

## **ASSIGNMENT : 3.4**

**HALL-TICKET\_NO : 2303A51603**

### **Documentation**

**QUESTION :** a retail store wants to automate its daily billing process.as a programmer, you are asked to develop a console-based application that assits the casheir in generating customer bills. generate python code the program should accept the customer name, the number of items purchased, and the price of each item. it should calculate the total bill amount and apply discount based on the total purchase value(for example, higher discounts for higher bill amounts ). The program must also calculate tax on the discounts amount and display the final payable bill clearly. The systems should allow the cashier to generate bills for multiple customers until to stop the program

**PROMPT:** A retail store wants to automate its daily billing process, develop a console-based application that assits the casheir in generating customer bills. generate python code. the program should accept the customer name, the number of items purchased, and the

price of each item. it should calculate the total bill amount and apply discount based on the total purchase value(for example, higher discounts for higher bill amounts.

Optimized code:

```
# Fixed item catalog with prices and units
ITEMS_CATALOG = {
    1: {"name": "Rice (1kg)", "price": 50},
    2: {"name": "Wheat (1kg)", "price": 45},
    3: {"name": "Sugar (1kg)", "price": 55},
    4: {"name": "Salt (1kg)", "price": 20},
    5: {"name": "Oil (1L)", "price": 120},
    6: {"name": "Soap (1pack)", "price": 25},
    7: {"name": "Detergent (500g)", "price": 80},
    8: {"name": "Tea (250g)", "price": 180},
    9: {"name": "Coffee (250g)", "price": 200},
    10: {"name": "Milk Powder (400g)", "price": 250},
    11: {"name": "Flour (1kg)", "price": 40},
    12: {"name": "Lentils (1kg)", "price": 90},
    13: {"name": "Chickpeas (1kg)", "price": 85},
    14: {"name": "Butter (200g)", "price": 180},
    15: {"name": "Honey (500ml)", "price": 350},
    16: {"name": "Peanut Butter (500g)", "price": 220},
    17: {"name": "Pasta (500g)", "price": 60},
    18: {"name": "Noodles (6pack)", "price": 90},
    19: {"name": "Biscuits (200g)", "price": 40},
    20: {"name": "Chocolate (100g)", "price": 60},
    21: {"name": "Shampoo (250ml)", "price": 120},
    22: {"name": "Toothpaste (100ml)", "price": 50},
    23: {"name": "Hand Wash (250ml)", "price": 80},
    24: {"name": "Spices Mix (100g)", "price": 150},
}

# Discount tiers: (minimum_amount, discount_percentage)
DISCOUNT_TIERS = [
    (5000, 0.15),
    (3000, 0.10),
    (1000, 0.08),
    (500, 0.05),
]
```

```

TAX_RATE = 0.05
CURRENCY = "₹"
SEPARATOR = "=" * 60
SUB_SEPARATOR = "-" * 60

def display_items():
    """Display all available items."""
    print(f"\n{SEPARATOR}")
    print("AVAILABLE ITEMS")
    print(f"{SEPARATOR}")
    for item_id, details in ITEMS_CATALOG.items():
        print(f"{item_id:2d}. {details['name']:<25}"
              f"{CURRENCY}{details['price']:.2f}")
    print(f"{SEPARATOR}")

def calculate_discount(total_amount):
    """Calculate discount based on total amount."""
    for min_amount, discount_rate in DISCOUNT_TIERS:
        if total_amount > min_amount:
            return total_amount * discount_rate
    return 0

def calculate_tax(total_amount):
    """Calculate tax on total amount."""
    return total_amount * TAX_RATE

def main():
    """Main function to run the billing system."""
    while True:
        customer_name = input("\nEnter customer name (or type 'exit' to stop):")
        customer_name = customer_name.strip()
        if customer_name.lower() == 'exit':
            print("Thank you for using our billing system!")
            break

        display_items()

        cart = {}
        total_amount = 0

        while True:
            try:

```

```

        item_choice = input("\nEnter item number to add (or 'done' to
finish): ").strip()

        if item_choice.lower() == 'done':
            if not cart:
                print("No items selected. Please select at least one
item.")
                continue
            break

        item_id = int(item_choice)

        if item_id not in ITEMS_CATALOG:
            print("Invalid item number. Please try again.")
            continue

        quantity = int(input(f"Enter quantity for
{ITEMS_CATALOG[item_id]['name']}: "))

        if quantity <= 0:
            print("Quantity must be greater than 0.")
            continue

        # Get item details and calculate subtotal
        item_info = ITEMS_CATALOG[item_id]
        item_subtotal = item_info["price"] * quantity

        # Update or add item to cart
        if item_id in cart:
            cart[item_id]["quantity"] += quantity
            cart[item_id]["subtotal"] += item_subtotal
        else:
            cart[item_id] = {
                "name": item_info["name"],
                "price": item_info["price"],
                "quantity": quantity,
                "subtotal": item_subtotal
            }

        total_amount += item_subtotal
        print(f"Added {quantity} x {item_info['name']} -
{CURRENCY}{item_subtotal:.2f}")

    except ValueError:
        print("Invalid input. Please enter a valid number or 'done'.")

```

```

# Calculate discount and tax
discount = calculate_discount(total_amount)
tax = calculate_tax(total_amount - discount)
final_amount = total_amount - discount + tax

# Display receipt
print(f"\n{SEPARATOR}")
print("RECEIPT")
print(f"{SEPARATOR}")
print(f"Customer Name: {customer_name}")
print(f"{SUB_SEPARATOR}")
print("Item Details:")
print(f"{SUB_SEPARATOR}")

for item_id, item_data in cart.items():
    print(f"{item_data['name']:<30} {item_data['quantity']:>5} x  

{CURRENCY}{item_data['price']:>8.2f} = {CURRENCY}{item_data['subtotal']:>10.2f}")

print(f"{SUB_SEPARATOR}")
print(f"'Subtotal':<45} {CURRENCY}{total_amount:>12.2f}")
print(f"'Discount':<45} {CURRENCY}{discount:>12.2f}")
print(f"'Tax (5%)':<45} {CURRENCY}{tax:>12.2f}")
print(f"{SEPARATOR}")
print(f"'FINAL AMOUNT':<45} {CURRENCY}{final_amount:>12.2f}")
print(f"{SEPARATOR}\n")

if __name__ == '__main__':
    main()

```

Output:

Enter customer name (or type 'exit' to stop): mike

=====

AVAILABLE ITEMS

=====

1. Rice (1kg)	₹50.00
2. Wheat (1kg)	₹45.00
3. Sugar (1kg)	₹55.00
4. Salt (1kg)	₹20.00
5. Oil (1L)	₹120.00
6. Soap (1pack)	₹25.00
7. Detergent (500g)	₹80.00
8. Tea (250g)	₹180.00
9. Coffee (250g)	₹200.00
10. Milk Powder (400g)	₹250.00
11. Flour (1kg)	₹40.00
12. Lentils (1kg)	₹90.00
13. Chickpeas (1kg)	₹85.00
14. Butter (200g)	₹180.00
15. Honey (500ml)	₹350.00
16. Peanut Butter (500g)	₹220.00
17. Pasta (500g)	₹60.00
18. Noodles (6pack)	₹90.00
19. Biscuits (200g)	₹40.00

20. Chocolate (100g)	₹60.00
21. Shampoo (250ml)	₹120.00
22. Toothpaste (100ml)	₹50.00
23. Hand Wash (250ml)	₹80.00
24. Spices Mix (100g)	₹150.00

=====

Enter item number to add (or 'done' to finish): 20

Enter quantity for Chocolate (100g): 100

Added 100 x Chocolate (100g) - ₹6000.00

Enter item number to add (or 'done' to finish): 5

Enter quantity for Oil (1L): 3

Added 3 x Oil (1L) - ₹360.00

Enter item number to add (or 'done' to finish): done

RECEIPT: Customer Name: Mike

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Item Details:

-----

Chocolate (100g)                      100 x ₹ 60.00 = ₹ 6000.00

Oil (1L)                                  3 x ₹ 120.00 = ₹ 360.00

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Subtotal                                  ₹ 6360.00

Discount                                  ₹ 954.00

Tax (5%)                                  ₹ 270.30

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FINAL AMOUNT                          ₹ 5676.30

QUESTION: Lab 4: Advanced Prompt Engineering – Zero-shot, One-shot, and

Few-shot Techniques Week2

Task 1: Zero-shot Prompt – Fibonacci Series Generator

Task Description #1

- Without giving an example, write a single comment prompt asking GitHub Copilot to generate a Python function to print the first N Fibonacci numbers.

Expected Output #1

- A complete Python function generated by Copilot without any example provided.
- Correct output for sample input  $N = 7 \rightarrow 0\ 1\ 1\ 2\ 3\ 5\ 8$
- Observation on how Copilot understood the instruction with zero context.

## Task 2: One-shot Prompt – List Reversal Function

### Task Description #2

- Write a comment prompt to reverse a list and provide one example below the comment to guide Copilot.

### Expected Output #2

- Copilot-generated function to reverse a list using slicing or loop.
- Output: `[3, 2, 1]` for input `[1, 2, 3]`
- Observation on how adding a single example improved Copilot's accuracy.

## Task 3: Few-shot Prompt – String Pattern Matching

### Task Description #3

- Write a comment with 2–3 examples to help Copilot understand how to check if a string starts with a capital letter and ends with a period.

### Expected Output #3

- A function `is_valid()` that checks the pattern.
- Output: True or False based on input.
- Students reflect on how multiple examples guide Copilot to generate more accurate code.

#### Task 4: Zero-shot vs Few-shot – Email Validator

##### Task Description #4

- First, prompt Copilot to write an email validation function using zero-shot (just the task in comment).
- Then, rewrite the prompt using few-shot examples.

##### Expected Output #4

- Compare both outputs:

Zero-shot may result in basic or generic validation.

Few-shot gives detailed and specific logic (e.g., @ and domain checking).

- Submit both code versions and note how few-shot improves reliability.

#### Task 5: Prompt Tuning – Summing Digits of a Number

##### Task Description #5

- Experiment with 2 different prompt styles to generate a function that returns the sum of digits of a number.

Style 1: Generic task prompt

Style 2: Task + Input/Output example

Expected Output #5

- Two versions of the `sum_of_digits()` function.
- Example Output: `sum_of_digits(123) → 6`
- Short analysis: which prompt produced cleaner or more optimized code and why?

Note: Report should be submitted a word document for all tasks in a single document with prompts, comments & code explanation, and output and if required, screenshots

PROMPT :

Generate Python functions and explanations for the following tasks. For each task, include:

1. The comment prompt used (zero-shot, one-shot, or few-shot).
2. The Python function generated.
3. Sample output for the given input.
4. A short observation/explanation of how the prompt style influenced Copilot's response.

**Task 1: Zero-shot Prompt – Fibonacci Series Generator** • Write a single comment prompt asking Copilot to generate a Python function to print the first N Fibonacci numbers. • Expected Output: Function + correct output for  $N=7 \rightarrow 0\ 1\ 1\ 2\ 3\ 5\ 8$  • Observation: How Copilot understood the instruction with zero context.

**Task 2: One-shot Prompt – List Reversal Function** • Write a comment prompt to reverse a list and provide one example below the comment. • Expected Output:

Function + output [3, 2, 1] for input [1, 2, 3]. • Observation: How adding a single example improved accuracy.

**Task 3: Few-shot Prompt – String Pattern Matching** • Write a comment with 2–3 examples to help Copilot understand how to check if a string starts with a capital letter and ends with a period. • Expected Output: Function is `_valid()` returning True/False. • Observation: How multiple examples guided Copilot to generate more accurate code.

**Task 4: Zero-shot vs Few-shot – Email Validator** • First, prompt Copilot to write an email validation function using zero-shot. • Then, rewrite the prompt using few-shot examples. • Expected Output: Compare both versions (basic vs detailed). • Observation: How few-shot improved reliability.

**Task 5: Prompt Tuning – Summing Digits of a Number** • Experiment with 2 prompt styles: – Style 1: Generic task prompt. – Style 2: Task + Input/Output example. • Expected Output: Two versions of `sum_of_digits()` function. • Example: `sum_of_digits(123) → 6` • Observation: Which prompt produced cleaner or more optimized code and why.

ASSIGNMENT-3.4 code:

```
from typing import List, Tuple, Generator
from functools import lru_cache

@lru_cache(maxsize=128)
def _fib(n: int) -> int:
    """Calculate nth Fibonacci number with memoization."""
    if n < 0:
        raise ValueError("Index must be non-negative")
    return n if n <= 1 else _fib(n - 1) + _fib(n - 2)

def fibonacci_generator(n: int) -> Generator[int, None, None]:
    """Generate first N Fibonacci numbers efficiently."""
    if n <= 0:
        return
    a, b = 0, 1
```

```

    yield a
    if n > 1:
        yield b
        for _ in range(n - 2):
            a, b = b, a + b
            yield b

def fibonacci_zero_shot(n: int) -> None:
    """Print first N Fibonacci numbers."""
    if n < 0:
        raise ValueError("N must be non-negative")
    print(' '.join(map(str, fibonacci_generator(n))))

def reverse_list(lst: List) -> List:
    """Reverse list using Python slicing."""
    return lst[::-1]

def reverse_list_inplace(lst: List) -> List:
    """Reverse list in-place using two-pointer technique."""
    left, right = 0, len(lst) - 1
    while left < right:
        lst[left], lst[right] = lst[right], lst[left]
        left += 1
        right -= 1
    return lst

def is_valid_sentence(text: str) -> bool:
    """Check if text starts with capital letter and ends with period."""
    if not text:
        return False
    return text[0].isupper() and text[-1] == '.'

_SENTENCE_TESTS: List[Tuple[str, bool]] = [
    ('Hello world.', True),
    ('hello world.', False),
    ('Hello world', False),
    ('A.', True),
    ('', False),
]

def validate_email_basic(email: str) -> bool:
    """Basic email validation (Zero-shot)."""
    return '@' in email and '.' in email

```

```

def validate_email(email: str) -> bool:
    """Comprehensive email validation (Few-shot)."""
    if not email or not isinstance(email, str):
        return False

    if email.count('@') != 1:
        return False

    local, domain = email.rsplit('@', 1)

    if not local or len(local) > 64 or not domain or len(domain) < 3:
        return False

    if '.' not in domain or domain.startswith('.') or domain.endswith('.'):
        return False

    if domain.startswith('-') or domain.endswith('-'):
        return False

    valid_chars =
set('abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789._%+-')
    return all(c in valid_chars for c in local)

_EMAIL_TESTS: List[Tuple[str, bool, bool]] = [
    ('user@example.com', True, True),
    ('invalid.email@.com', True, False),
    ('user@domain', False, False),
    ('user@domain.co.uk', True, True),
    ('@example.com', True, False),
]

def sum_of_digits_style1(n: int) -> int:
    """Sum digits using generator expression (Pythonic)."""
    return sum(int(d) for d in str(abs(n)))

def sum_of_digits_style2(n: int) -> int:
    """Sum digits using iterative approach."""
    total = 0
    n = abs(n)
    while n > 0:
        total += n % 10
        n //= 10

```

```

    return total

def sum_of_digits_optimized(n: int) -> int:
    """Sum digits using map function (most optimized)."""
    return sum(map(int, str(abs(n))))

_DIGIT_SUM_TESTS: List[Tuple[int, int]] = [
    (123, 6),
    (9876, 30),
    (0, 0),
    (555, 15),
    (1, 1),
    (-123, 6),
]

def run_all_tests() -> None:
    """Execute all test cases with validation."""

    print("=" * 80)
    print("TASK 1: ZERO-SHOT FIBONACCI GENERATOR")
    print("=" * 80)
    print("Output for N=7: ", end="")
    fibonacci_zero_shot(7)
    print()

    print("=" * 80)
    print("TASK 2: ONE-SHOT LIST REVERSAL")
    print("=" * 80)
    test_list = [1, 2, 3]
    print(f"Input: {test_list}")
    print(f"Slicing: {reverse_list(test_list)}")
    print(f"Two-pointer: {reverse_list_inplace([1, 2, 3])}")
    print()

    print("=" * 80)
    print("TASK 3: FEW-SHOT STRING PATTERN MATCHING")
    print("=" * 80)
    print(f"{'Text':<20} {'Result':<8} {'Status':<8}")
    print("-" * 36)
    for text, expected in _SENTENCE_TESTS:
        result = is_valid_sentence(text)
        status = "✓" if result == expected else "✗"
        print(f"{text:<20} {str(result):<8} {status:<8}")
    print()

```

```

print("=" * 80)
print("TASK 4: EMAIL VALIDATION COMPARISON")
print("=" * 80)
print(f"{'Email':<25} {'Basic':<8} {'Full':<8} {'Status':<8}")
print("-" * 50)
for email, basic_exp, full_exp in _EMAIL_TESTS:
    basic = validate_email_basic(email)
    full = validate_email(email)
    status = "✓" if (basic == basic_exp and full == full_exp) else "✗"
    print(f"{'email':<25} {'str(basic)':<8} {'str(full)':<8} {'status':<8}")
print()

print("=" * 80)
print("TASK 5: SUM OF DIGITS")
print("=" * 80)
print(f"{'Number':<10} {'Style1':<10} {'Style2':<10} {'Optimized':<10}
{'Status':<8}")
print("-" * 50)
for num, expected in _DIGIT_SUM_TESTS:
    s1 = sum_of_digits_style1(num)
    s2 = sum_of_digits_style2(num)
    opt = sum_of_digits_optimized(num)
    status = "✓" if (s1 == expected and s2 == expected and opt == expected)
else "✗"
    print(f"{'num':<10} {'s1':<10} {'s2':<10} {'opt':<10} {'status':<8}")
print()

if __name__ == "__main__":
    run_all_tests()

```

OUTPUT:

TASK 1: ZERO-SHOT FIBONACCI GENERATOR

Output for N=7: 0 1 1 2 3 5 8

TASK 2: ONE-SHOT LIST REVERSAL

Input: [1, 2, 3]

Slicing: [3, 2, 1]

Two-pointer: [3, 2, 1]

### TASK 3: FEW-SHOT STRING PATTERN MATCHING

Text	Result	Status
------	--------	--------

-----

Hello world.	True	✓
--------------	------	---

hello world.	False	✓
--------------	-------	---

Hello world	False	✓
-------------	-------	---

A.	True	✓
----	------	---

	False	✓
--	-------	---

### TASK 4: EMAIL VALIDATION COMPARISON

Email	Basic	Full	Status
-------	-------	------	--------

-----

user@example.com	True	True	✓
------------------	------	------	---

invalid.email@.com	True	False	✓
--------------------	------	-------	---

user@domain	False	False	✓
-------------	-------	-------	---

user@domain.co.uk	True	True	✓
-------------------	------	------	---

@example.com	True	False	✓
--------------	------	-------	---

## TASK 5: SUM OF DIGITS

Number	Style1	Style2	Optimized	Status
--------	--------	--------	-----------	--------

-----

123	6	6	6	✓
-----	---	---	---	---

9876	30	30	30	✓
------	----	----	----	---

0	0	0	0	✓
---	---	---	---	---

555	15	15	15	✓
-----	----	----	----	---

1	1	1	1	✓
---	---	---	---	---

-123	6	6	6	✓
------	---	---	---	---