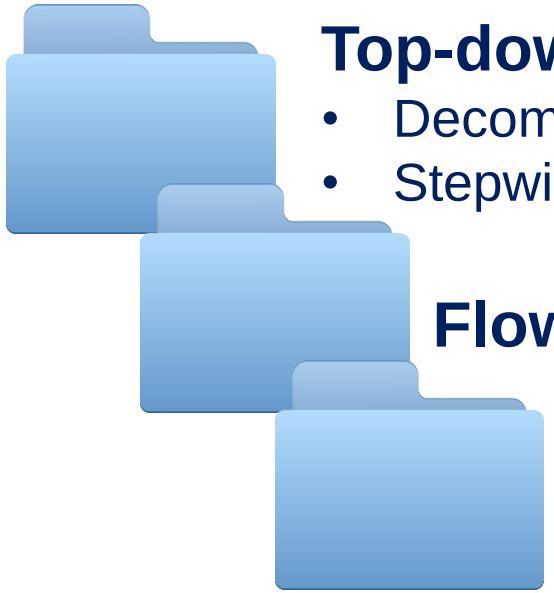
Basic Program Structure
Flowchart and Pseudocode

Lesson Objectives

At the end of this lesson, you should be able to:

- Apply top-down design methodology to develop an algorithm to solve a problem
- Express the solution(s) of a problem in such a way that a computer – human or machine – can effectively carry out
- Express an algorithm using:
  - Flowcharts
  - Pseudocode

Topic Outline



Top-down Design Methodology

- Decomposition
- Stepwise Refinement

Flowcharts

Pseudocode

Scenario 1: Finding the Nearer Coffee Shop

NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

Watch the video lecture to view the animation clip.

Top-down Stepwise Refinement: Decomposition

NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

Scenario 1: Finding the Nearer Coffee Shop

Calculate the distances to locations

Find the nearer location

Algorithms are basically sequential (step-by-step).

Stepwise Refinement

- When you formulate a method/ procedure for solving a problem, it has to be computable.
- Such a procedure is called **Algorithm**.

Scenario 1: Finding the Nearer Coffee Shop

Find the distance to location 1

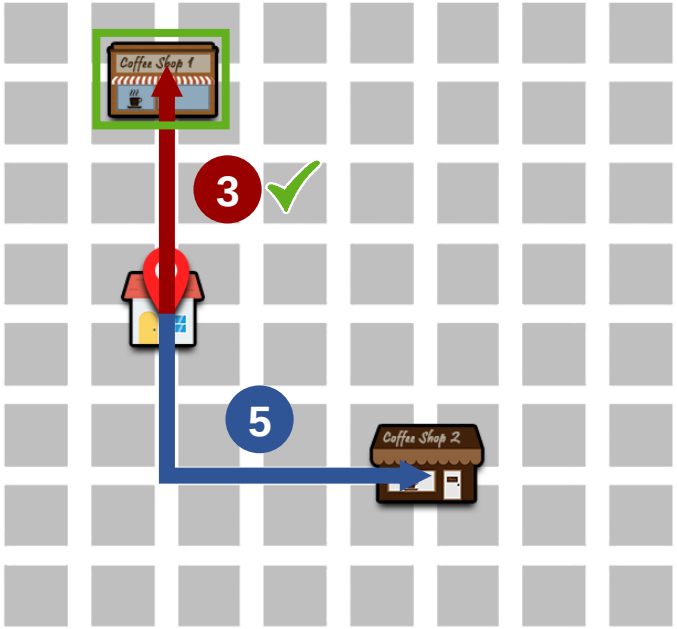
Calculate the distances to locations

Find the distance to location 2

Compare the two distances

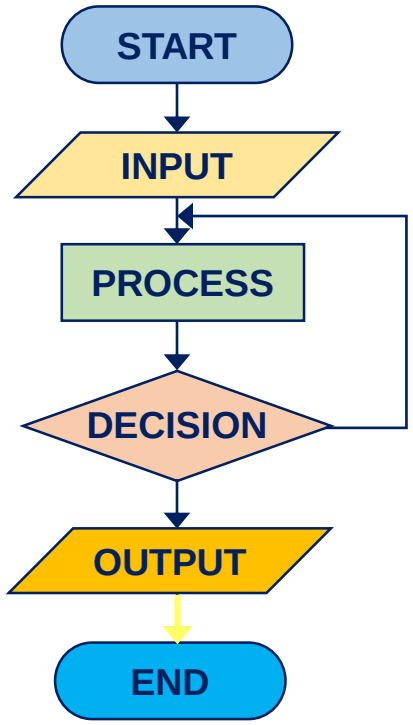
Find the nearer location

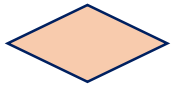
Select the nearer one based on comparison result



Flowcharts

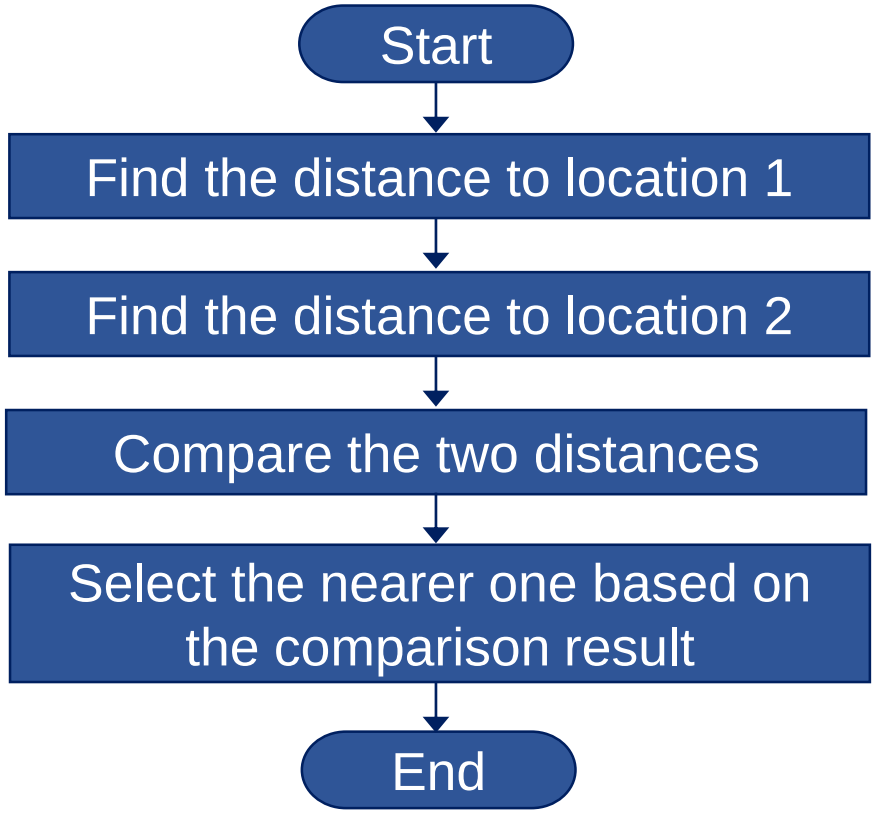
Flowchart: a representation of an algorithm using diagram for effective visualization



Name	Symbol	Use in Flowchart
Oval		Denotes the beginning or end of a program
Flow line		Denotes the direction of logic flow in a program
Parallelogram		Denotes either an input operation (e.g. INPUT) or an output operation (e.g. PRINT)
Rectangle		Denotes a process to be carried out (e.g. an addition)
Diamond		Denotes a decision or branch to be made; the program should continue along one of two routes

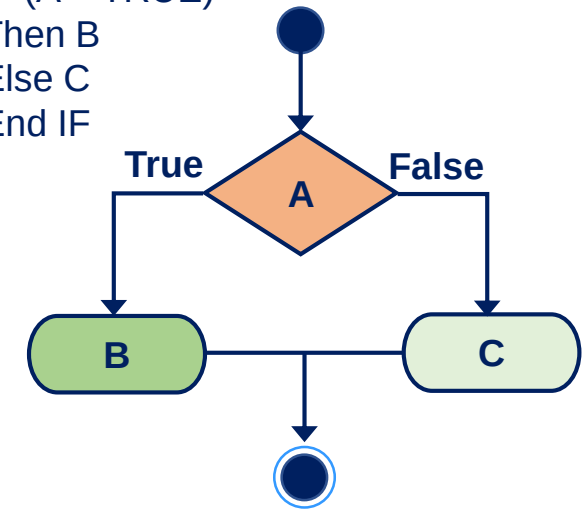
Flowcharts (Cont'd)

Scenario 1: Flowchart 1



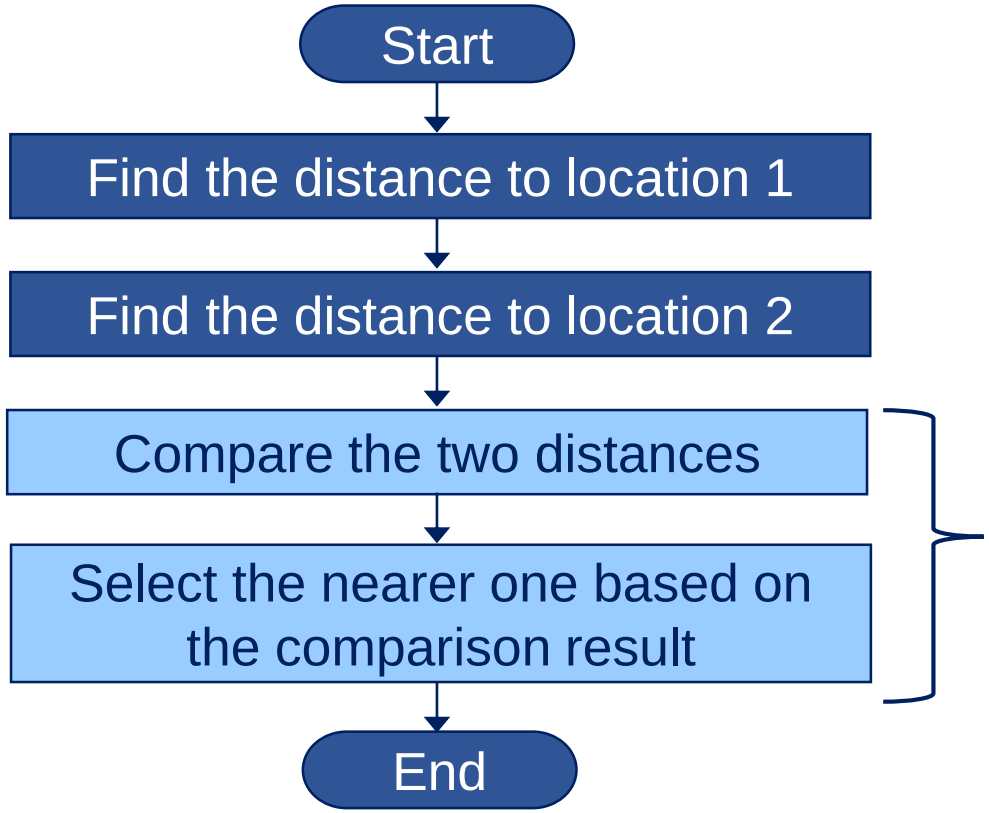
May include **Branching** (making selection)

IF (A = TRUE)
Then B
Else C
End IF

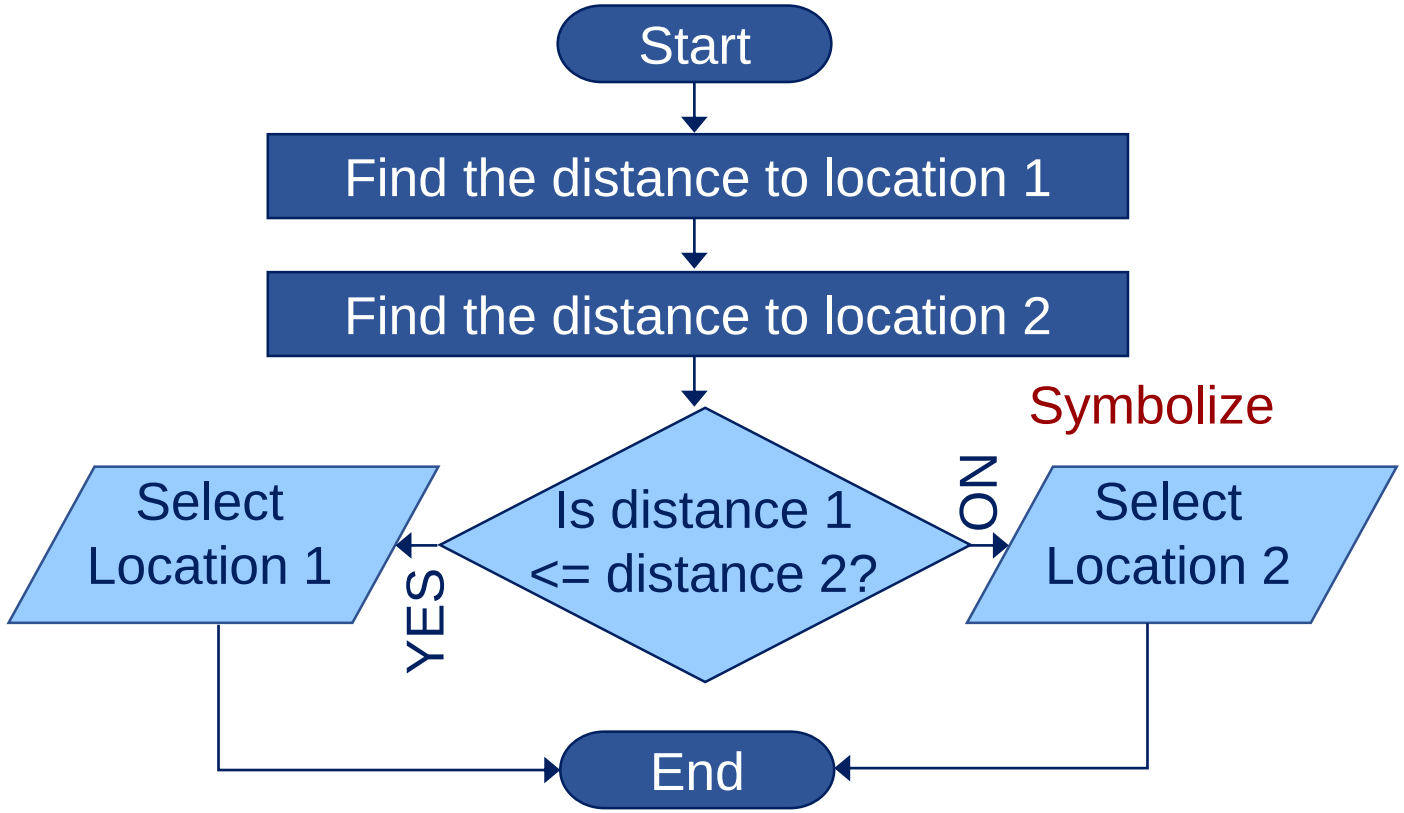


Flowcharts (Cont'd)

Scenario 1: Flowchart 1

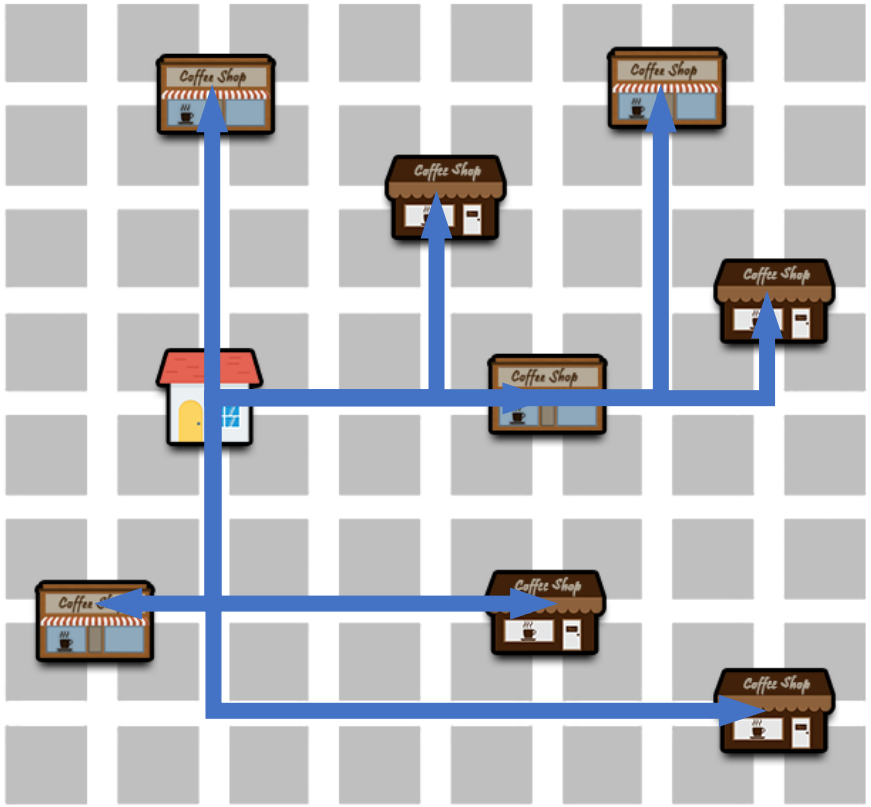


Flowchart 2



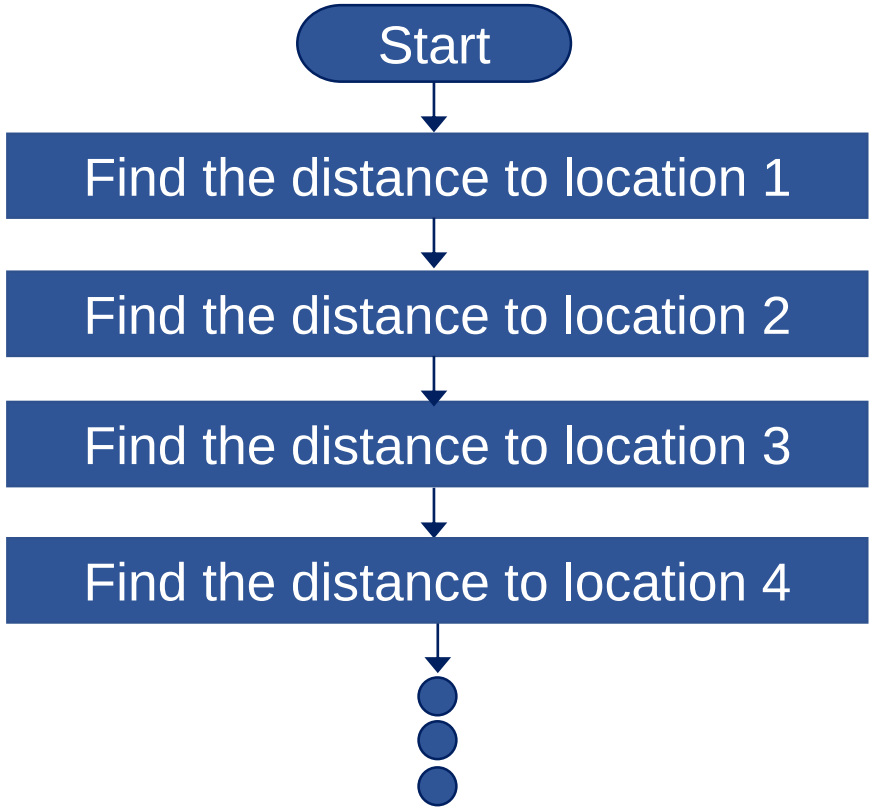
Flowcharts (Cont'd)

What if there were many coffee shops?

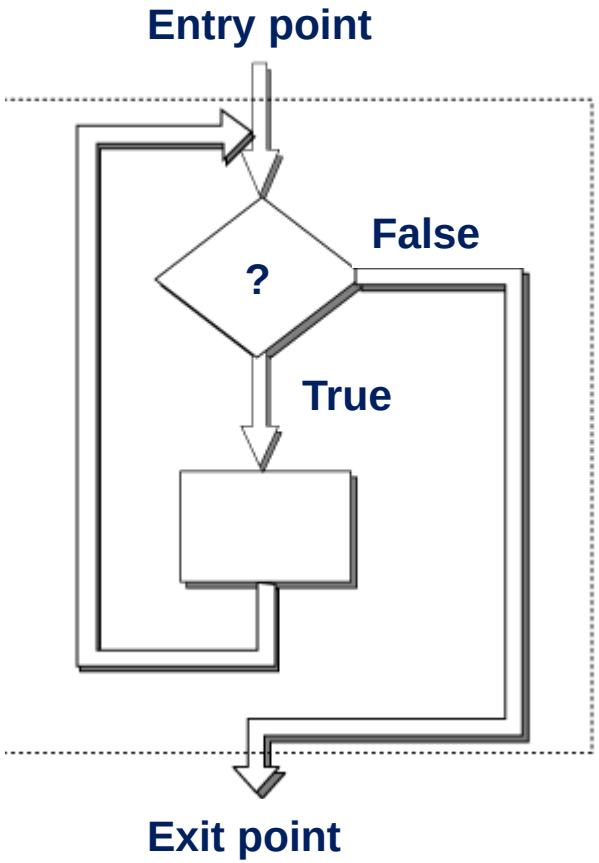


Flowcharts (Cont'd)

What if there were many coffee shops?

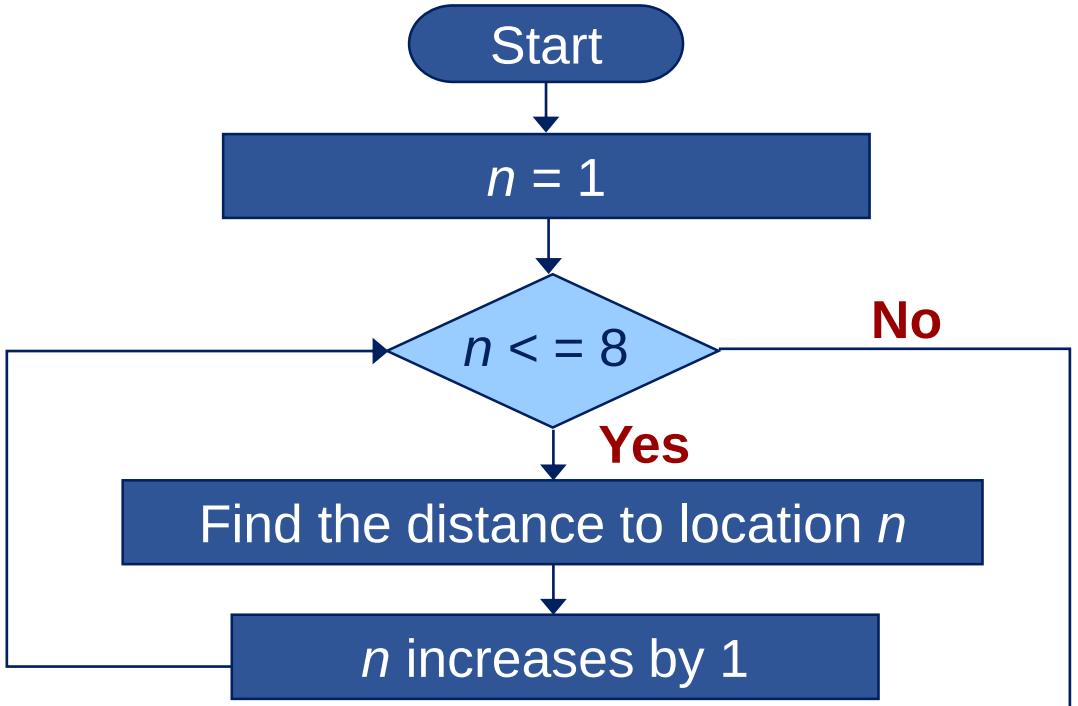


May include Looping (repeating certain operations)



Flowcharts (Cont'd)

May include Looping (repeating certain operations)



Find nearest location Data Structure (Ch. 4); Function (Ch. 5 & 6); Algorithm (Ch.7)

More on this later..

Pseudocode

Pseudocode: pronounced as /ˈ**s(j)uːdəʊˌkəʊd**/ 

- IDEA: directly uses informal English to describe an algorithm step by step with one step per line
- Uses the structural conventions of a normal programming language
  - but is intended for human reading rather than machine reading

Pseudocode (Cont'd)

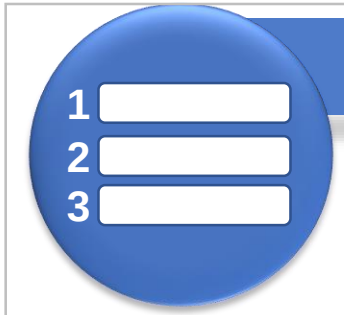
General Notes:

- No strict rules
- Uses informal language – combination of English and keywords

Common Keywords	Other Keywords
`IF, ELSE, WHILE`	`READ, PRINT, INITIALIZE, COMPUTE, ADD, SUBTRACT`

- Usually starts an operation sentence with a verb (description should be concise and precise)

Pseudocode (Cont'd)

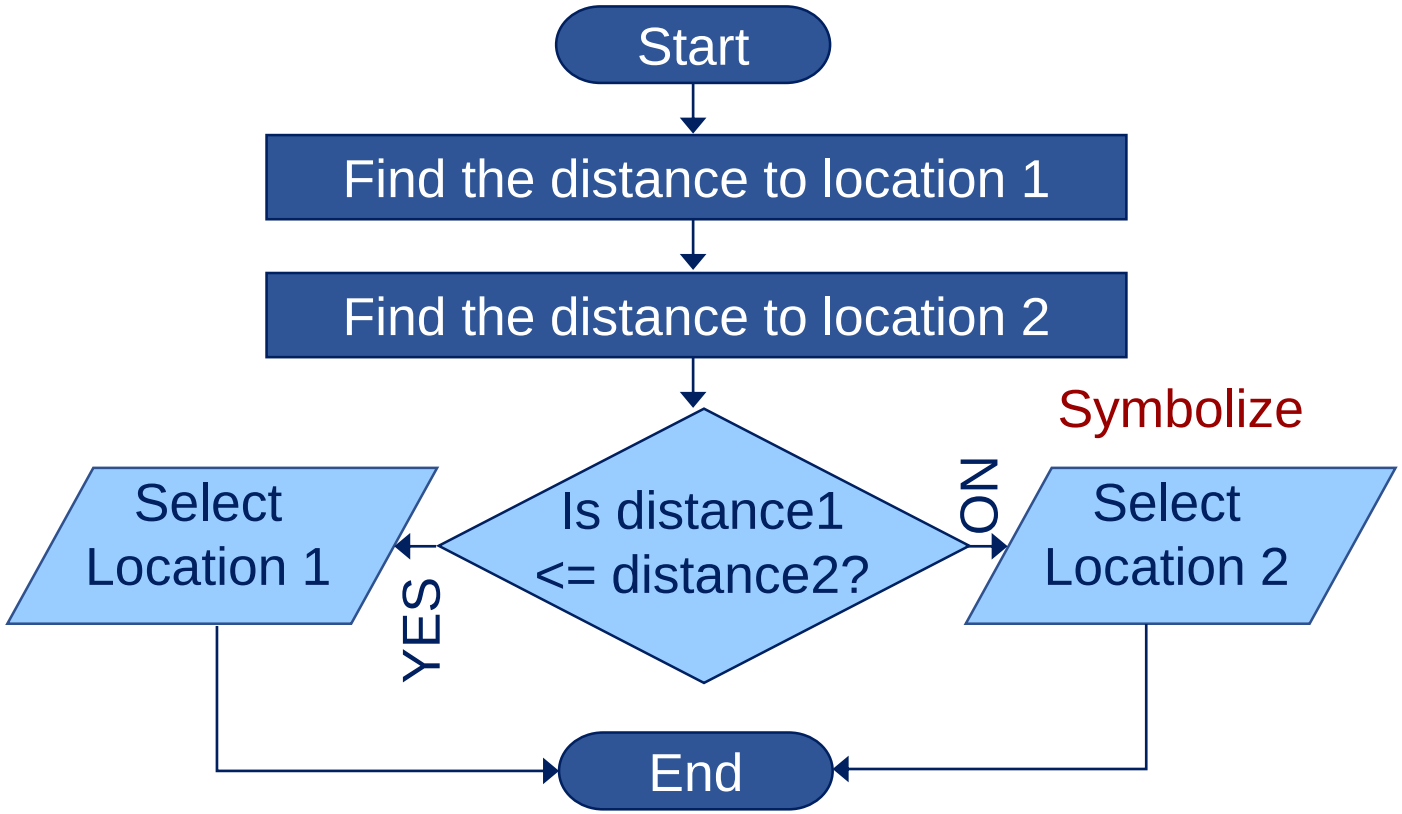


Guidelines

- *Write one statement per line only.*
- *Capitalize the keywords.*
- *Indent to show hierarchy.*
- *End multi-line structures.*
- *Keep statements programming-language independent.*

Flowchart vs. Pseudocode

Flowchart



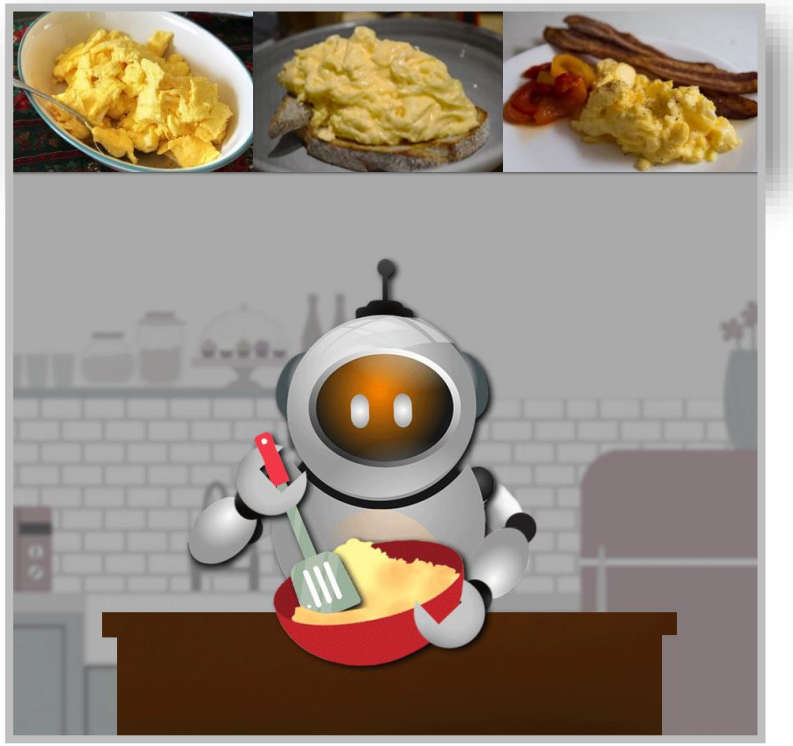
Pseudocode

```
FIND the distance to location 1
FIND the distance to location 2
IF distance1 <= distance2
   SELECT Location 1
ELSE
   SELECT Location 2
END IF
```

Scenario 2

Making Scrambled Eggs

1. Beat the eggs for 20 to 35 seconds in a bowl.
2. Heat a frying pan over a medium-low heat.
3. Melt some butter in the frying pan.
4. Cook eggs on the pan and stir eggs while cooking.
5. Add other ingredients.
6. Serve the scrambled eggs.



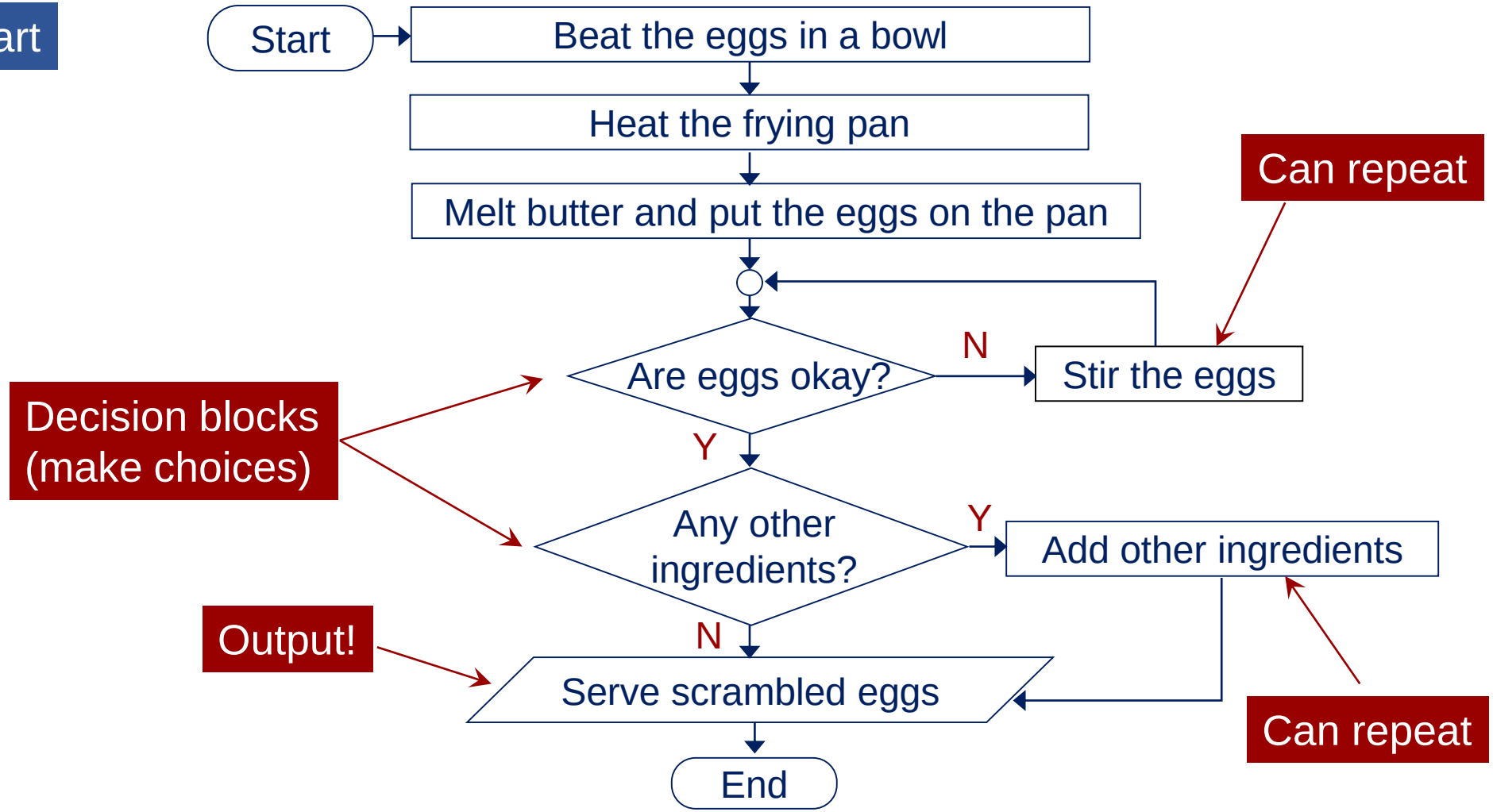
Scenario 2: Making Scrambled Eggs (Cont'd)

Pseudocode

```
BEAT the eggs for 20 to 35 seconds in a bowl
HEAT a frying pan over a medium-low heat
MELT some butter in the frying pan and PUT eggs on pan
WHILE eggs not okay
   STIR eggs while cooking
END WHILE
IF any ingredients
   Add other ingredients
END IF
SERVE the scrambled eggs
```

Scenario 2: Making Scrambled Eggs (Cont'd)

Flowchart



Quick Check

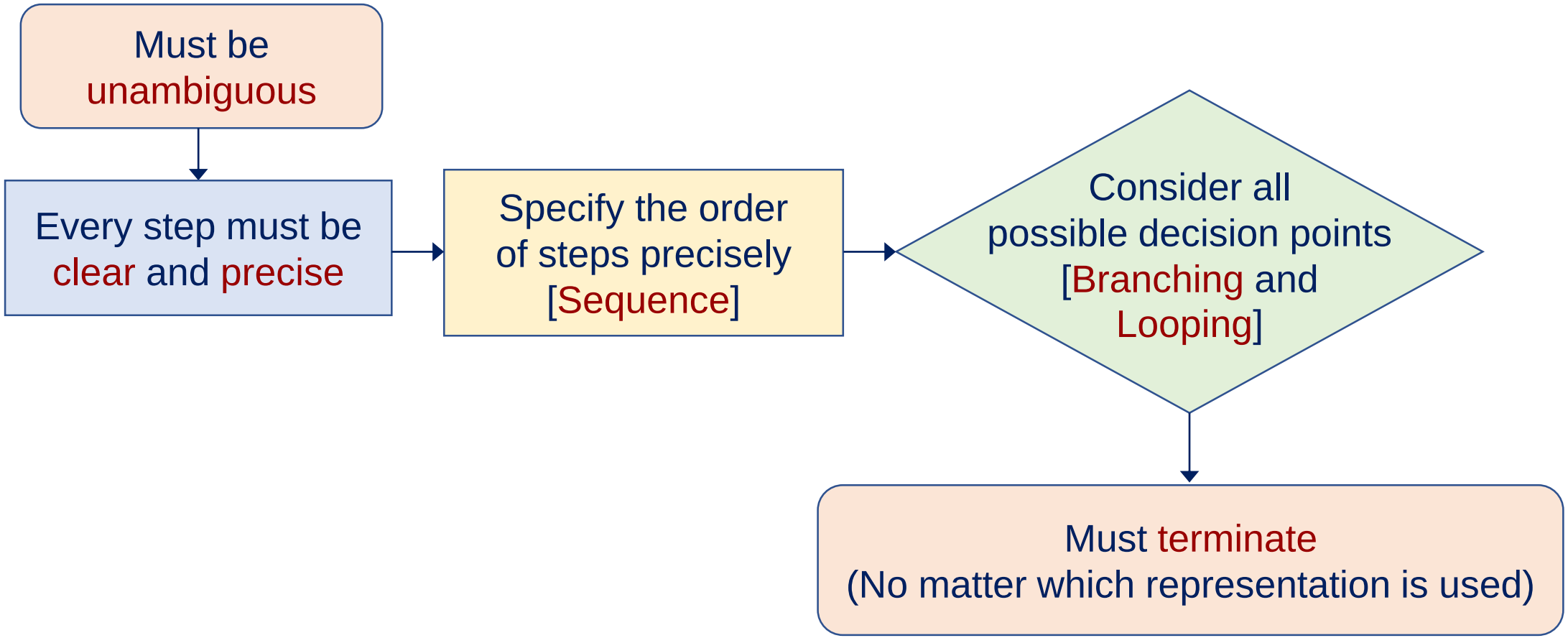
Is an algorithm readable by computers?

Quick Check: Answer

Is an algorithm readable by computers?

Answer **No**

Summary: Expressing an Algorithm



References for Images

No.	Slide No.	Image	Reference
1	11, 12		Question problem [Online Image]. Retrieved April 18, 2018 from https://pixabay.com/en/question-problem-think-thinking-622164/.
2	18		By Tom Ipri - Scrambled Eggs auf flickr, CC BY-SA 2.0, retrieved April 17, 2018 from https://commons.wikimedia.org/w/index.php?curid=19780642.
3	18		Alpha (2017). Scrambled Eggs AUD11 [Online Image]. Retrieved April 17, 2018 from https://www.flickr.com/photos/avlxyz/35785591606.
4	18		Kim, E. (2015). Inspiration in the Form of Scrambled Eggs [Online Image]. Retrieved April 17, 2018 from Survey icon [Online Image]. Retrieved April 18, 2018 from https://www.flickr.com/photos/eekim/22938049693.