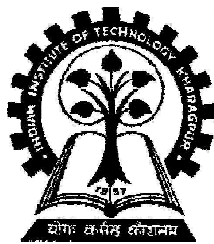


Basic Programming Concepts

CS10001: Programming & Data Structures



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Some Terminologies

- **Algorithm / Flowchart**
 - A step-by-step procedure for solving a particular problem.
 - Independent of the programming language.
- **Program**
 - A translation of the algorithm/flowchart into a form that can be processed by a computer.
 - Typically written in a high-level language like C, C++, Java, etc.

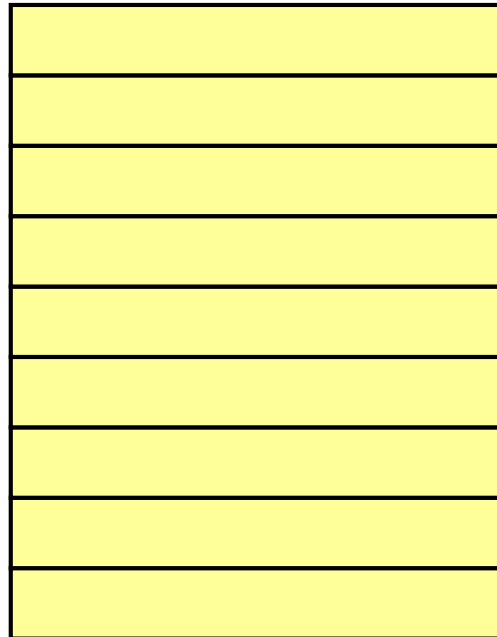
Variables and Constants

- **Most important concept for problem solving using computers**
- **All temporary results are stored in terms of variables**
 - **The value of a variable can be changed.**
 - **The value of a constant do not change.**
- **Where are they stored?**
 - **In main memory.**

Contd.

- **How does memory look like (logically)?**
 - **As a list of storage locations, each having a unique address.**
 - **Variables and constants are stored in these storage locations.**
 - **A variable is like a *bin***
 - **The contents of the *bin* is the *value* of the variable**
 - **The variable name is used to refer to the value of the variable**
 - **A variable is mapped to a *location* of the memory, called its *address***

Memory map



Address 0

Address 1

Address 2

Address 3

Address 4

Address 5

Address 6

Every variable is mapped to a particular memory address



Address N-1

Variables in Memory

Instruction executed

Variable X

Time
↓

$X = 10$



10

$X = 20$



20

$X = X + 1$



21

$X = X * 5$



105

Variables in Memory (contd.)

Instruction executed

Time
↓

$$X = 20$$



$$Y = 15$$



$$X = Y + 3$$



$$Y = X / 6$$



Variable

X

Y

20

?

20

15

18

15

18

3

Data Types

- **Three common data types used:**
 - **Integer :: can store only whole numbers**
 - **Examples: 25, -56, 1, 0**
 - **Floating-point :: can store numbers with fractional values.**
 - **Examples: 3.14159, 5.0, -12345.345**
 - **Character :: can store a character**
 - **Examples: 'A', 'a', '*', '3', ' ', '+'**

Data Types (contd.)

- **How are they stored in memory?**
 - **Integer ::**
 - 16 bits
 - 32 bits
 - **Float ::**
 - 32 bits
 - 64 bits
 - **Char ::**
 - 8 bits (ASCII code)
 - 16 bits (UNICODE, used in Java)

Actual number of bits vary from one computer to another

Problem solving

- **Step 1:**
 - **Clearly specify the problem to be solved.**
- **Step 2:**
 - **Draw flowchart or write algorithm.**
- **Step 3:**
 - **Convert flowchart (algorithm) into program code.**
- **Step 4:**
 - **Compile the program into object code.**
- **Step 5:**
 - **Execute the program.**

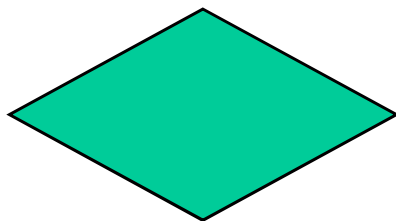
Flowchart: basic symbols



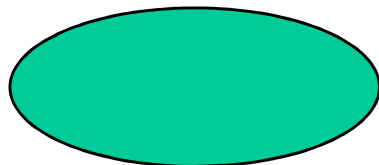
Computation



Input / Output



Decision Box



Start / Stop

Contd.

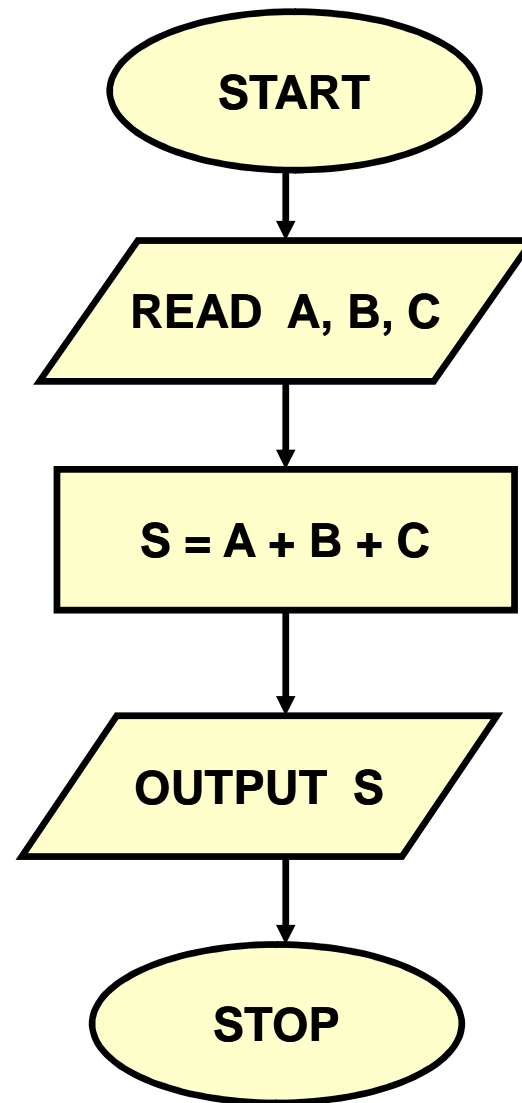


**Flow of
control**

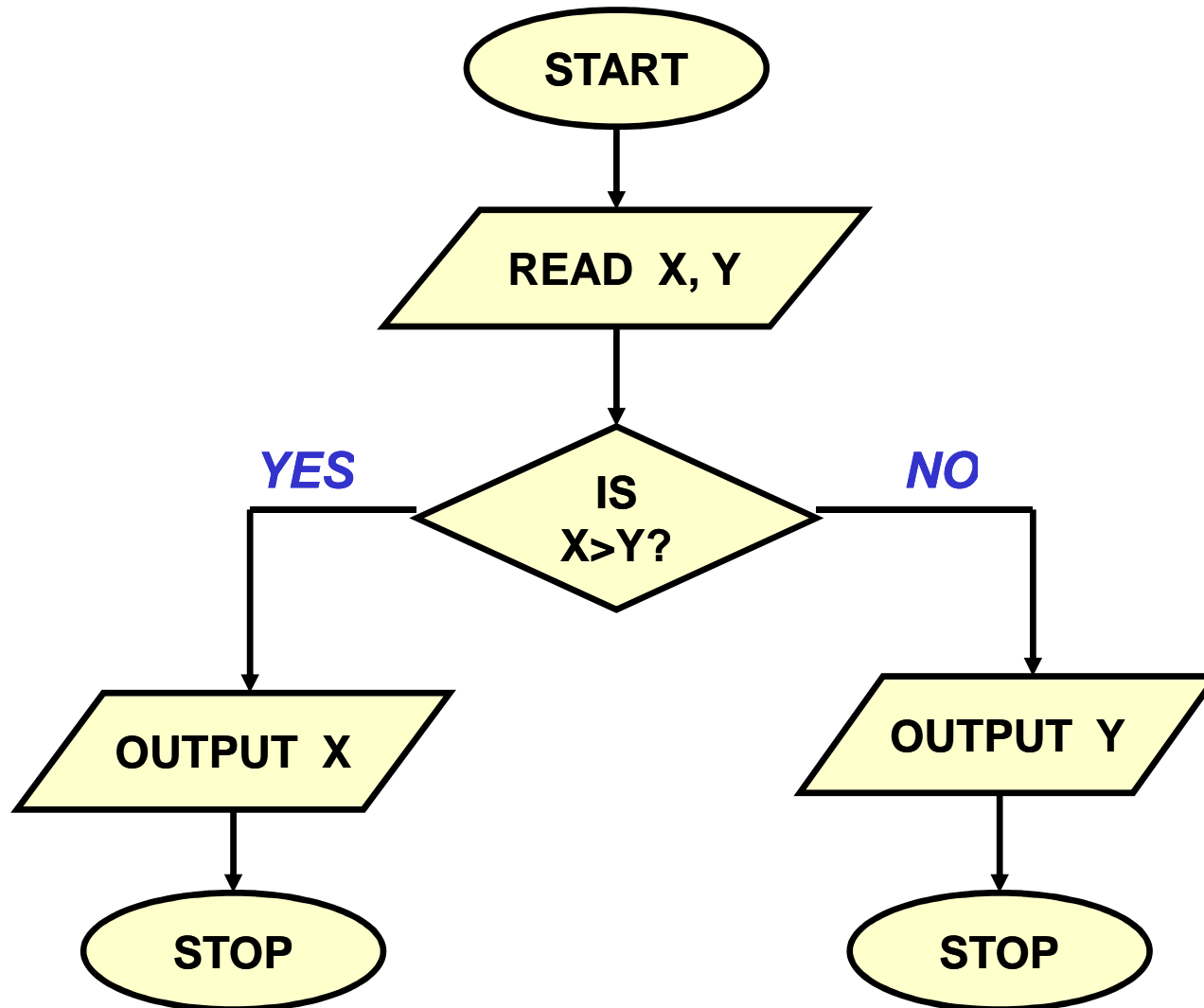


Connector

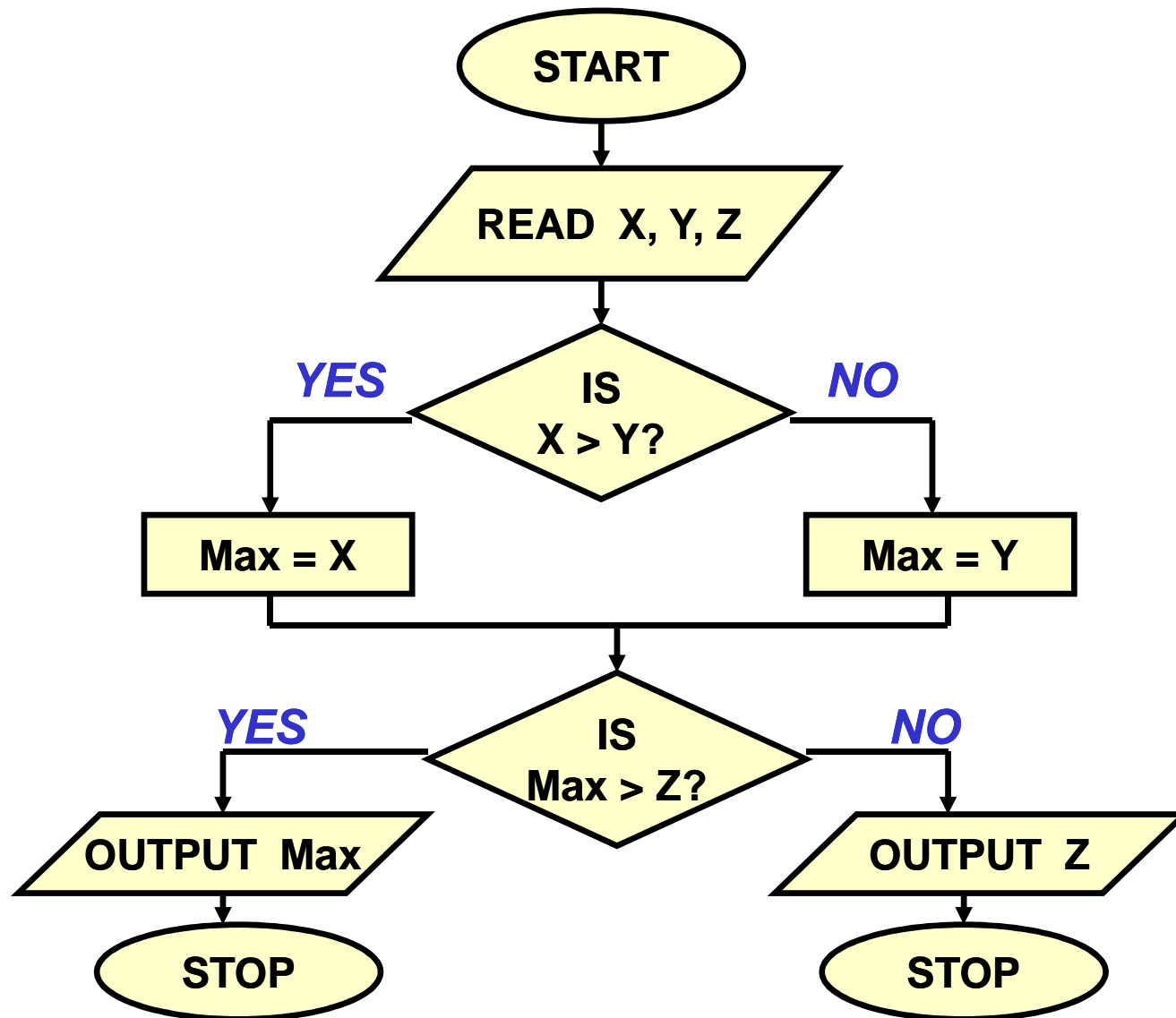
Example 1: Adding three numbers



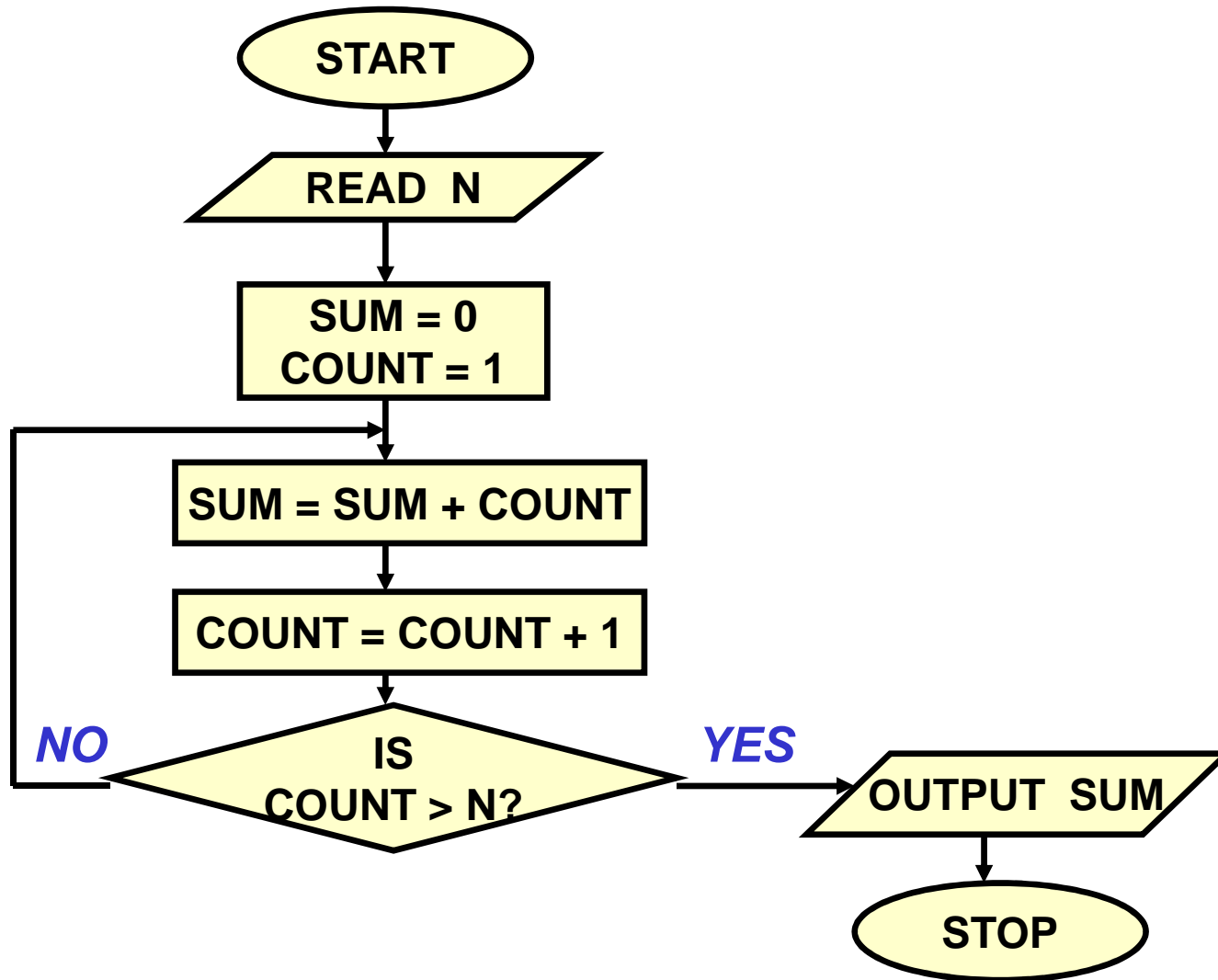
Example 2: Larger of two numbers



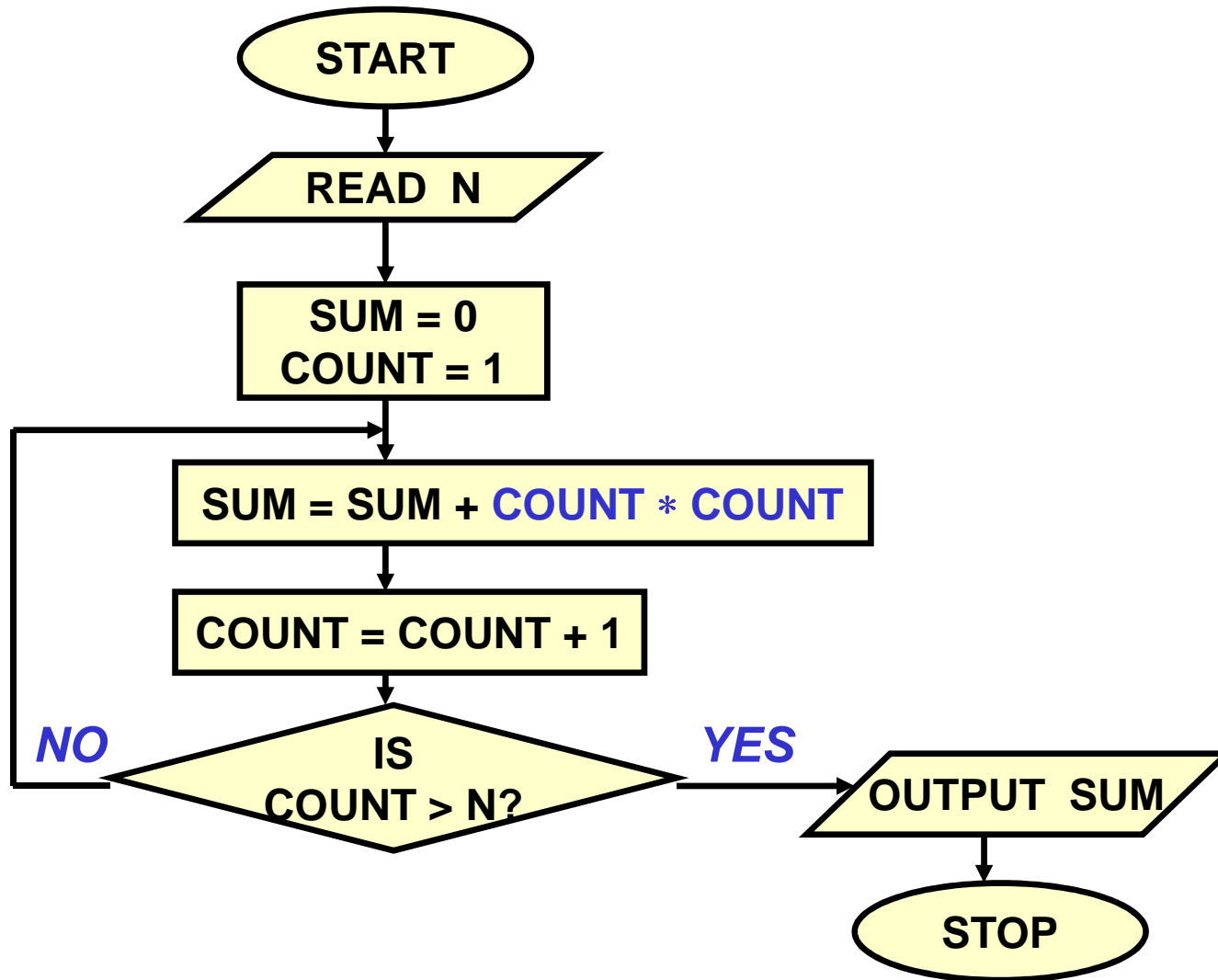
Example 3: Largest of three numbers



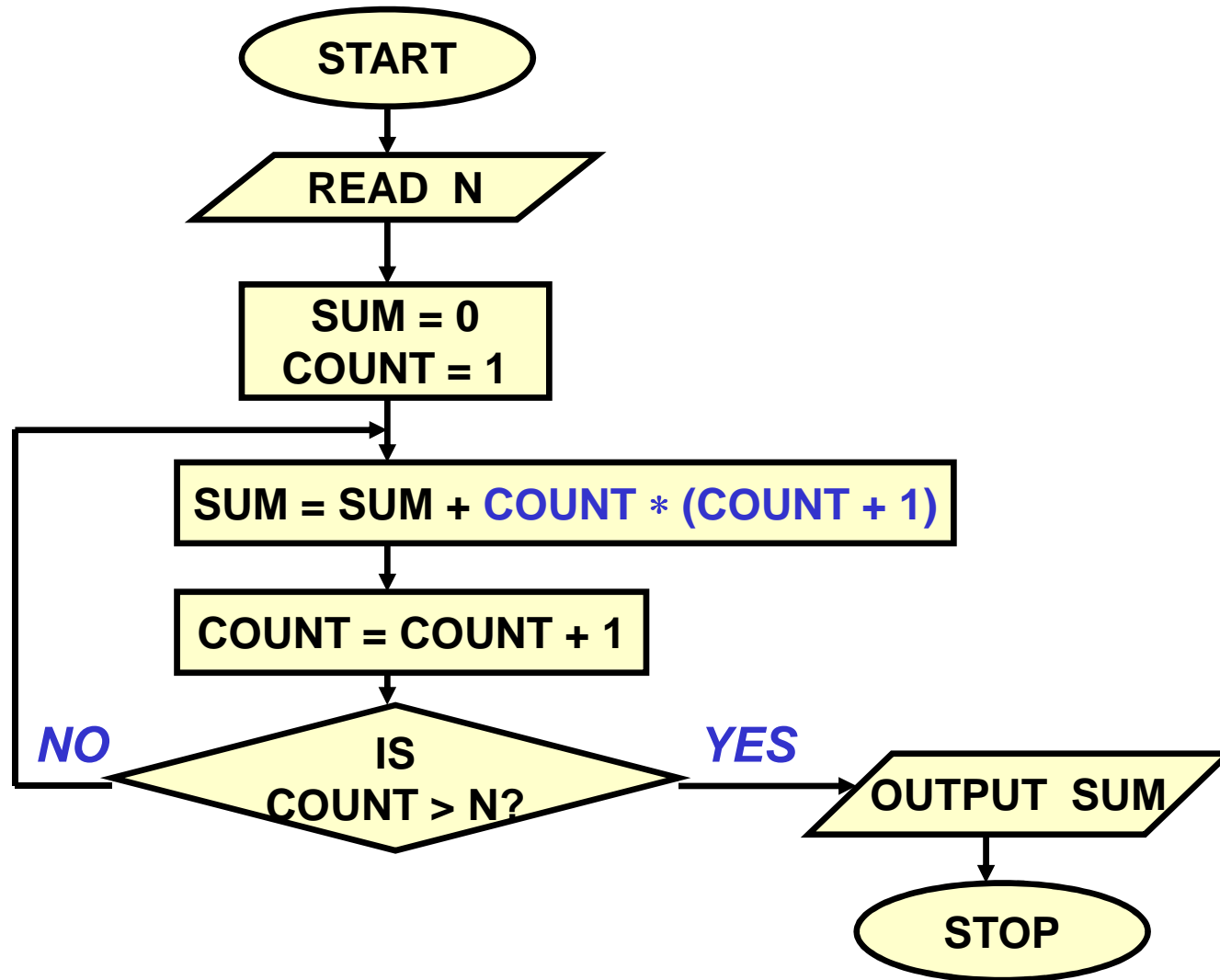
Example 4: *Sum of first N natural numbers*



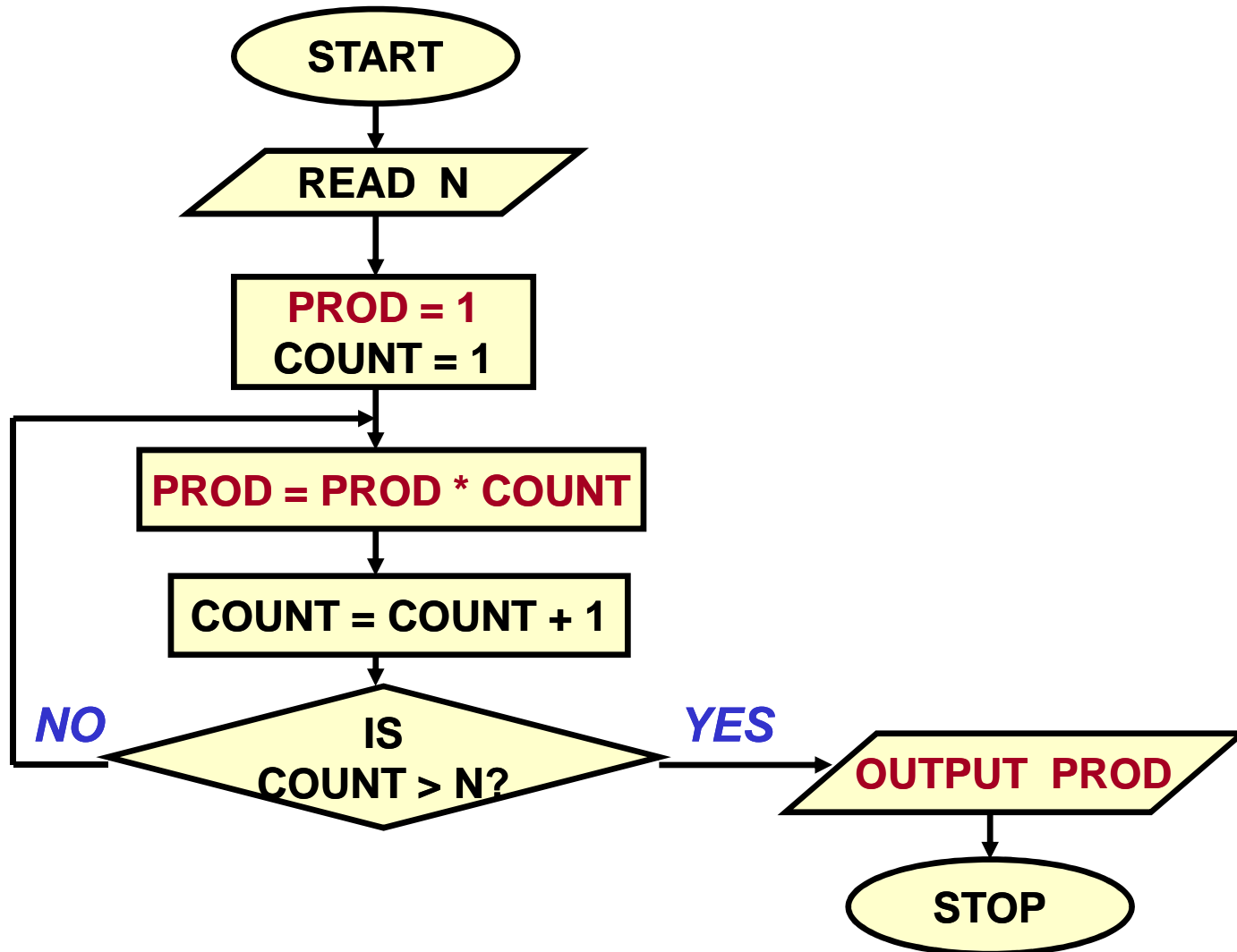
Example 5: $SUM = 1^2 + 2^2 + 3^2 + N^2$



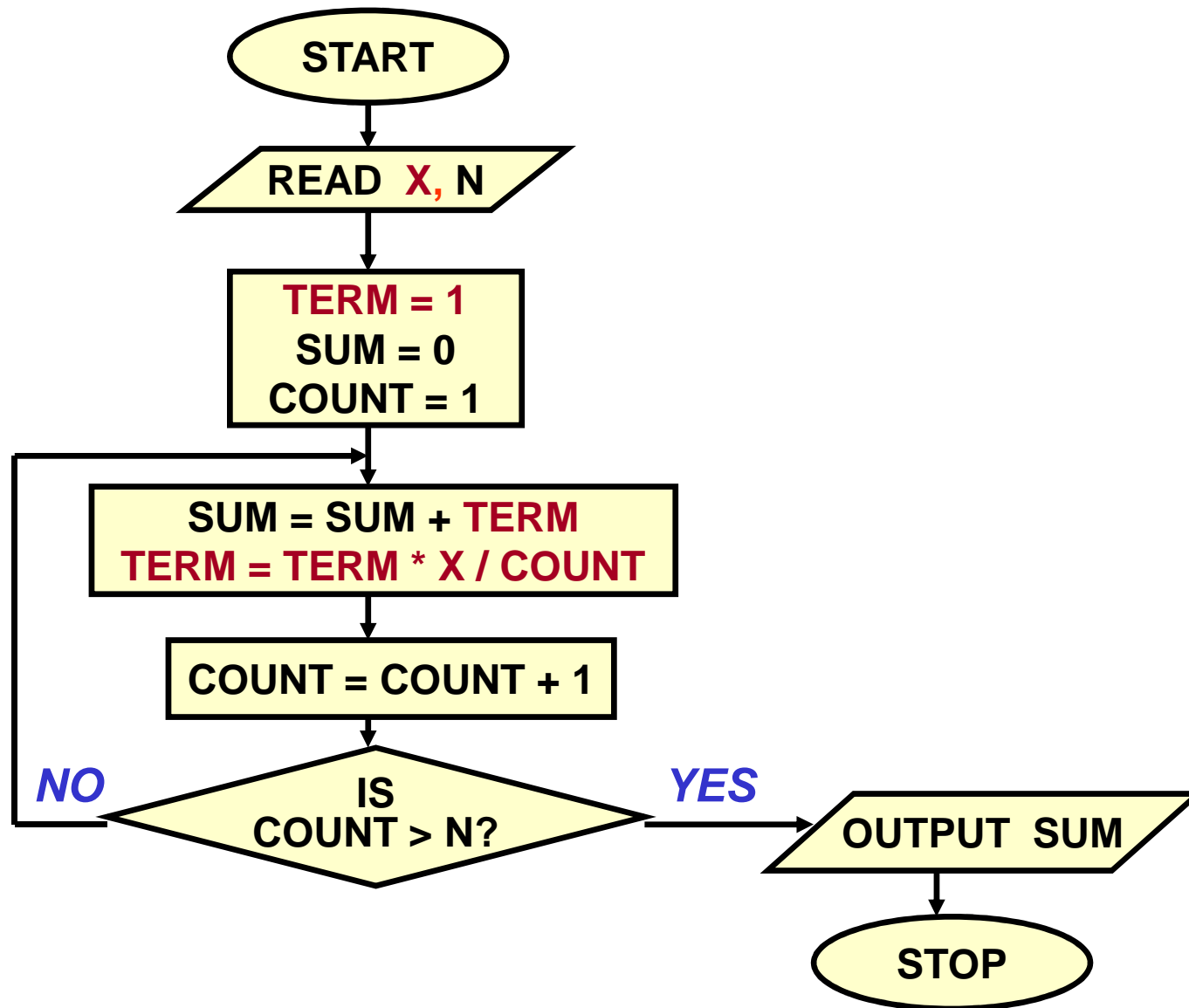
Example 6: $SUM = 1.2 + 2.3 + 3.4 + \dots$ to N terms



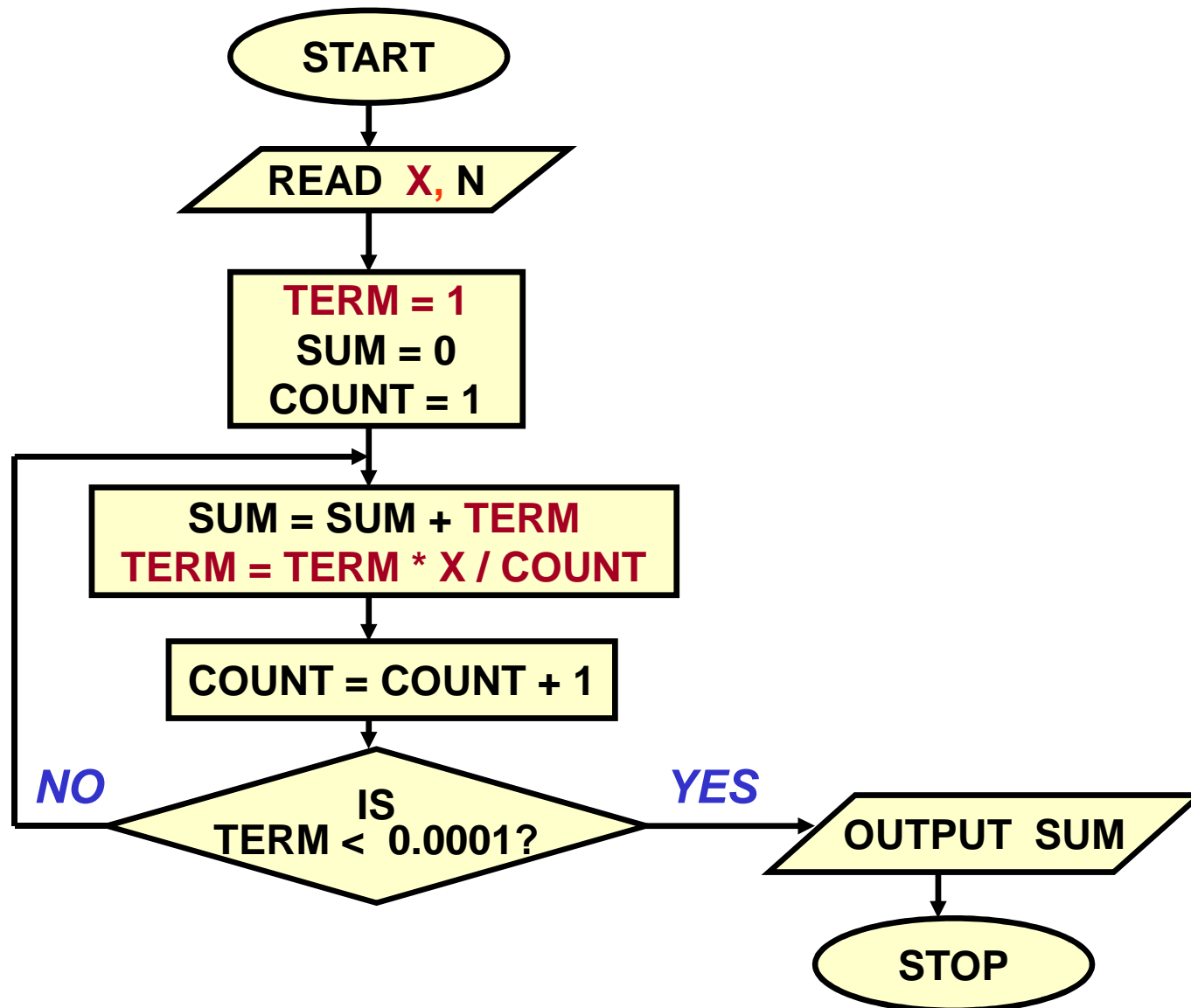
Example 7: Computing Factorial



Example 8: Computing e^x series up to N terms



Example 8: Computing e^x series up to 4 decimal places



Example 10: *Roots of a quadratic equation*

$$ax^2 + bx + c = 0$$

TRY YOURSELF

Example 11: *Grade computation*

MARKS \geq 90	\rightarrow Ex
89 \geq MARKS \geq 80	\rightarrow A
79 \geq MARKS \geq 70	\rightarrow B
69 \geq MARKS \geq 60	\rightarrow C
59 \geq MARKS \geq 50	\rightarrow D
49 \geq MARKS \geq 35	\rightarrow P
34 \geq MARKS	\rightarrow F

Grade Computation (contd.)

