

## Assignment 8.4 Ai Assisted Coding

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### Task 1: Developing a Utility Function Using TDD

#### Scenario

You are working on a small utility library for a larger software system. One of the required functions should calculate the square of a given number, and correctness is critical because other modules depend on it.

#### Task Description

Following the Test Driven Development (TDD) approach:

1. First, write unit test cases to verify that a function correctly returns the square of a number for multiple inputs.
2. After defining the test cases, use GitHub Copilot or Cursor AI to generate the function implementation so that all tests pass.

Ensure that the function is written only after the tests are created.

#### Expected Outcome

- A separate test file and implementation file
- Clearly written test cases executed before implementation
- AI-assisted function implementation that passes all tests •

Demonstration of the TDD cycle: test → fail → implement → pass

#### Code:

The screenshot shows a Google Colab interface with three code cells and a terminal cell.

**Cell [1]:**

```
import unittest

# ---- TEST CASES (written first in TDD) ----
class TestSquareFunction(unittest.TestCase):

    def test_positive_number(self):
        self.assertEqual(square(4), 16)

    def test_negative_number(self):
        self.assertEqual(square(-3), 9)

    def test_zero(self):
        self.assertEqual(square(0), 0)

    def test_large_number(self):
        self.assertEqual(square(100), 10000)
```

**Cell [2]:**

```
# ---- IMPLEMENTATION (written AFTER tests) ----
def square(n):
    return n * n
```

**Cell [3]:**

```
unittest.main(argv=[''], verbosity=2, exit=False)
```

**Terminal:**

```
✓ 9:40 AM Python 3
```

Output:

The screenshot shows a Google Colab interface with a notebook titled 'Untitled30.ipynb'. The code cell contains Python unit tests for a 'TestSquareFunction' class. The output shows 4 tests running successfully ('ok') and ending with 'OK <unittest.main.TestProgram at 0x7e0211f2cda0>'. The Colab interface includes a sidebar with file navigation, a toolbar with various icons, and status indicators for RAM and Disk usage.

## Task 2: Email Validation for a User Registration System

### Scenario

You are developing the backend of a user registration system. One requirement is to validate user email addresses before storing them in the database.

### Task Description

Apply Test Driven Development by:

1. Writing unit test cases that define valid and invalid email formats (e.g., missing @, missing domain, incorrect structure).
2. Using AI assistance to implement the `validate_email()` function based strictly on the behavior described by the test cases.

The implementation should be driven entirely by the test expectations.

### Expected Outcome

- Well-defined unit tests using unittest or pytest
- An AI-generated email validation function
- All test cases passing successfully

- Clear alignment between test cases and function behavior Code:

```

[4]  import unittest
      # ----- TEST CASES (WRITTEN BEFORE FUNCTION) -----
      class TestEmailValidation(unittest.TestCase):
          def test_valid_email(self):
              self.assertTrue(validate_email("user@example.com"))

          def test_missing_at_symbol(self):
              self.assertFalse(validate_email("userexample.com"))

          def test_missing_domain(self):
              self.assertFalse(validate_email("user@"))

          def test_missing_username(self):
              self.assertFalse(validate_email("@example.com"))

          def test_invalid_structure(self):
              self.assertFalse(validate_email("user@com"))

          def test_email_with_numbers(self):
              self.assertTrue(validate_email("user123@gmail.com"))

[5]  import re
      # ----- IMPLEMENTATION (AFTER TESTS) -----
      def validate_email(email):
          pattern = r'^[A-Za-z0-9._%+-]+@[A-Za-z0-9.-]+\.[A-Za-z]{2,}$'
          return re.match(pattern, email) is not None
  
```

#Run Tests

```

[6]  unittest.main(argv=[''], verbosity=2, exit=False)
  
```

Output:

```
test_email_with_numbers (_main_.TestEmailValidation.test_email_with_numbers) ... ok
test_invalid_structure (_main_.TestEmailValidation.test_invalid_structure) ... ok
test_missing_at_symbol (_main_.TestEmailValidation.test_missing_at_symbol) ... ok
test_missing_domain (_main_.TestEmailValidation.test_missing_domain) ... ok
test_missing_username (_main_.TestEmailValidation.test_missing_username) ... ok
test_valid_email (_main_.TestEmailValidation.test_valid_email) ... ok
test_large_number (_main_.TestSquareFunction.test_lange_number) ... ok
test_negative_number (_main_.TestSquareFunction.test_negative_number) ... ok
test_positive_number (_main_.TestSquareFunction.test_positive_number) ... ok
test_zero (_main_.TestSquareFunction.test_zero) ... ok
-----
Ran 10 tests in 0.023s
OK
<unittest.main.TestProgram at 0x7e0211f2eab0>
```

## Task 3: Decision Logic Development Using TDD

### Scenario

In a grading or evaluation module, a function is required to determine the maximum value among three inputs. Accuracy is essential, as incorrect results could affect downstream decision logic.

### Task Description

Using the TDD methodology:

1. Write test cases that describe the expected output for different combinations of three numbers.
2. Prompt GitHub Copilot or Cursor AI to implement the function logic based on the written tests.

Avoid writing any logic before test cases are completed.

### Expected Outcome

- Comprehensive test cases covering normal and edge cases
- AI-generated function implementation
- Passing test results demonstrating correctness

- Evidence that logic was derived from tests, not assumptions Code:

The screenshot displays two versions of a Python script in Google Colab, illustrating the process of Test-Driven Development (TDD).

**Top Notebook (Untitled30.ipynb):**

```
[7]  Os
  import unittest

  # ----- TEST CASES FIRST (TDD) -----
  class TestMaxOfThree(unittest.TestCase):

      def test_normal_numbers(self):
          self.assertEqual(max_of_three(2, 8, 5), 8)

      def test_first_is_largest(self):
          self.assertEqual(max_of_three(10, 3, 6), 10)

      def test_negative_numbers(self):
          self.assertEqual(max_of_three(-1, -5, -3), -1)

      def test_all_equal(self):
          self.assertEqual(max_of_three(4, 4, 4), 4)

      def test_two_equal_largest(self):
          self.assertEqual(max_of_three(7, 7, 2), 7)
```

**Bottom Notebook (Untitled30.ipynb):**

```
[7]  Os
  def test_all_equal(self):
      self.assertEqual(max_of_three(4, 4, 4), 4)

  def test_two_equal_largest(self):
      self.assertEqual(max_of_three(7, 7, 2), 7)

  #AI-Generated Implementation

[8]  Os
  # ----- IMPLEMENTATION (AFTER TESTS) -----
  def max_of_three(a, b, c):
      return max(a, b, c)

  #Run Tests

[9]  Os
  unittest.main(argv=[''], verbosity=2, exit=False)
```

The bottom notebook shows the AI-generated implementation of the `max_of_three` function, which simply returns the maximum value among three arguments. The test cases remain the same as in the top notebook.

Output:

The screenshot shows a Google Colab interface with a terminal window displaying test results. The terminal output includes:

```
test_email_with_numbers (_main_.TestEmailValidation.test_email_with_numbers) ... ok
test_invalid_structure (_main_.TestEmailValidation.test_invalid_structure) ... ok
test_missing_at_symbol (_main_.TestEmailValidation.test_missing_at_symbol) ... ok
test_missing_domain (_main_.TestEmailValidation.test_missing_domain) ... ok
test_missing_username (_main_.TestEmailValidation.test_missing_username) ... ok
test_valid_email (_main_.TestEmailValidation.test_valid_email) ... ok
test_all_equal (_main_.TestMaxOfThree.test_all_equal) ... ok
test_first_is_largest (_main_.TestMaxOfThree.test_first_is_largest) ... ok
test_negative_numbers (_main_.TestMaxOfThree.test_negative_numbers) ... ok
test_normal_numbers (_main_.TestMaxOfThree.test_normal_numbers) ... ok
test_two_equal_largest (_main_.TestMaxOfThree.test_two_equal_largest) ... ok
test_large_number (_main_.TestSquareFunction.test_large_number) ... ok
test_negative_number (_main_.TestSquareFunction.test_negative_number) ... ok
test_positive_number (_main_.TestSquareFunction.test_positive_number) ... ok
test_zero (_main_.TestSquareFunction.test_zero) ... ok

Ran 15 tests in 0.033s
OK
<unittest.main.TestProgram at 0x7e0211f2d0a>
```

## Task 4: Shopping Cart Development with AI-Assisted TDD

### Scenario

You are building a simple shopping cart module for an e-commerce application.

The cart must support adding items, removing items, and calculating the total price accurately.

### Task Description

Follow a test-driven approach:

1. Write unit tests for each required behavior:

o Adding an item o Removing

an item o Calculating the total

price

2. After defining all tests, use AI tools to generate the ShoppingCart class and its methods so that the tests pass.

Focus on behavior-driven testing rather than implementation details.

### Expected Outcome

- Unit tests defining expected shopping cart behavior

- AI-generated class implementation
- All tests passing successfully
- Clear demonstration of TDD applied to a class-based design Code:

```
[10]: import unittest

# ----- TESTS FIRST (TDD RULE) -----
class TestShoppingCart(unittest.TestCase):

    def test_add_item(self):
        cart = ShoppingCart()
        cart.add_item("Book", 100)
        self.assertEqual(cart.calculate_total(), 100)

    def test_add_multiple_items(self):
        cart = ShoppingCart()
        cart.add_item("Book", 100)
        cart.add_item("Pen", 20)
        self.assertEqual(cart.calculate_total(), 120)

    def test_remove_item(self):
        cart = ShoppingCart()
        cart.add_item("Book", 100)
        cart.remove_item("Book")
        self.assertEqual(cart.calculate_total(), 0)
```

  

```
[11]: # ----- IMPLEMENTATION AFTER TESTS -----
class ShoppingCart:

    def __init__(self):
        self.items = {}

    def add_item(self, name, price):
        self.items[name] = price

    def remove_item(self, name):
        if name in self.items:
            del self.items[name]

    def calculate_total(self):
        return sum(self.items.values())
```

```

class ShoppingCart:
    def __init__(self):
        self.items = {}

    def add_item(self, name, price):
        self.items[name] = price

    def remove_item(self, name):
        if name in self.items:
            del self.items[name]

    def calculate_total(self):
        return sum(self.items.values())

```

#Run Tests

```

unittest.main(argv=[''], verbosity=2, exit=False)

```

Output:

```

test_invalid_structure (_main_.TestEmailValidation.test_invalid_structure) ... ok
test_missing_at_symbol (_main_.TestEmailValidation.test_missing_at_symbol) ... ok
test_missing_domain (_main_.TestEmailValidation.test_missing_domain) ... ok
test_missing_username (_main_.TestEmailValidation.test_missing_username) ... ok
test_valid_email (_main_.TestEmailValidation.test_valid_email) ... ok
test_all_equal (_main_.TestMaxOfThree.test_all_equal) ... ok
test_first_is_largest (_main_.TestMaxOfThree.test_first_is_largest) ... ok
test_negative_numbers (_main_.TestMaxOfThree.test_negative_numbers) ... ok
test_normal_numbers (_main_.TestMaxOfThree.test_normal_numbers) ... ok
test_two_equal_largest (_main_.TestMaxOfThree.test_two_equal_largest) ... ok
test_add_item (_main_.TestShoppingCart.test_add_item) ... ok
test_add_multiple_items (_main_.TestShoppingCart.test_add_multiple_items) ... ok
test_remove_item (_main_.TestShoppingCart.test_remove_item) ... ok
test_remove_non_existing_item (_main_.TestShoppingCart.test_remove_non_existing_item) ... ok
test_large_number (_main_.TestSquareFunction.test_large_number) ... ok
test_negative_number (_main_.TestSquareFunction.test_negative_number) ... ok
test_positive_number (_main_.TestSquareFunction.test_positive_number) ... ok
test_zero (_main_.TestSquareFunction.test_zero) ... ok

Ran 19 tests in 0.029s
OK
<unittest.main.TestProgram at 0x7e0211f2d00>

```

## Task 5: String Validation Module Using TDD

### Scenario

You are working on a text-processing module where a function is required to identify whether a given string is a palindrome. The function must handle different cases and inputs reliably.

## Task Description

Using Test Driven Development:

1. Write test cases for a palindrome checker covering:

- o Simple palindromes
- o Non-palindromes

Case variations

2. Use GitHub Copilot or Cursor AI to generate the `is_palindrome()` function based on the test case expectations.

The function should be implemented only after tests are written.

Expected Outcome

- Clearly written test cases defining expected behavior
- AI-assisted implementation of the palindrome checker
- All test cases passing successfully • Evidence of TDD methodology applied correctly

Code:

The screenshot shows two sessions of Google Colab code execution.

**Session 1 (Top):**

- Code cell [13]:

```
import unittest

# ----- TEST CASES FIRST (TDD) -----
class TestPalindrome(unittest.TestCase):

    def test_simple_palindrome(self):
        self.assertTrue(is_palindrome("madam"))

    def test_not_palindrome(self):
        self.assertFalse(is_palindrome("hello"))

    def test_case_insensitive(self):
        self.assertTrue(is_palindrome("Madam"))

    def test_with_spaces(self):
        self.assertTrue(is_palindrome("nurses run"))

    def test_single_character(self):
        self.assertTrue(is_palindrome("a"))
```

**Session 2 (Bottom):**

- Code cell [13]:

```
self.assertTrue(is_palindrome("nurses run"))

def test_single_character(self):
    self.assertTrue(is_palindrome("a"))

#Ai Implemented Code
```
- Code cell [14]:

```
# ----- IMPLEMENTATION AFTER TESTS -----
def is_palindrome(s):
    s = s.replace(" ", "").lower()
    return s == s[::-1]
```
- Code cell [15]:

```
unittest.main(argv=[''], verbosity=2, exit=False)
```

Output:

A screenshot of a Google Colab interface showing a terminal window. The terminal window displays the output of a Python unittest run. The output includes 24 test cases, all of which passed ('ok'). The tests are categorized under various modules like `TestMaxOfThree`, `TestPalindrome`, `TestShoppingCart`, and `TestSquareFunction`. The terminal also shows the time taken for the test run (0.032s) and the final status (OK). The Colab interface has a dark theme with tabs for 'word - Search', 'Document 11.docx', 'google colab - Search', and 'Untitled30.ipynb - Colab'. The bottom right corner shows the date and time (10:05 AM) and the Python version (Python 3).

```
test_all_equal (__main__.TestMaxOfThree.test_all_equal) ... ok
test_first_is_largest (__main__.TestMaxOfThree.test_first_is_largest) ... ok
test_negative_numbers (__main__.TestMaxOfThree.test_negative_numbers) ... ok
test_normal_numbers (__main__.TestMaxOfThree.test_normal_numbers) ... ok
test_two_equal_largest (__main__.TestMaxOfThree.test_two_equal_largest) ... ok
test_case_insensitive (__main__.TestPalindrome.test_case_insensitive) ... ok
test_not_palindrome (__main__.TestPalindrome.test_not_palindrome) ... ok
test_simple_palindrome (__main__.TestPalindrome.test_simple_palindrome) ... ok
test_single_character (__main__.TestPalindrome.test_single_character) ... ok
test_with_spaces (__main__.TestPalindrome.test_with_spaces) ... ok
test_add_item (__main__.Test ShoppingCart.test_add_item) ... ok
test_add_multiple_items (__main__.Test ShoppingCart.test_add_multiple_items) ... ok
test_remove_item (__main__.Test ShoppingCart.test_remove_item) ... ok
test_remove_non_existing_item (__main__.Test ShoppingCart.test_remove_non_existing_item) ... ok
test_large_number (__main__.Test Square Function.test_large_number) ... ok
test_negative_number (__main__.Test Square Function.test_negative_number) ... ok
test_positive_number (__main__.Test Square Function.test_positive_number) ... ok
test_zero (__main__.Test Square Function.test_zero) ... ok

-----
Ran 24 tests in 0.032s
OK
<unittest.main.TestProgram at 0x7e0211f3cc80>
```