

Lecture 11- Introduction to AI-Assistant for Programming (AI4Coding)

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CSC-1004: Computational Laboratory Using Java

Course Page: [\[Click\]](#)

The Trend of AI Programming

Sentiment and usage

3.1

AI tools in the development process

76% of all respondents are using or are planning to use AI tools in their development process this year, an increase from last year (70%). Many more developers are currently using AI tools this year, too (62% vs. 44%).

Do you currently use AI tools in your development process? *

All Respondents Professional Developers Learning to Code Other Coders



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Responses: 46,049 (70.4%)

AI tool sentiment

72% of all respondents are favorable or very favorable of AI tools for development. This is lower than last year's favorability of 77%; a decline in favorability could be due to disappointing results from usage.

How favorable is your stance on using AI tools as part of your development workflow?

All Respondents Professional Developers Learning to Code Other Coders



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Responses: 45,873 (70.1%)

Image: KnewTutor

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The Trend of AI Programming

DevOps process evolution

AI has contributed to the evolution of DevOps practices and continuous integration/continuous delivery (CI/CD) pipelines. AI techniques can analyze code changes, test results, and production metrics to provide insights on performance, quality, and potential issues. This helps streamline the software development lifecycle, improve deployment processes, and enhance overall software quality.

“AI won't replace programmers, but it will become an essential tool in their arsenal. It's about empowering humans to do more, not do less.” - Satya Nadella, CEO of Microsoft



The Trend of AI Programming

AI algorithms analyze vast amounts of data to make intelligent recommendations and personalize software experiences. For example, AI-powered recommendation systems are used in e-commerce applications to suggest products based on user preferences and browsing history. Similarly, AI can personalize user interfaces, content, and features based on individual user behavior and patterns.



AI can be a powerful tool for programmers, assisting them in writing better code and accelerating development cycles. AI still lacks creativity and problem-solving skills, so it won't replace programmers. - Jeff Dean, Senior Fellow at Google AI



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The Trend of AI Programming

Growing worries

According to a team of researchers at the US Department of Energy's Oak Ridge National Laboratory, there's a high chance that **AI will replace software developers as early as 2040.**

Programming trends suggest that software development will undergo a radical change in the future: the combination of machine learning, artificial intelligence, natural language processing, and code generation technologies will improve in such a way that machines, instead of humans, will write most of their own code by 2040, state the researchers.



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The Trend of AI Programming

The trend you can never ignore!

Software engineers' need to be gradually reduced by AI: OpenAI CEO Sam Altman

ETtech • Last Updated: Mar 22, 2025, 08:23:00 PM IST

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Synopsis

OpenAI's Altman said that impact of AI on jobs would not set in suddenly but would accelerate gradually over time. He also highlighted that, while AI has already taken over significant portions of coding, the next big step would be "agentic coding". For success in future, he underlined the importance of adaptability and the capacity to learn.



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AI-Assistant for Programming

AI programming assistants are intelligent tools that help developers **write, understand, and debug code**. These assistants use artificial intelligence and machine learning models to provide **real-time suggestions, code generation, and explanations**.

The AI Code Editor

Built to make you extraordinarily productive, Cursor is the best way to code with AI.



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AI-Assistant for Programming

Popular AI Coding Assistants:

- **GitHub Copilot:** Developed by GitHub and OpenAI, writes code based on comments and context.
- **Amazon CodeWhisperer:** Generates code for general-purpose programming.
- **Tabnine:** Offers AI-based autocomplete for multiple languages and IDEs.
- **Codeium:** Fast and free AI assistant with support for many languages.
- **Cursor AI:** is an AI-powered code editor that integrates advanced artificial intelligence features into the development environment



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AI-Assistant for Programming

AI coding assistants are powered by **large language models (LLMs)** trained on vast datasets of source code and natural language. These models:

- Understand programming syntax and patterns
- Predict the next line of code
- Translate human language into code
- Explain and refactor existing code



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Traditional Programming v.s., AI Programming

Traditional Programming	AI Programming
Programmers write all code manually	AI generates code automatically
Requires deep knowledge of syntax and semantics	Can help beginners by explaining and generating syntax
Debugging is done manually step-by-step	AI may detect and suggest fixes for bugs in real-time



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Traditional Programming v.s., AI Programming

Traditional Programming	AI Programming
Time-consuming for repetitive coding tasks	Boosts productivity by handling boilerplate and repetitive tasks
Code is written based on programmer logic and planning	Code can be written from natural language prompts or comments
High control and precision over every line of code	May require reviewing and correcting AI-generated code



A Case Study: Cursor AI

Cursor AI is an AI-powered code editor that integrates advanced artificial intelligence features into the development environment, aiming to enhance productivity and streamline coding tasks.



CURSOR

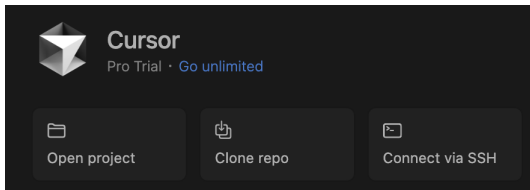


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A Case Study: Cursor AI

Setting Up a Project:

- Open Cursor AI and create a new project by selecting a folder on your computer. This folder will serve as your project directory, storing all code files.
- Utilize the file explorer to navigate through your project files and manage your codebase efficiently.



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A Case Study: Cursor AI

Using AI Features:

- **AI Chat Panel:** Interact with the AI assistant by opening the chat panel (press Ctrl + L). Ask questions about your code, request code generation, or seek explanations for code snippets.
- **Composer:** Access the composer (press Ctrl + K) to instruct the AI to create multiple code files or implement significant features based on your descriptions.
- **Terminal Integration:** Open the integrated terminal to execute commands directly within the editor. Use AI-generated commands to streamline your workflow.

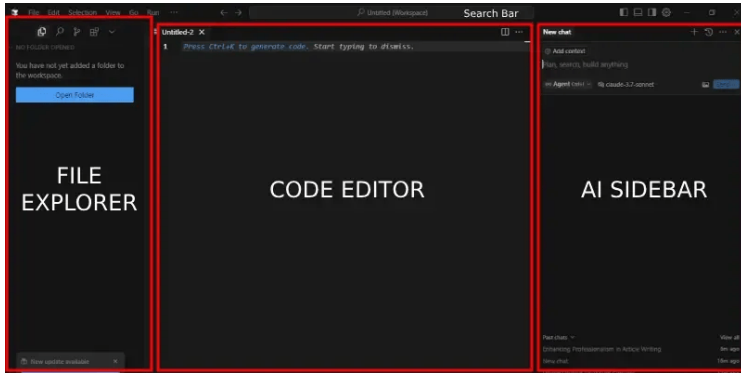


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A Case Study: Cursor AI

- **Code Editor:** The central pane where you write and edit code.
- **AI Sidebar:** AI-powered features like code suggestions, documentation, and chat.
- **File Explorer:** Navigate through your project files and directories.



Cursor AI for Programming

The **Key Features** of Cursor AI:

- **Code Explanation**: Breaks down complex code into simple explanations.
- **Code Autocompletion**: Suggests code as you type.
- **Bug Detection and Fixes**: Highlights issues and proposes solutions.
- **Code Generation**: Creates functions, classes, and components from scratch.
- **Natural Language to Code**: Converts plain English into working code.



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Cursor AI for Programming

Code Explanation: Given a Java code of advanced concepts.



Advanced Concepts Used

Concept	Usage
Thread-safe Client Handling	Uses <code>ConcurrentHashMap.newKeySet()</code> for clients
MySQL JDBC	Stores all messages with <code>PreparedStatement</code>
Multithreading	Each client runs in its own thread
Message Broadcasting	Server sends messages to all clients
Graceful Exit	Clients can type <code>exit</code> to leave the chat

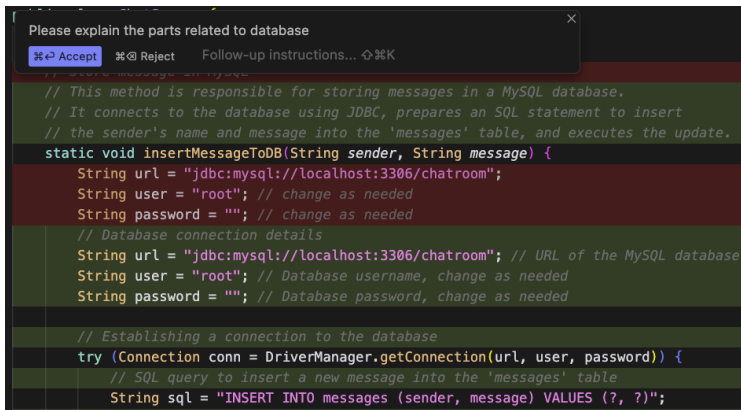


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Cursor AI for Programming

Code Explanation: Add comments and simple explanations into complex code.



```
// Store message in MySQL
// This method is responsible for storing messages in a MySQL database.
// It connects to the database using JDBC, prepares an SQL statement to insert
// the sender's name and message into the 'messages' table, and executes the update.
static void insertMessageToDB(String sender, String message) {
    String url = "jdbc:mysql://localhost:3306/chatroom";
    String user = "root"; // change as needed
    String password = ""; // change as needed

    // Database connection details
    String url = "jdbc:mysql://localhost:3306/chatroom"; // URL of the MySQL database
    String user = "root"; // Database username, change as needed
    String password = ""; // Database password, change as needed

    // Establishing a connection to the database
    try (Connection conn = DriverManager.getConnection(url, user, password)) {
        // SQL query to insert a new message into the 'messages' table
        String sql = "INSERT INTO messages (sender, message) VALUES (?, ?)";
```



Cursor AI for Programming

Code Auto-completion: Given an incomplete code and suggest the completion:

"Create a Java program where a thread prints numbers from 1 to 5. "

```
package org.example;

public class NumberPrinter {
    public static void main(String[] args) {
        Thread numberThread = ...
        numberThread.start();
    }
}
```

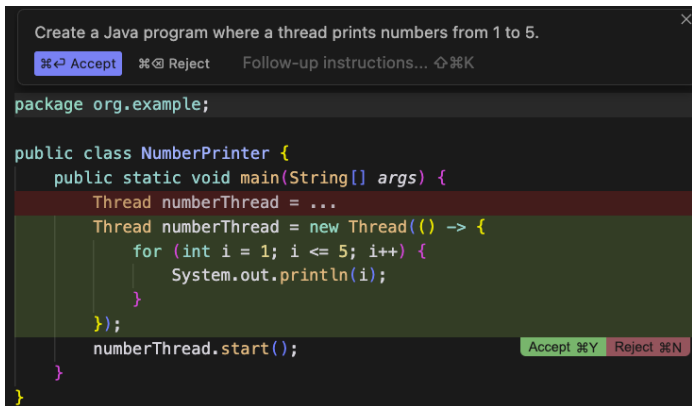


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Cursor AI for Programming

Code Auto-completion: Cursor AI completes the code, and the user can either choose acceptance or rejection.



```
Create a Java program where a thread prints numbers from 1 to 5.

package org.example;

public class NumberPrinter {
    public static void main(String[] args) {
        Thread numberThread = ...
        Thread numberThread = new Thread(() -> {
            for (int i = 1; i <= 5; i++) {
                System.out.println(i);
            }
        });
        numberThread.start();
    }
}
```

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Cursor AI for Programming

Code Auto-completion: Given an incomplete code, and then accept the suggested completion by pressing "<tab>":

```
public class NumberPrinter {  
    public static void main(String[] args) {  
        Thread thread = new Thread(() -> {  
            for (int i = 1; i <= 5; i++) {  
                System.out.println("Number: " + i);  
            }  
        });  
        thread.start();  
    }  
}
```

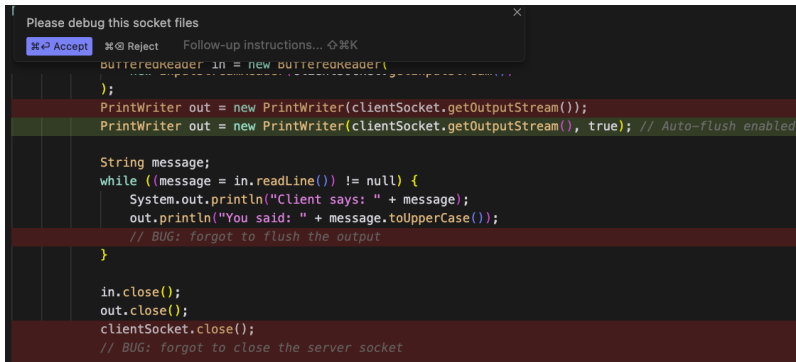
Auto-Generated Code



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Cursor AI for Programming

Bug Detection and Fixes: Highlights issues and proposes solutions.



The screenshot shows a code editor with a Java socket program. A tooltip at the top left says "Please debug this socket files" and contains buttons for "Accept", "Reject", and "Follow-up instructions...". The code is as follows:

```
BufferedReader in = new BufferedReader(
    ...
);
PrintWriter out = new PrintWriter(clientSocket.getOutputStream());
PrintWriter out = new PrintWriter(clientSocket.getOutputStream(), true); // Auto-flush enabled

String message;
while ((message = in.readLine()) != null) {
    System.out.println("Client says: " + message);
    out.println("You said: " + message.toUpperCase());
    // BUG: forgot to flush the output
}

in.close();
out.close();
clientSocket.close();
// BUG: forgot to close the server socket
```



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Cursor AI for Programming

Bug Detection and Fixes: Highlights issues and proposes solutions.



Known Bugs and Issues

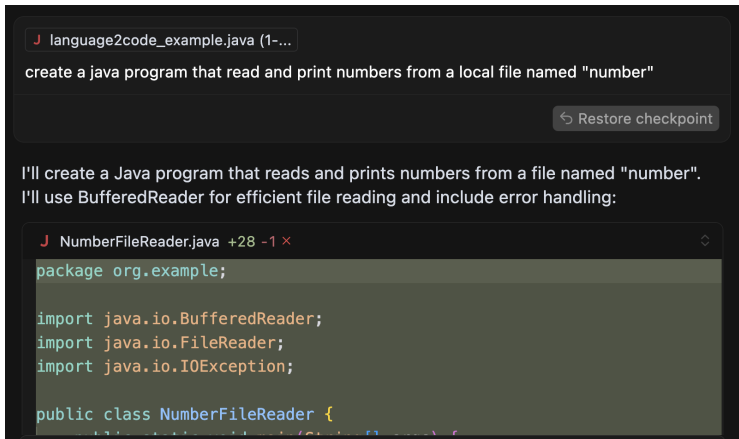
Bug	Description
✗ No flush() on PrintWriter	Causes the server/client to not actually send messages immediately.
✗ Server socket not closed	Resource leak in startServer().
✗ No thread separation	Server and client must be run in separate processes, but this code doesn't handle concurrency or threading for multiple clients.
✗ No error handling for null input	If the user presses Enter or passes null, readLine() may break.
✗ No timeout or socket configuration	Not robust for real-world use.

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Cursor AI for Programming

Code Generation: Creates functions, classes, and components from scratch.



The screenshot displays the Cursor AI interface. At the top, a chat input field contains the prompt: "create a java program that read and print numbers from a local file named 'number'". Below the input field is a "Restore checkpoint" button. The AI's response is: "I'll create a Java program that reads and prints numbers from a file named 'number'. I'll use BufferedReader for efficient file reading and include error handling:". Below the response, a code editor window titled "NumberFileReader.java" shows the generated Java code. The code includes package, import, and class declarations.

```
language2code_example.java (1-...)
```

create a java program that read and print numbers from a local file named "number"

Restore checkpoint

I'll create a Java program that reads and prints numbers from a file named "number".
I'll use BufferedReader for efficient file reading and include error handling:

```
NumberFileReader.java +28 -1 ×
```

```
package org.example;

import java.io.BufferedReader;
import java.io.FileReader;
import java.io.IOException;

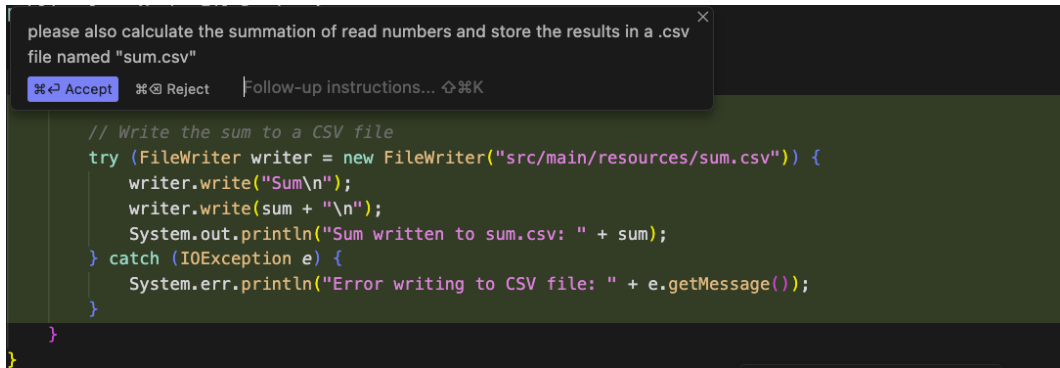
public class NumberFileReader {
```

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Cursor AI for Programming

Natural Language to Code: Converts plain English into working code.



The screenshot shows the Cursor AI interface. At the top, a dark prompt box contains the text: "please also calculate the summation of read numbers and store the results in a .csv file named 'sum.csv'". Below the prompt box are three buttons: "Accept" (with a checkmark icon), "Reject" (with an 'X' icon), and "Follow-up instructions..." (with a speech bubble icon). The main area of the interface is a code editor with a dark green background, displaying the following Java code:

```
// Write the sum to a CSV file
try (FileWriter writer = new FileWriter("src/main/resources/sum.csv")) {
    writer.write("Sum\n");
    writer.write(sum + "\n");
    System.out.println("Sum written to sum.csv: " + sum);
} catch (IOException e) {
    System.err.println("Error writing to CSV file: " + e.getMessage());
}
```

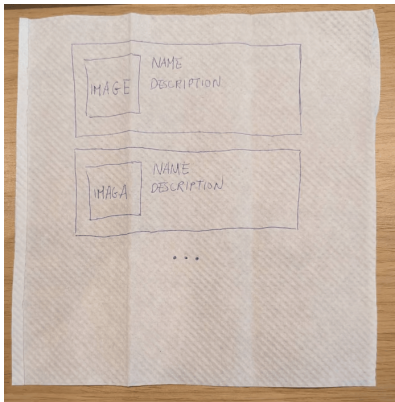


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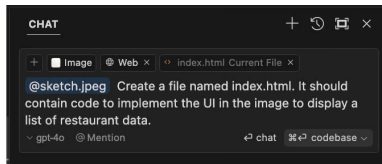
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Cursor AI for Programming

Image Support: sketch a UI design for a website and ask it to generate the HTML and CSS code for it.



UI napkin sketch



Chat input and rendered HTML code output

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Question and Answering (Q&A)



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