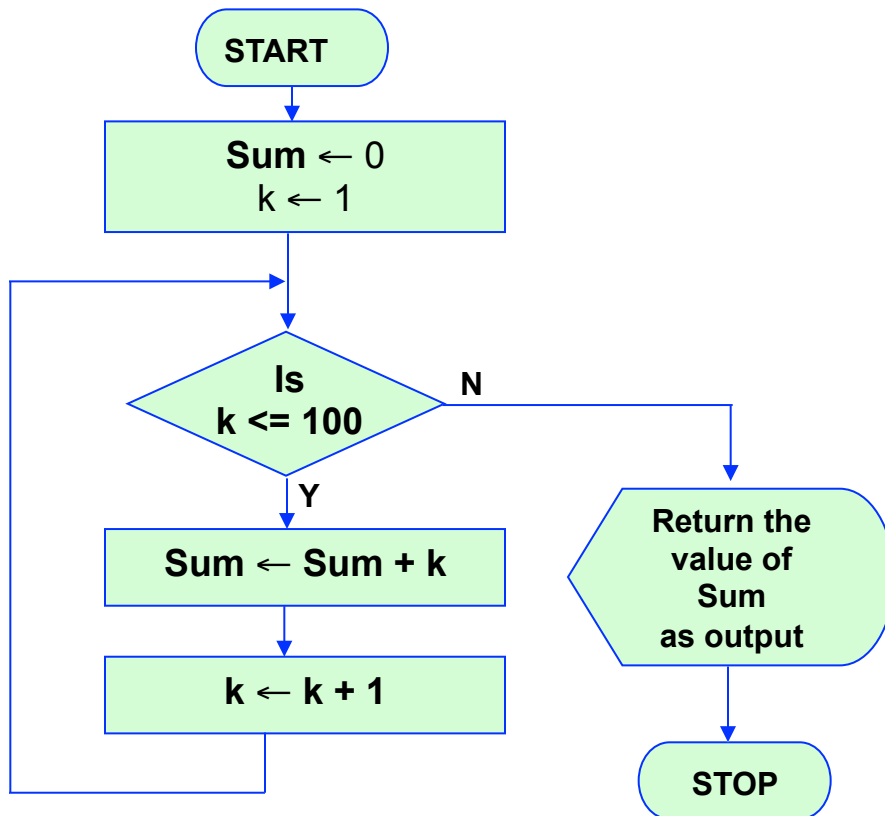Return the
value of
Sum
as output

STOP
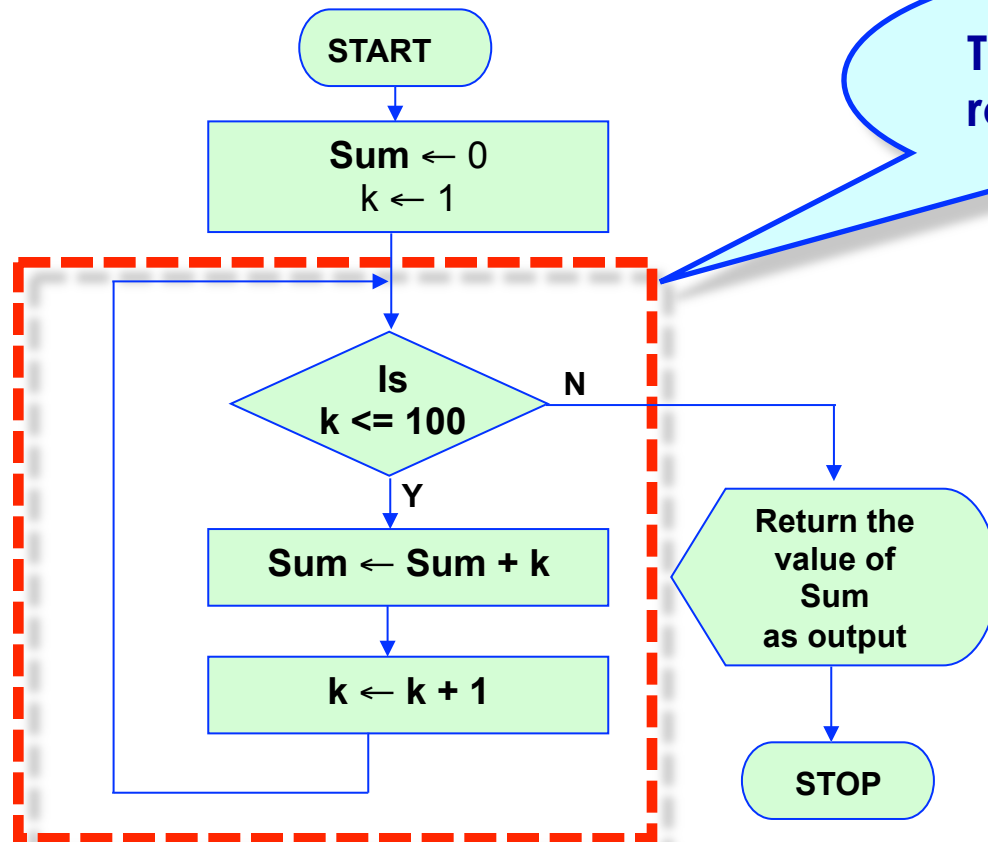
This loop is
repeated 100 times.

Each time round the loop,
k is added to Sum
k is incremented.

So, consecutive values of k
are added to Sum

First algorithm with a loop…

Algorithm Sum-1-to-100
(in a flowchart)

Algorithm Sum-1-to-100
(in pseudo-code)

START

Sum ← 0
k ← 1

Is
k <= 100   N

Y

Sum ← Sum + k

k ← k + 1

Return the
value of
Sum
as output

STOP

ALGORITHM Sum-1-to-100;

1. Let Sum ← 0 ;
2. Let k ← 1 ;
3. While (k ≤ 100) repeat Steps 4-6
4.   Sum ← Sum + k
5.   k ← k + 1
6. end-of-while-block;
7. Print out the value of Sum
8. End

First algorithm with a loop.

Algorithm Sum-1-to-100
(in pseudo-code)

ALGORITHM Sum-v1;

1. Let Sum ← 0 ;

2. Let k ← 1 ;

3. While (k ≤ 100) repeat Steps 4-6

4.   Sum ← Sum + k

5.   k ← k + 1

6. end-of-while-block;

7. Print out the value of Sum

8. End

This loop is repeated 100 times.

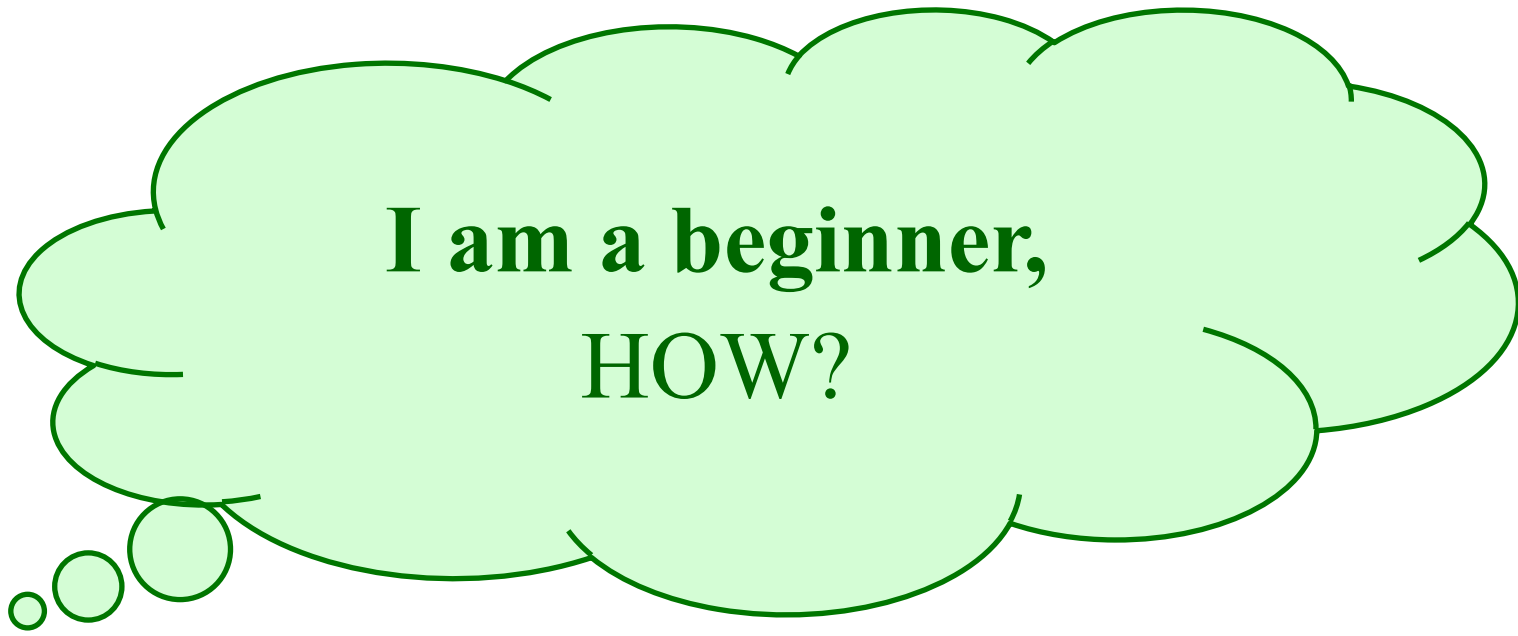**Each time round the loop, k is added to Sum k is incremented.**

So, increasing values of k is added to Sum

(Q-Module: CT, Algorithm Design) Page 12

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The *Magic* of the loop-structure

The Power of the loop (iterations)

- 4 step short loop does same work as the very long "calculator method"

- Done by repeatedly going around the loop, each time with a different value of k

I am a beginner,
HOW?

For beginners…

If you are a beginner,
there is good news. See below

Download ppt file CT-6.3d-Supp.pptx

**Follow the step-by-step execution
of the algorithm SLOWLY.**

Do it NOW and master Algorithm Sum-1-to-100.

**Do that before viewing Video 6.3e
and BEFORE attending tutorials.**

(End of video 6.3d)

If you want to contact me,

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