Data Structures and Algorithms

Lab

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DEIK

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Timeplan for the semester

- 1. test in the 6th week

Timeplan for the semester

- 1. test in the 6th week
- 2. test in the 12th week

Timeplan for the semester

- 1. test in the 6th week
- 2. test in the 12th week
- retake in the 13th week

Definition of algorithm

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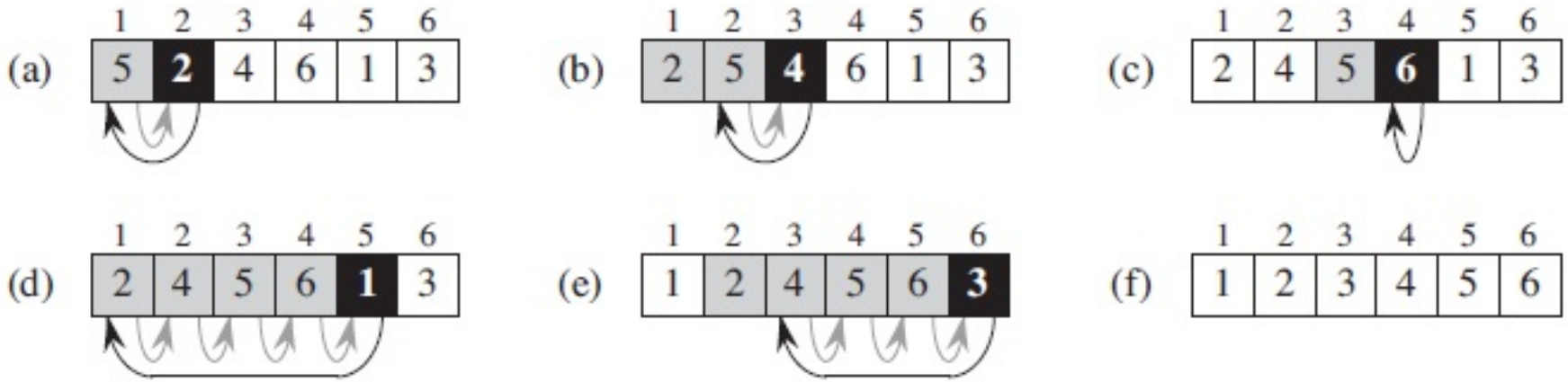
- The relation between input and output depends on the problem.

Algoritmus rendezésre

Input: A=<5,2,4,6,1,3>

Output: A'=<1,2,3,4,5,6>



Pseudocode

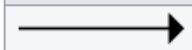
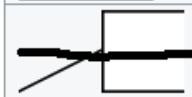
```
for j = 2 to A.length do
    key = A[j]                          ▷ Put A[j] into A[1..j-1].
    i = j − 1
    while i > 0 do
        if A[i] > key then
            A[i + 1] = A[i]
            i = i − 1
            A[i + 1] = key
        end if
    end while
end for
```

Flowchart

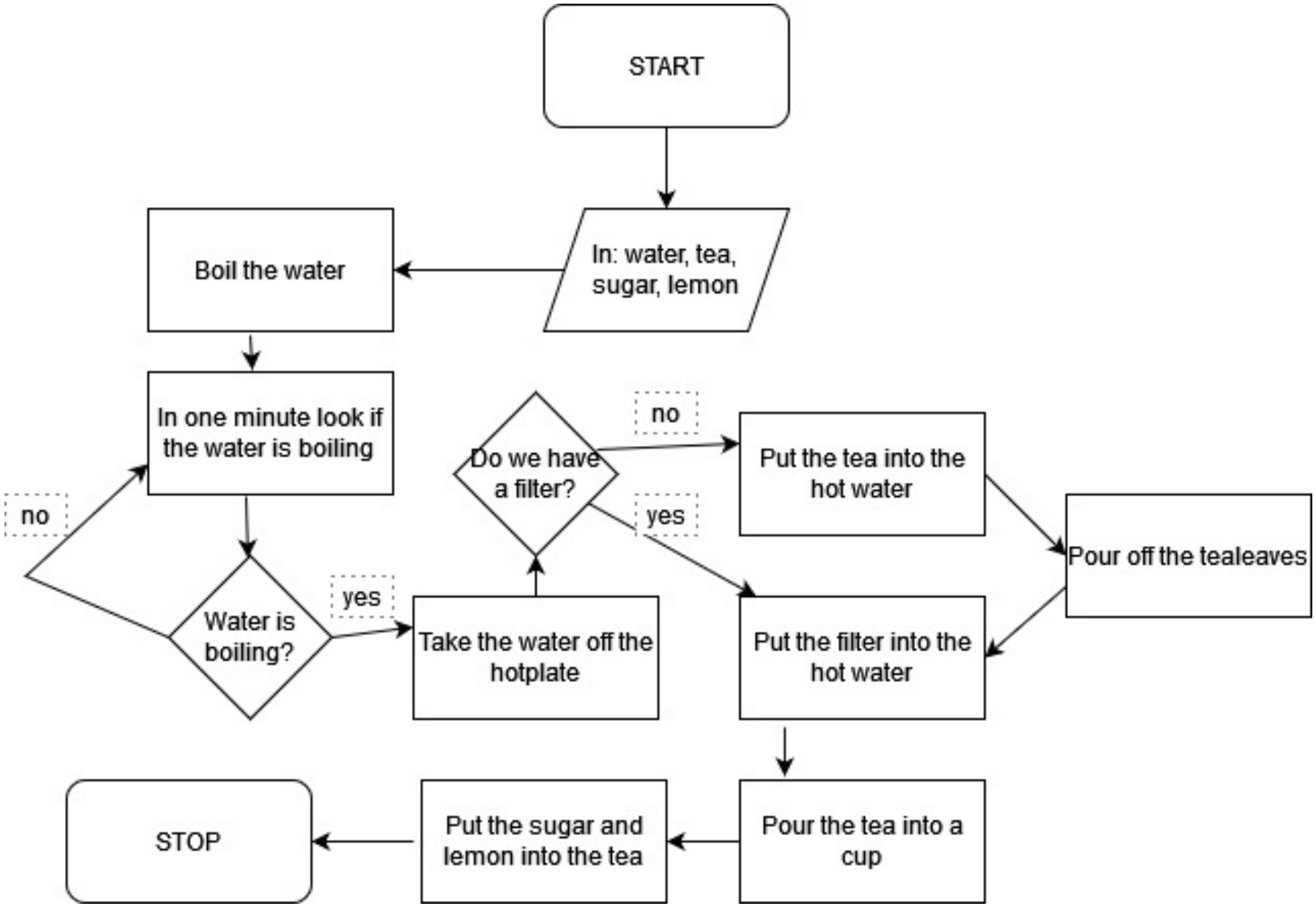
Building blocks [edit]

Common symbols [edit]

The American National Standards Institute (ANSI) set standards for flowcharts and their symbols in the 1960s.[14] The International Organization for Standardization (ISO) adopted the ANS
Generally, flowcharts flow from top to bottom and left to right.[17]

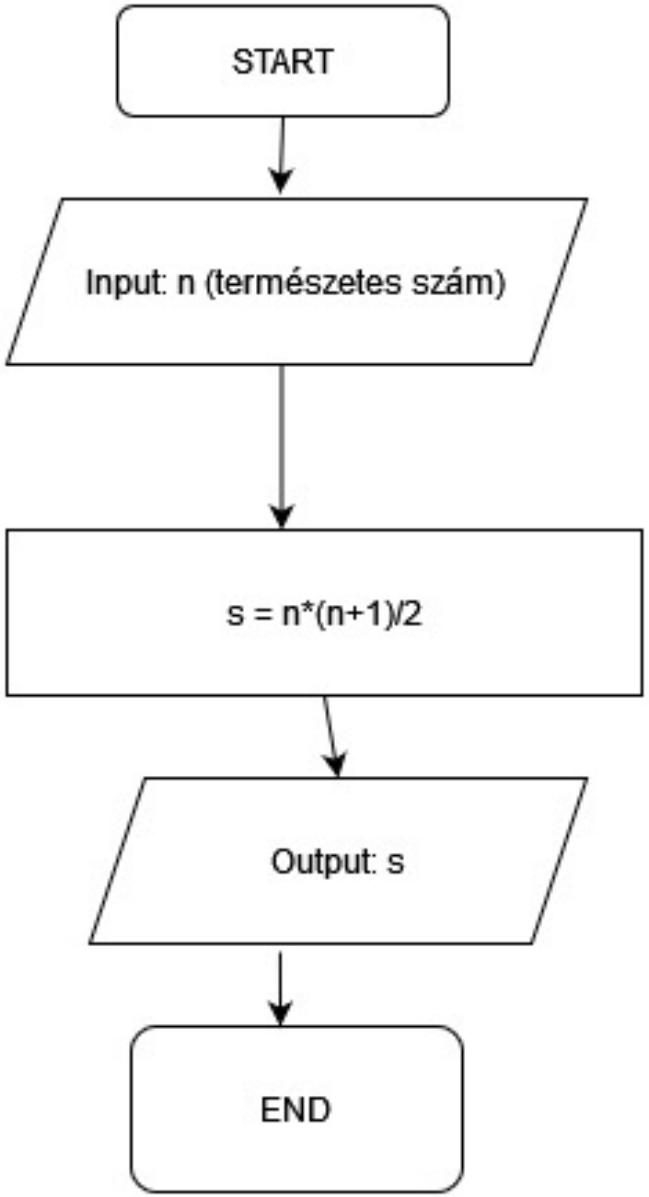
ANSI/ISO Shape	Name	Description
	Flowline (Arrowhead)[15]	Shows the process's order of operation. A line coming from one symbol and pointing at another.[14] Arrowheads are added if the flow is not t
	Terminal[14]	Indicates the beginning and ending of a program or sub-process. Represented as a stadium,[14] oval or rounded (fillet) rectangle. They usua a process, such as "submit inquiry" or "receive product".
	Process[15]	Represents a set of operations that changes value, form, or location of data. Represented as a rectangle.[15]
	Decision[15]	Shows a conditional operation that determines which one of the two paths the program will take.[14] The operation is commonly a yes/no que
	Input/Output[15]	Indicates the process of inputting and outputting data,[15] as in entering data or displaying results. Represented as a parallelogram.[14]
	Annotation[14] (Comment)[15]	Indicating additional information about a step in the program. Represented as an open rectangle with a dashed or solid line connecting it to t
	Predefined Process[14]	Shows named process which is defined elsewhere. Represented as a rectangle with double-struck vertical edges.[14]
	On-page Connector[14]	Pairs of labeled connectors replace long or confusing lines on a flowchart page. Represented by a small circle with a letter inside.[14][18]
	Off-page Connector[14]	A labeled connector for use when the target is on another page. Represented as a home plate-shaped pentagon.[14][18]

Make a tea

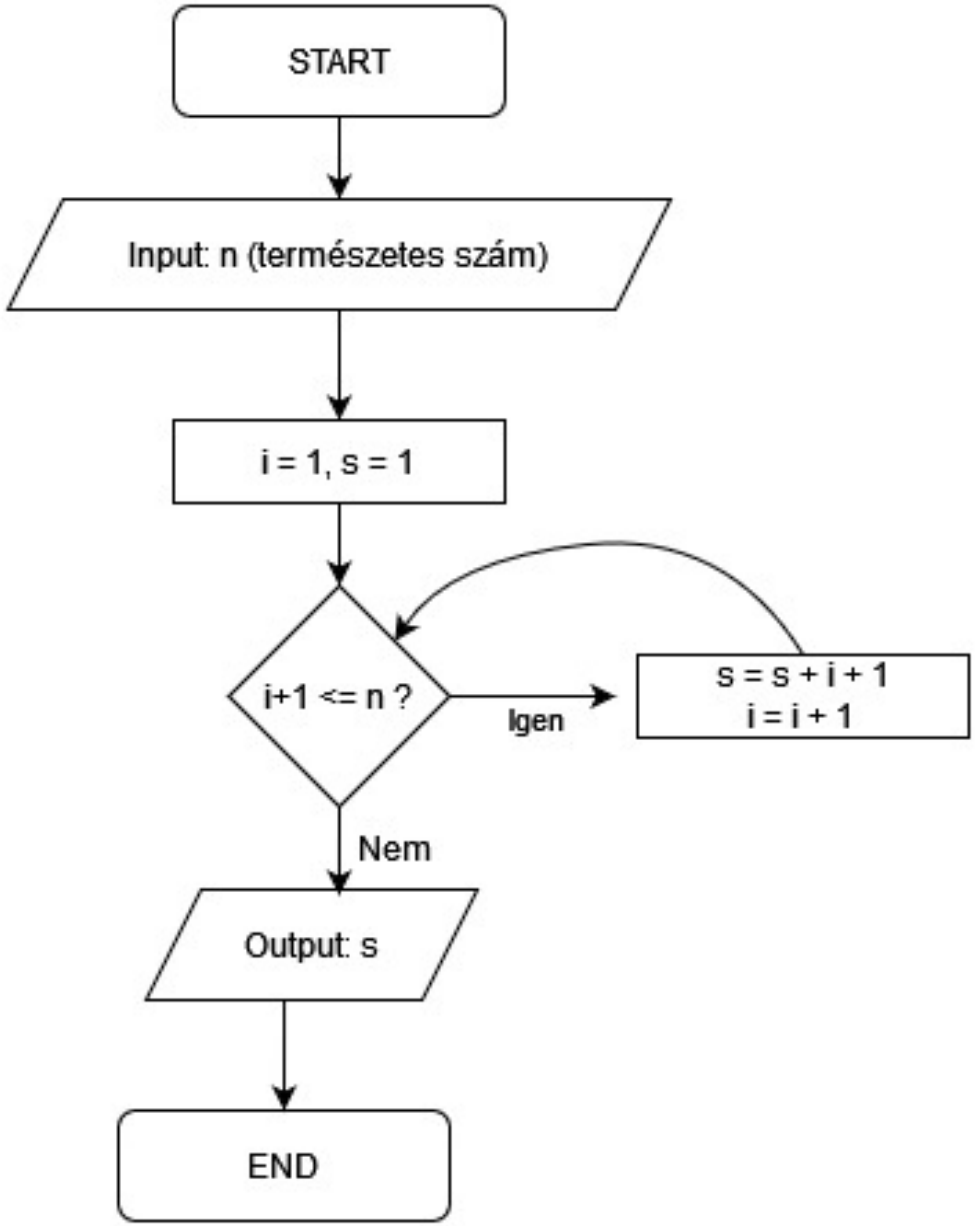

START
In: water, tea, sugar, lemon
Boil the water
In one minute look if the water is boiling
Water is boiling?
no
yes
Take the water off the hotplate
Do we have a filter?
no
yes
Put the tea into the hot water
Put the filter into the hot water
Pour off the tealeaves
Pour the tea into a cup
Put the sugar and lemon into the tea
STOP

Add the numbers from 1 to n

Add the numbers from 1 to n



...with n steps


START
Input: n (természetes szám)
i = 1, s = 1
i+1 <= n ?
Igen
s = s + i + 1
i = i + 1
Nem
Output: s
END

```
>>> def osszeadrek(n):
...     x = 0
...     i = 1
...     while i < n+1:
...         x = x + i
...         i = i + 1
...     return x
...
>>> osszeadrek(10)
55
```

```
>>> def osszeadas(n):
...     sum = n*(n+1)/2
...     return sum
...
>>> osszeadas(10)
55.0
>>> osszeadas(9)
45.0
```

Linear search

Input: vector

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Output: the coordinate of a given value in the vector

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The algorithm starts at the first coordinate of the vector and proceeds along. At each coordinate it investigates if the coordinate coincides with the given value.

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The algorithm starts at the first coordinate of the vector and proceeds along. At each coordinate it investigates if the coordinate coincides with the given value. If the length of the vector is increased by 1, then the number of steps in the algorithm also increases by 1. The running time is at most n.

Binary search

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The algorithm divides the vector into two parts in the middle. The value we search is either greater or smaller than the value in the middle. Therefore, we can cut one half of the vector.

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The algorithm divides the vector into two parts in the middle. The value we search is either greater or smaller than the value in the middle. Therefore, we can cut one half of the vector. The running time of the algorithm is at most $log_2 n + 1$.

```
>>> def linear_search(A,n):
...     for i in range(1, len(A)+1):
...         if i == n:
...             print(i)
...         else:
...             print(0)
...
>>> linear_search([1,2,3,4],2)
0
2
0
0
```

```
>>> def binary_search(A, n, x):
...     L = 0
...     R = n-1
...     while L <= R:
...         m = math.floor((L+R)/2)
...         if A[m] < x:
...             L = m +1
...         elif A[m] > x:
...             R = m - 1
...         else:
...             return m
...     return unsuccesful
...
>>>
>>> binary_search([1,2,3,4,5],5,2)
1
>>> binary_search([1,2,3,4,5],5,1)
0
>>> binary_search([1,3,4,5,7,9,33],7,9)
5
```