

Designing an Algorithm

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Introductory Computer Science
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Designing an algorithm

Algorithm design

Pseudocode

Flowcharts

Common flowchart symbols

- An **algorithm** is a plan, a logical step-by-step process for solving a problem.
 - *Algorithm*: A sequence of logical instructions for carrying out a task. In computing, algorithms are needed to design computer programs
- Algorithms are normally written as a flowchart or in pseudocode.
 - *Flowchart (akış diyagramı)*: A diagram that shows a process, made up of boxes representing steps, decision, inputs and outputs.
 - *Pseudocode (sözde kod)*: A method of writing up a set of instructions for a computer program using plain language. This is a good way of planning a program before coding.

Designing an algorithm (cont.)

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- The key to any problem-solving task is to guide your thought process. The most useful thing to do is keep asking 'What if we did it this way?' Exploring different ways of solving a problem can help to find the best way to solve it.
- When designing an algorithm, consider if there is more than one way of solving the problem.

Designing an algorithm (cont.)

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When designing an algorithm there are two main issues to look at:

- the **big picture** - What is the final goal?
- the **individual stages** - What obstacles should be overcome on the way to the goal?

Understanding the problem

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- Before an algorithm can be designed, it is important to check that the problem is completely understood.
- There are a number of basic things to know in order to really understand the problem:
 - What are the **inputs** into the problem?
 - What will be the **outputs** of the problem?
 - In what **order** do instructions need to be carried out?
 - What **decisions** need to be made in the problem?
 - Are any areas of the problem **repeated**?
- Once these basic things are understood, it is time to design the algorithm.

Pseudocode

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- Most programs are developed using programming languages.
 - **Programming language:** A language used by a programmer to write a piece of software. There are many programming languages; e.g., ...
- These languages have specific syntax that must be used so that the program will run properly.
 - **Syntax (sözdizimi, sözdizimi kuralları):** Rules governing how to write statements in a programming language.
 - **Program:** Sequences of instructions for a computer.
 - **Instruction:** A single action that can be performed by a computer processor.
- Pseudocode is not a programming language, it is a simple way of describing a set of instructions that does not have to use specific syntax.

Common pseudocode notation

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- There is no strict set of standard notations for pseudocode
 - **Notation:** A system of written symbols or graphics used to represent something in order to aid communication and understanding.

Common pseudocode notation

- Some of the most widely recognised notations for pseudocode are:
 - **INPUT**: indicates a user will be inputting something
 - **OUTPUT**: indicates that an output will appear on the screen
 - **WHILE**: a loop (iteration that has a condition at the beginning)
 - **Loop**: A method used in programming to repeat a set of instructions.
 - **Iteration**: In computer programming, this is a single pass through a set of instructions.
 - **Condition**: In computing, this is a statement or sum that is either true or false. A computation depends on whether a condition equates to true or false.
 - **FOR**: a counting loop (iteration)
 - **REPEAT - UNTIL**: a loop (iteration) that has a condition at the end
 - **IF - THEN - ELSE**: a decision (selection) in which a choice is made

Using pseudocode

- Pseudocode can be used to plan out programs.
- Planning a program that asks people what the best subject they take is, would look like this in pseudocode

REPEAT

 OUTPUT 'What is the best subject you take?'

 INPUT user inputs the best subject they take

 STORE user's input in the answer variable

 IF answer = 'Computer Science'

 THEN

 OUTPUT 'Of course it is!'

 ELSE

 OUTPUT 'Try again!'

UNTIL answer = 'Computer Science'

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symbols

- A flowchart is a diagram that represents a set of instructions.
- Flowcharts normally use standard symbols to represent the different types of instructions.
- These symbols are used to construct the flowchart and show the step-by-step solution to the problem.

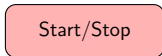
Common flowchart symbols

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- This shape tells you where the flowchart begins and ends.
- In other words, it shows the entry point of your flowchart and the exit point.

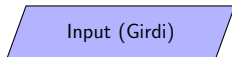
Common flowchart symbols

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- Veri bilgi girişi
- This takes the shape of a parallelogram.
- The Data object, often referred to as the I shows the Inputs to a process.

Common flowchart symbols

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Process / işlem

- Represents a process, action, or function.
- It's the most widely-used symbol in flowcharting.

$$c = a^2 + b^2$$

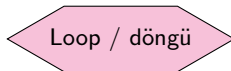
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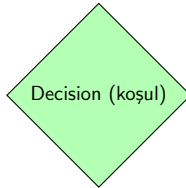
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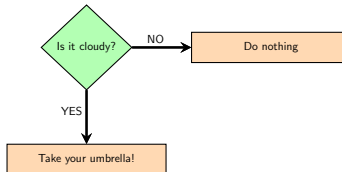


- A loop is a sequence of instructions that is continually repeated until a certain condition is reached.

Common flowchart symbols



- A decision asks a question. The answer to the question determines which arrow you follow
- If it is cloudy, follow the arrow down near the word **Yes**. If it is not cloudy, follow the arrow to the right near **No**



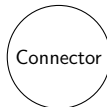
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- Represents a jump/flow from one point in the sequence to another.

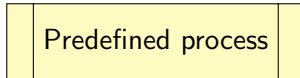
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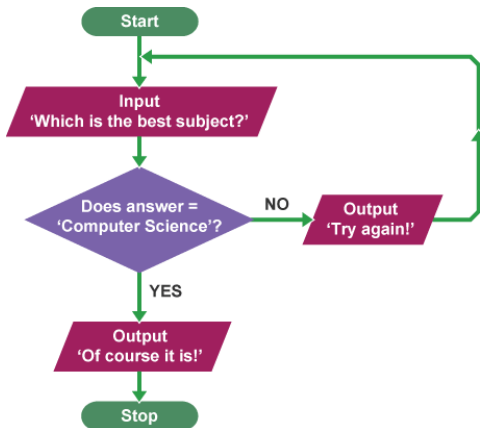
Common flowchart
symbols



- Önceden tanımlanmış işlem
- One or more named operations or program steps specified in a subroutine or another set of flowcharts.

Using flowcharts

- Flowcharts can be used to plan out programs.
- Planning a program that asks people what the best subject they take is, would look like this as a flowchart:



Advantages of algorithms/flowcharts

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- makes it easier to write a program
- reduces errors when coding
- decreases the time needed to write the program
- as the flow of the processes are easily seen, it makes it easier to control the program and check for/spot errors
- makes it easier to do additional arrangements/designs