

Penza State University
Faculty of Computer Science
Department of Computer Science

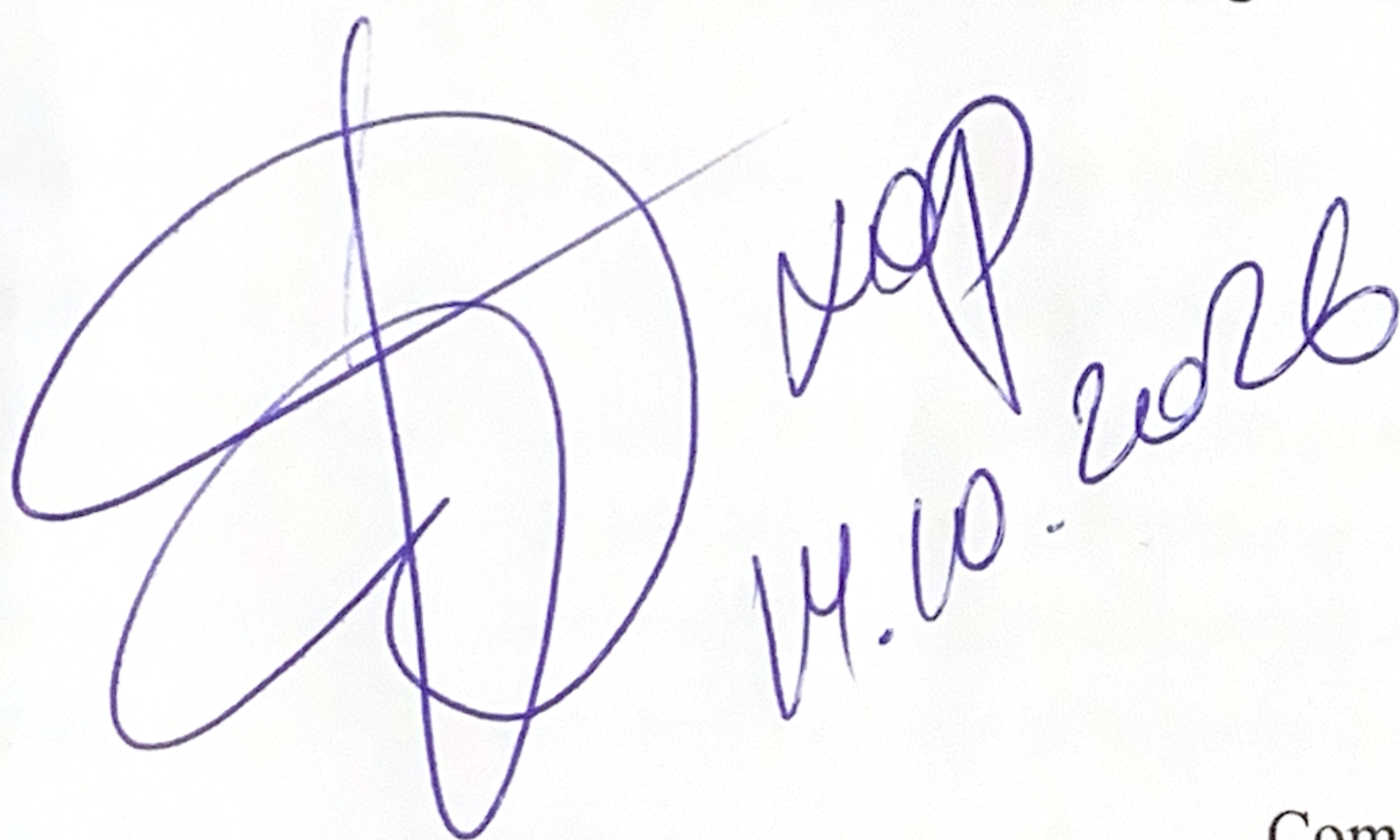
EXPLANATORY NOTE

for course design for the course

«Logic and fundamentals of algorithmization in engineering problems»

on the topic

Complex program structure «Inverting Matrices of Different Dimensions»



Handwritten signature and date: 14.10.2026

Completed: BERKE CAN ESKICIRAK

student of group: 24VVIA1

Accepted: Fedjunin R.N.

Penza 2026



Penza State University
Faculty of Computer Engineering
Department of Computer Engineering

"APPROVE"

Head of the Department of Computer Engineering

N.S. Karamysheva

« 3 » September 2026 y.

EXERCISE

for course design for the course

Programming

Student: BERKE CAN ESKICIRAK

Group: 24BBMa1

Project topic: Inverting Matrices of Different Dimensions

Initial data (technical requirements) for design

Application name: Matrix Operations and Inversion Application

Task: The program must implement basic operations on matrices of different dimensions entered from the keyboard (such as addition, multiplication, transposition, and matrix inversion). Calculations must be performed on the entered matrices and the results displayed on the screen.

Mandatory requirements for the program:

1. Multimodularity.
2. Using complex data types (structures, dynamic memory/arrays, files).
3. The video system operating mode is text.
4. Input device: keyboard, mouse.
5. The user interface should be built on the basis of menus.
6. Availability of a screensaver.
7. MS Windows operating system.
8. C programming language (Pure C).

✓

9. Software development environment - Microsoft Visual Studio.

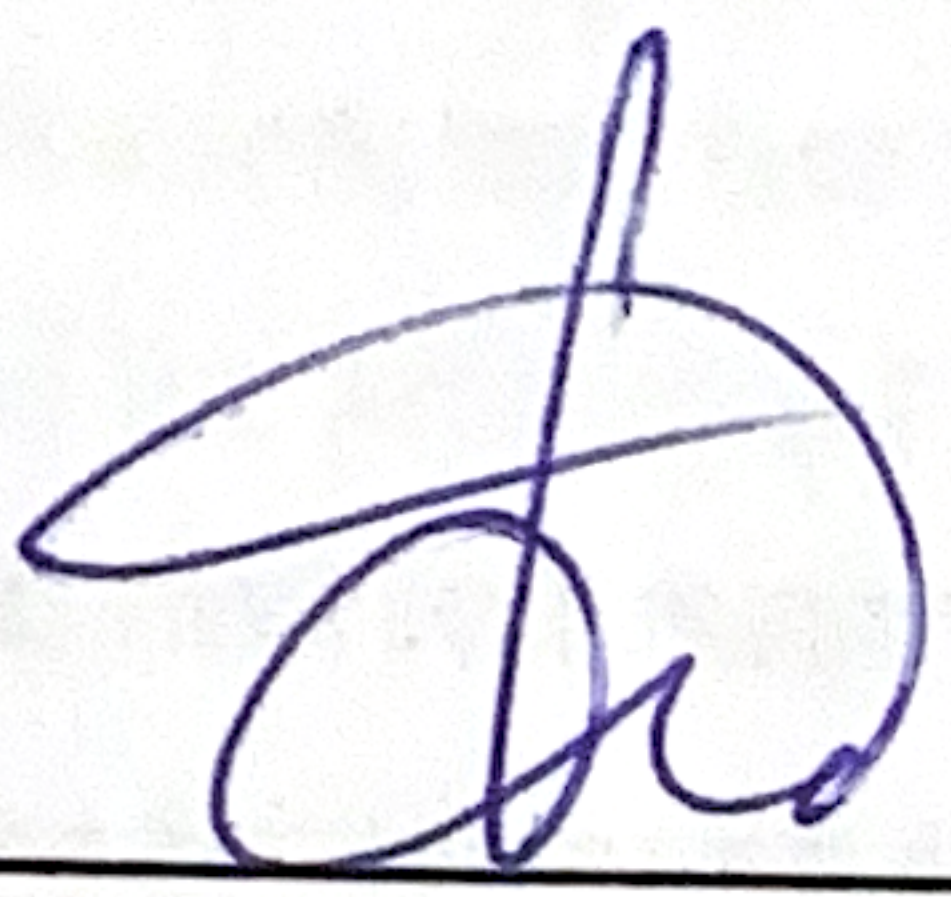
Scope of work for the course

- 1. Calculation part:** Program development in pure C for dynamic matrix dimensions, addition, multiplication, transposition, and matrix inversion algorithms.
- 2. Graphic part:** Data diagram, system resource diagram, system operation diagram, program hierarchical structure, program interaction diagram.
- 3. Experimental part:** Debugging and testing the program with matrices of different dimensions.

Project completion time by section: According to schedule

The assignment issuance date: _____, 2026.

Project defense date: "4" September 2026 y.

Manager:  Fedjunin R.N.

Received the task: "4" September 2026 y.

Student: B. CAN BERKE CAN ESKICIRAK



2. Project Task

The task

Write a program in the C language that adds two matrices and multiplies two matrices. The report must contain an introduction, a description of all the functions used, the code, a run of the program with its result, and a graph that explains how the functions work.

Steps

1. Understood the task. I read the requirement and listed what the program must do: take two matrices, add them, multiply them, and show the results.
2. Reviewed the mathematics. I recalled the rules of matrix addition (same position, same size) and matrix multiplication (row of the first matrix times column of the second), and tried both on a small 2×2 example.
3. Chose a simple design. I used fixed 2×2 matrices (`#define SIZE 2`) and only basic C features: arrays, for loops, `scanf` and `printf`, so that the code stays very simple.
4. Divided the program into functions. Each function has one job: `inputMatrix` reads, `printMatrix` prints, `addMatrices` adds, `multiplyMatrices` multiplies, and `main` connects them.
5. Wrote the code step by step. First the input and print functions, then the addition, then the multiplication, and last the main function that calls everything in order.
6. Compiled the program. I compiled it with `gcc` using the `-Wall` option, which shows warnings, to find and remove mistakes.
7. Tested the program. I ran it with sample matrices, $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$, and checked every result by hand.
8. Drew a flowchart. I made a graph that shows the order in which `main()` calls the functions, to explain how the program works.
9. Wrote the report. I organized the work in the required order: introduction, description of the functions, code, program run and result, and graph, followed by a conclusion and references.

The date of the issue of the task is "October 12" 2026

Project defense date" " 2026

Teacher Fediunin R.N.

Received the task on October 12, 2026

Signature: B. Can Berke Can Eskicirak

1.00	2.00	3.00
4.00	5.00	6.00

Transpose of A =

1.00	4.00
2.00	5.00
3.00	6.00

5.4 Inversion of a 2x2 matrix

Matrix A = $\begin{bmatrix} 4 & 7 \\ 2 & 6 \end{bmatrix}$, operation = Invert A.

Matrix A:

4.00	7.00
2.00	6.00

Inverse of A =

0.60	-0.70
-0.20	0.40

This result can be checked by multiplying A by its computed inverse: the product is the identity matrix $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, which confirms that the inversion was correct.

6. Conclusion

This term paper reviewed the basic operations on matrices of different dimensions - addition, multiplication, transposition, and inversion - and presented a C program that lets the user enter two matrices and apply one of these operations. Matrix inversion was implemented using the Gauss-Jordan elimination method with partial pivoting, which also detects and reports singular matrices that have no inverse. Test runs with several different matrix sizes showed that the program produces correct results.