Tallinn University of Technology

School of Engineering

Integrated Engineering

Emma Hansson

243487MVEB

**TABULATION OF THE FUNCTION**

First homework in course IAX0583

Supervisor: Vladimir Viies

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# AUTHORS DECLARATION

I confirm that I have prepared this homework independently and that it has not been previously submitted for defense by someone else. All the works of other authors used in the preparation of the work, important points of view, data from literary sources and elsewhere are cited in the work.

Author: Emma Hansson

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**CONTENTS**

[AUTHORS DECLARATION 2](#_Toc181726356)

[1. TASK STATEMENT 4](#_Toc181726357)

[1.1. Specific task 4](#_Toc181726358)

[1.1.1. Method 4](#_Toc181726359)

[1.1.2. The function 4](#_Toc181726360)

[2. ANALYSIS OF THE FUNCTION y=f(x) 5](#_Toc181726361)

[2.1. The domain of the function 5](#_Toc181726362)

[2.2. The graph of the function 5](#_Toc181726363)

[3. SOLUTION DESCRIPTION 6](#_Toc181726364)

[3.1. Workflow 6](#_Toc181726365)

[3.2. The algorithm 8](#_Toc181726366)

[3.3. The code in C 9](#_Toc181726367)

[3.4. Special cases 10](#_Toc181726368)

[4. CONCLUSION 11](#_Toc181726369)

[EXTRA MATERIALS 12](#_Toc181726370)

[REFERENCES 14](#_Toc181726371)

# TASK STATEMENT

The task is to construct the algorithm of the task and the corresponding program in C language. All raw data are real numbers and are entered from the keyboard. The results are displayed on the screen in the form of a table, the columns of which are the values ​​of the argument x and the function y = f(x).

The function value is displayed only if it exists. If the value of the function is not specified for the given argument x or is complex, then 'none' or 'complex' must be output in the y column.

## Specific task

The basis of the tabulation method and the function to be tabulated is matriculation number: 243487.

### 1.1.1. Method

The initial and final values ​​A and B of the argument x and the step H are given. Valid conditions: A < B; H > 0.

The value of the function y is calculated in points:

* A;
* A+H;
* A + 2H;
* A + 3H;

until the condition that the value of the argument < B holds.

### 1.1.2. The function

# ANALYSIS OF THE FUNCTION y=f(x)

## The domain of the function

In order for the parameters entered by the user to be computable, the domain of this function needs to be found. The parameters, concerning the function ,are computable, when:

1. the denominator is not equal to 0.

7x ≠ 0 => x ≠ 0

The domain of this function is x ∈ {R} \ 0.

## The graph of the function

I used *GeoGebra* software to display the graph. When the graph is zoomed in on y-axis, it is visible that the graph never touches or crosses the y-axis, therefore, the domain of this function found by calculating, is correct.

**A graph of a function

Description automatically generated**

Figure 1. Graph of the function

# SOLUTION DESCRIPTION

The goal of this programme is to give x and y values for function f(x)= , in table form where the number of rows is 15. If it exceeds 15 rows then the program will output first 15 rows. X values will be determined by the user, where the user inserts the initial value A, the final value B and the step H. Data type ,,double” is used for all numeric values (A; B; H; x and y) for precise decimal representation.

The user enters 3 parameters:

* the initial value A (where A < B and A ≠ 0);
* the final value B (where B > A);
* the step H (where H > 0),

which all are real numbers.

All values ​​are entered separately and in case of incorrect form or parameters not being met, the user is asked to re-enter the values.

Since inserted number for A cannot be 0 (A=0 is the only case, where the function values do not exist) there will always be a corresponding value y for every x.

## Workflow

Simple description of the workflow of programme:

1. Defines the original data
2. Introduces the programme to the user
3. Asks for inputs
4. Check’s inputs and asks again if needed
5. Calculates x and then y values
6. Outputs the results

In code, the **prototypes** declare functions. The **main** initializes arrays and variables needed for the program's calculations (e.g., **xValues, yValues, A, B, H,** and **count**).The **main** also calls other functions to perform specific tasks:

* + **PrintIntroduction**: Displays an introductory message.
  + **AskForInput**: Prompts the user for input values.
  + **CalculateXValues:** Calculates x-values based on user input.
  + **CalculateYValues**: Calculates y-values based on the calculated x-values.
  + **OutputResults:** Displays the results to the user.

## 3.2. The algorithm

Based on the workflow, I conducted an algorithm, using “yEd” graph editor. Alrogithm has 3 separate parts: input, process and output, which are shown visually by columns.

**A diagram of a flowchart

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## The code in C

**A screenshot of a computer

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**A screen shot of a computer program

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**A screenshot of a computer program

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**A computer screen shot of a code

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## 3.4. Special cases

|  |  |  |  |
| --- | --- | --- | --- |
| **#** | **Description** | **State** | **Solution** |
| 1. | User inserts non-numeric values as inputs | solved | Checking the return value of *scanf*to confirm that a number was successfully read. (lines 49, 57, 66)  Clearing the input buffer if the input is invalid, allowing the user to try again without causing an infinite loop. (lines 52, 60, 69) |
| 3. | User inserts 0 as A | solved | Program won’t accept 0 as a valid input for A, due to the validation check (line 49) and asks user to re-enter A. (line 50) |
| 4. | User inserts B<A | solved | Program won’t accept it, due to the validation check (line 57) and asks user to re-enter values. (line 58) |
| 5. | User inserts H=0 | solved | Program won’t accept it, due to the validation check (line 66) and asks user to re-enter values. (line 67) |

Table 1. Special cases

# CONCLUSION

I conducted a program that calculates the x and y values in function , based on the values (initial value A; final value B and step H) that the user inserts. The algorithm was put together in “yEd” software and the main parts were input, process and output. Input asks for values A, B and H and checks if A<B; H=0; A=0. If inserted values are not valid, then the programme asks to insert values again. Process calculates first the x values and puts them to array and then calculates y values, based on x values. Output prints the x and y values as a table, with maximum of 15 rows.

Conducting the algorithm was not that difficult, but when conducting the code in C, I had to visit many consultations. At first, I got a code that did not have prototypes and functions were depending on each-other (could not use them separately). The code had ponters, but since we covered that topic in class, I left them in. Also the code was not prepared to deal with special cases. I had to figure out the missing parts and asked artificial intelligence to modify the functions such that the programme would not go to infinite loop, when non-number is inserted by user.

I learned a lot about proper code structure.

# EXTRA MATERIALS

**A screenshot of a computer program

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Picture 1. Code excecution, where inputs were valid.

**A screenshot of a computer program

Description automatically generated**

Picture 2. Code excecution, where inputs were invalid twice (A was invalid number: A=0; A was non-mumeric symbol: A=&).

**A screenshot of a computer program

Description automatically generated**

Picture 3. Code excecution, where number of rows were limited to 15.

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