

Penza State University
Faculty of Computer Science
Department of Computer Science

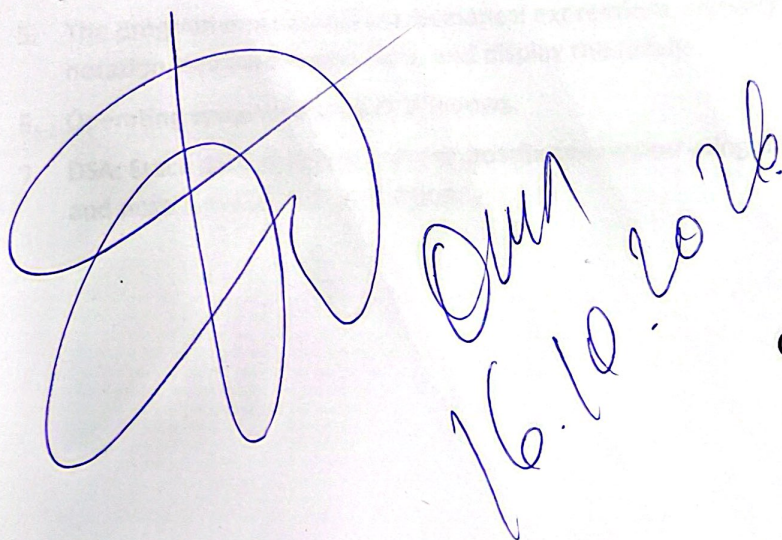
EXPLANATORY NOTE

for course design for the course

«Logic and fundamentals of algorithmization in engineering problems»

on the topic

Complex program structure «Floyd-Warshall Shortest-Path Algorithm»



A handwritten signature in blue ink, followed by the date "16.10.2026" written vertically.

Completed: Khalid Alakbari
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Accepted: Fedjunin R.N.

APPROVED

Head Department of VT

M.A. Mitrokhin

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2024 year

THE TASK LIST

for the course task

Logic and basic of algorithmization in engineering problems

Student Khalid Alakbari, Group 24VVia1

Project topic: Development of a Calculator Program Using Stack Data Structure .

Initial data (technical requirements) for design Develop a console-based calculator program for evaluating mathematical expressions using the stack data structure.

Mandatory program requirements:

1. IDE: Microsoft Visual Studio.
2. Programming language: C.
3. Input device: Keyboard.
4. The user interface should be console-based (CLI).
5. The program must accept mathematical expressions, convert infix expressions into postfix notation, evaluate expressions, and display the results.
6. Operating system: Microsoft Windows.
7. DSA: Stack data structure, infix-to-postfix conversion using the Shunting Yard algorithm, and postfix expression evaluation.

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Scope of work for the course

Algorithmic part

Study the stack data structure and its operations.

Develop an algorithm for converting infix expressions into postfix notation.

Develop an algorithm for evaluating postfix expressions.

Implement the calculator program in C.

☐ The grafical part

- Program flowchart.
- System operation diagram.
- Hierarchical structure of the program.
- Program interaction diagram.
- Diagram illustrating stack operations and expression evaluation.

Experimental part

- Compile and run the program.
- Test arithmetic operations and operator precedence.
- Test expressions containing parentheses and decimal numbers.
- Debug the program and verify the correctness of the results.

Project completion time by section

According to schedule.

The date of issue of the task is "October 14", 2026.

Project defense date " " _____

Teacher Fediunin R.N. _____

Received the task on Oct 14, 2026.

Student Khalid Alakbari. _____

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Conclusion

During the completion of this coursework, important programming skills were developed and strengthened, including:

- Implementation of the Floyd-Warshall dynamic-programming algorithm;
- Working with two-dimensional arrays as matrices;
- Path-reconstruction techniques using an auxiliary matrix;
- Modular programming in C;
- Debugging and testing of console applications.

As a result, a fully functional program was created that correctly computes shortest distances between all pairs of vertices and reconstructs the corresponding routes.

Future improvements may include:

- Adding a graphical user interface;
- Supporting negative-cycle detection;
- Loading graphs from an external file;
- Animating the path-search process.



List of sources used

- 1. W3Schools -- C Programming Language Reference : website. -- URL: <https://www.w3schools.com/c/>.
- 2. GeeksforGeeks -- Floyd Warshall Algorithm : website. -- URL: <https://www.geeksforgeeks.org/floyd-warshall-algorithm-dp-16/> --
- 3. Programiz -- Data Structures Using C : website. -- URL: <https://www.programiz.com/dsa> (date of access: 12.05.2026). --.