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GitHub Copilot Developers Training

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Resources

- Getting started with GitHub Copilot
- Configuring GitHub Copilot in your environment
- Using GitHub Copilot Chat in your IDE GitHub Docs
- Video Get Started with the Future of Coding: GitHub Copilot
- Tutorial: GitHub Copilot and VS Code
- Copilot Exercises



Choose Workshop Track



Workshop for those who want to see how to build web application

Primary IDE: VS Code
Primary OS: Independent



Workshop for those who want to see how to build Java applications

Primary IDE: IntelliJ

Primary OS: Independent



Workshop for those who want to see how to build .NET applications

Primary IDE: Visual Studio

IDE

Primary OS: Windows



GitHub Copilot - Introduction

Coding

Best practices & prompt engineering

Workshop (1 - 2 hours long)

Secure coding

Wrap-up, Q&A

AGENDA



Outcome of this training

You will achieve...



Get answers to specific use case scenario questions



Increase existing Copilot skills by following a specific workshop tutorial catered to your needs



Learn in-depth tips and tricks and best practices on how to best utilize GitHub Copilot





GitHub Copilot Fundamentals Recap



The software process can be broken down into two steps:

- 1) Design
- 2) Implementation

The first step is driven by you.

The second step is where Copilot can assist you with the development effort. Design





















GitHub Copilot

Helps developers stay in the flow throughout the entire SDLC

Refactoring code (code translate) Reviewing code (code explain) Documentation

Unit testing (TDD and BDD)
Finding code errors
Debugging
Code review
Al Pull Requests



Convert comments to code Autofill for repetitive code Show alternatives



parse expense

GitHub Copilot

- An intelligent pair programmer
- Draws context from comments & code in open tabs to suggest individual lines and whole functions
- Powered by OpenAl Codex
 - Copilot uses a transformative model
 - Trained on large datasets to ensure accuracy
- Available as extensions to popular IDEs
- Programming Languages and Technology available in Public code base all are supported

```
1 #!/usr/bin/env ts-node
 3 import { fetch } from "fetch-h2";
 5 // Determine whether the sentiment of
6 // Use a web service
 7 async function isPositive(text: string
     const response = await fetch(`http://
      method: "POST",
      body: `text=${text}`,
      headers: {
         "Content-Type": "application/x-ww
12
13
     const json = await response.json();
     return json.label === "pos";
17
   Copilot
```

sentiment.ts



Data flow through the Copilot ecosystem

Toxicity
Code classifier











CODE EDITOR

PROXY

MODEL



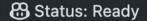
PII
Toxicity
Code classifier
Code quality
Duplicate detection

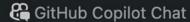


VS Code Settings

Configuration Options







Open Completions Panel...

Disable Completions

Disable Completions for 'markdown'

Edit Keyboard Shortcuts...

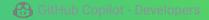
문화 Edit Settings...

Show Diagnostics...

Open Logs...

Configuring GitHub Copilot in your environment





Coding and Prompt Engineering



Copilot vs Copilot Chat

Copilot

Direct Code Writing

Seamless IDE Integration

Solo Development

Copilot Chat

In-Depth Assistance

Learning & Teaching

Collaborative Scenarios





Copilot Prompt Engineering

What

Prompt engineering is the process of designing and creating high-quality prompts that can be used to generate accurate and useful code suggestions with Copilot.

Why

- Maximizes utility of Copilot
- Minimizes repeated iterations
- Determines code suggestion quality
- Skill prompts guide Copilot to understand context & nuances
- Refined interactions reduces
 misunderstandings

How

- Neighboring Tabs
- Zero-Shot Prompting
- One-Shot Prompting
- Few-Shot Prompting
- Let's Think Step by Step



Prompting Best Practices

Improving results



These are best practices, now let's see how those can be used in different ways



Provide references

Improve relevance of the response by providing an example and context



Write clear instructions

Refine your prompt, provide context, write clearly, and give Copilot ample input for better results



Split up big tasks

Breaking down complex tasks minimizes errors and utilizes previous outcomes for efficiency



Allow time to think

Requesting Copilot's thought process will enhance Copilot accuracy, but it may prolong wait times.



Test changes systematically

Measure performance, watch for prompt changes' side effects, and use test suites for implementation



Providing Context

To help Copilot generate accurate suggestions:

- Add a top-level comment block describing the purpose of the file
- Front load as many imports as needed (import / include / requires / etc.)
- Use descriptive function / method / type names
- Use sample code as a starting point
- Have related content open in other tabs



Helpful Patterns

 $\ ^{*}$ Use descriptive variable names to make your intentions clear.

```
totalSampleCount = 1000
```

* Define method signatures with unambiguous parameter names and types.

```
double calculateAverageSampleSize(unsigned long samples[], size_t size)
```

* Show examples of how to use the code.

```
int samples[] = {1, 2, 3, 4, 5};
double average = calculateAverageSampleSize(samples, 5);
printf("Average: %f\n", average); // Average: 3.0
```

- * Maintain consistent naming conventions for variables and functions.
 - i.e. using camelCase for variable names consistency



Helpful Patterns

* Use comments to explain the purpose of the code.

This function 'palindrome' takes an array of strings as input and returns true if a palindrome is found.

* Specify error handling scenarios.

Exit where the input is NULL and throw and exception if the input out of range [min, max] inclusive.

* Describe control flow structures.

Write a while loop to print the first 'n' values in the fibonnaci sequence.

* Test your code.

Write a test suite to verify the correctness of the code.



Neighboring Tabs

Keep relevant files open, things related to your current code

```
J BookDatabaseImpl.iava ●

                           J BookDatabase.iava
                                                     J BookService.iava
                                                                             BookServiceException.iava
src > main > java > com > github > demo > service > J BookDatabaselmpl.java > 😭 BookDatabaselmpl > 🕅 getBool
             @Override
            public List<Book> getBooksByAuthor(String author) throws BookServiceException {
                 // 1.create list of type Books
                // 2.create Prepared statement and query to get books by Author
                // 3.iterate through results and add to list
                // 4.close connection if prepared statement is not null
                List<Book> books = new ArrayList<Book>():
                 if (!isValid()) {
                     throw new BookServiceException(message: "Database connection is not valid, check
                PreparedStatement ps = null;
                try {
                     ps = connection.prepareStatement(sql:"SELECT * FROM books WHERE author LIKE ?")
                     ps.setString(parameterIndex:1, "%" + author + "%");
                     ResultSet results = ps.executeQuery();
                     while (results.next()) {
                         Book book = new Book(
                                 results.getString(columnLabel:"author"),
                                 results.getString(columnLabel:"title"),
                                 results.getString(columnLabel:"image"));
                         books.add(book);
```



If at first you don't succeed, iterate!

Zero Shot Prompt

```
//Write a JavaScript function that finds
//the maximum value in an array.
function max(array) {
    return Math.max.apply(null, array);
}
```

One-Shot Prompt



Techniques



Zero-Shot Prompting



One-Shot Prompting

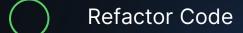


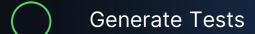
Few-Shot Prompting



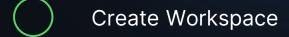
Using Copilot Chat

GitHub Copilot Chat







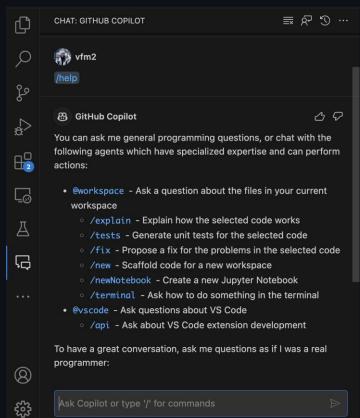


Documentation



Copilot Chat: Slash Commands

/help to find available commands in your IDE



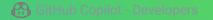


In-file Copilot Chat

Copilot offers in-file Copilot feature to selectively improve

```
sorting-algorithm.py 6
        SimpleDemo > ♦ sorting-algorithm.py > ⊕ insertionSort
              def guickSort(array) {
                   var pivot = array[0];
                   var left = []
                   for (var i = 1; i < array.length; i++) {
                      array[i] < pivot ? left.push(array[i]) : right.push(array[i]);
                   return quickSort(left).concat(pivot, quickSort(right));
               def bubbleSort(array) {
                      swapped = false:
                       for (var i = 0; i < array.length; i++) (
                              var temp = array[i];
                               swapped = true;
                   for (var i = 1: i < length: i++) {
                       for (var i = i - 1; i >= 8 55 array[i] > temp; i--) (
                      array[j + 1] = temp;
№ ⊗4∆2 ₩0
                                                                                                                                    Ln 30, Col 4 Spaces: 4 UTF-8 LF () Python 3.11.5 64-bit & (
```



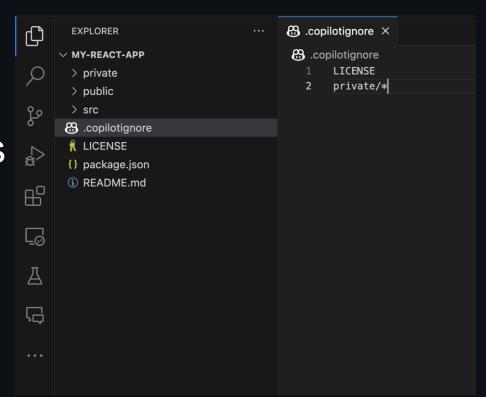


Secure coding



Block files from Copilot

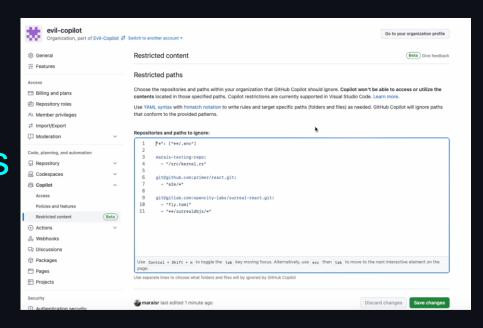
Use .copilotignore to block files and folders from being used by Github Copilot





Block files from Copilot

Ignore specific repositories and paths in Restricted Content





Copilot and Secure Coding

- Al-based vulnerability system that helps prevent insecure coding patterns (e.g. SQL script injection)
- Vulnerability filters are applied only to the Copilotgenerated suggestion itself
 - It cannot detect downstream vulnerabilities introduced by the code e.g. on deployment infrastructure
 - i We recommend taking the same precautions you take with code written by engineers (linting, code scanning, etc.)
- Copilot Chat can be used to query code for known vulnerabilities

```
••• O
     var app = express()
     app.use(bodyParser.json())
     app.use(bodyParser.urlencoded({
         extended: true
     app.get("/", function(reg){
          const user = req.params.q
         if (user != "") {
             pool.query('SELECT * FROM users WHERE name = $1', [user], (error
                  if (error) {
                      throw error
                  res.status(200).json(results.rows)
     app.listen(8000, function () {
         console.log("Server running");
```

Detection & Remediation

- Prompt for insecure coding patterns
- Use GHAS Code Scanning results
- Write custom CodeQL queries
- Increase your knowledge of secure coding patterns
- Create custom SecretScanning patterns

```
stebje
It looks like this code is insecure. Help me understand what the issue is and how to resolve it.
```

← GitHub Copilot

Yes, this code is vulnerable to SQL injection attacks. The issue is that the search parameter is directly concatenated into the SQL query string without any sanitization or validation. This means that an attacker could potentially inject malicious SQL code into the query, which could lead to data theft or destruction.

To fix this issue, you should use parameterized queries instead of concatenating strings. Parameterized queries use placeholders for the input values, which are then bound to the query separately. This ensures that the input values are properly sanitized and validated before being used in the query.

Here's an example of how to use parameterized queries with the pg library:

```
const search = req.params.q;
if (search != "") {
  const squery = "SELECT * FROM users WHERE name = $1";
  const values = [search];
  pool.query(squery, values, (err, res) => {
    console.log(err, res);
    pool.end();
    ));
}
```

In this example, the \$1 placeholder is used for the search parameter, and the actual value is passed in as an array of values to the pool.query() function. This ensures that the search parameter is properly sanitized and validated before being used in the query.

```
const pool = new Pool( config: {
  user: 'postares'.
 host: 'localhost'.
  database: 'postgres'.
  password: 'process.env.POSTGRES_PW',
 port: 5432.
var app = express():
app.use(bodyParser.ison()):
app.use(bodyParser.urlencoded({ extended: true }));
app.get('/', function (req, res) {
 const search = req.params.q;
  if (search != "") {
   var squery == "SELECT * FROM users WHERE name == \"" + search + "\"";
    pool.query( queryTextOrConfig: squery, callback: (err, res) => {
     console.log( message: err, optionalParams[0]: res);
     -pool.end();
app.listen( port: 8000, callback: function () {
  console.log( message: 'Example app listening on port 8000!');
```



Copilot + GHAS

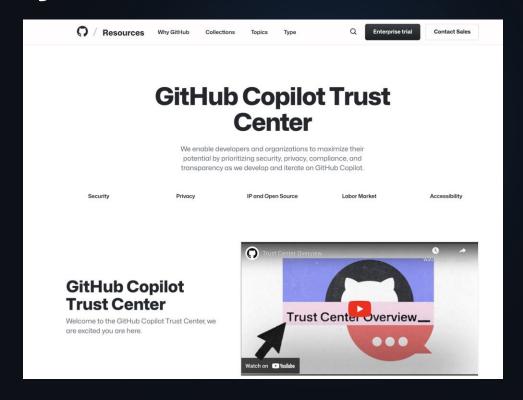
- Copilot is not a replacement of GHAS features
- Copilot can be used in tandem with GHAS features to detect and remediate vulnerabilities earlier during the SDLC
 - O GHAS Code scanning results
 - O GHAS Secret scanning



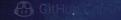
Security & Trust

Copilot Trust Center

- Security
- Privacy
- Data flow
- Copyright
- Labor market
- Accessibility
- Contracting







Wrap Up

Thankyou