

# Assignment 3.1 - Prompt Engineering - Improving Prompts and Context Management

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## Question 1: Zero-Shot Prompting - Palindrome Number

### Zero-Shot Prompt

“Write a Python function that checks whether a given number is a palindrome.”

### AI-Generated Code

```
1 #Write a Python function that checks whether a given number is a palindrome
2 def is_palindrome(number):
3     # Convert the number to string
4     str_num = str(number)
5     # Check if the string is equal to its reverse
6     return str_num == str_num[::-1]
7 # Test the function
8 test_number = 0
9 if is_palindrome(test_number):
10     print(f"{test_number} is a palindrome.")
11 else:
12     print(f"{test_number} is not a palindrome.")
13
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
● user@Users-Laptop aiac % cd /Users/user/Documents/aiac ; /usr/bin/env /usr/local/bin/python3 /Users/user/.vscode/
xtensions/ms-python.debugpy-2025.18.0-darwin-arm64/bundled/libs/debugpy/adapter/../../debugpy/launcher 50593 -- /Us
ers/user/Documents/aiac/Assignment1.py
121 is a palindrome.
● user@Users-Laptop aiac % cd /Users/user/Documents/aiac ; /usr/bin/env /usr/local/bin/python3 /Users/user/.vscode/
xtensions/ms-python.debugpy-2025.18.0-darwin-arm64/bundled/libs/debugpy/adapter/../../debugpy/launcher 50615 -- /Us
ers/user/Documents/aiac/Assignment1.py
123 is not a palindrome.
● user@Users-Laptop aiac % cd /Users/user/Documents/aiac ; /usr/bin/env /usr/local/bin/python3 /Users/user/.vscode/
xtensions/ms-python.debugpy-2025.18.0-darwin-arm64/bundled/libs/debugpy/adapter/../../debugpy/launcher 50644 -- /Us
ers/user/Documents/aiac/Assignment1.py
0 is a palindrome.
○ user@Users-Laptop aiac %
```

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## Question 2: One-Shot Prompting - Factorial Calculation

### One-Shot Prompt

“Write a Python function to calculate factorial.  
Example: Input: 5 → Output: 120”

## AI-Generated Code

```
14 #Write a Python function to calculate factorial.Example: Input: 5 → Output: 120
15 def factorial(n):
16     if n < 0:
17         return "Factorial is not defined for negative numbers."
18     elif n == 0 or n == 1:
19         return 1
20     else:
21         result = 1
22         for i in range(2, n + 1):
23             result *= i
24         return result
25 # Test the function
26 test_value = -3
27 print(f"The factorial of {test_value} is {factorial(test_value)}.")
28
29
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
● user@Users-Laptop aiac % cd /Users/user/Documents/aiac ; /usr/bin/env /usr/local/bin/python3 /Users/user/.vscode/e
xtensions/ms-python.debugpy-2025.18.0-darwin-arm64/bundled/libs/debugpy/adapter/../../debugpy/launcher 50878 -- /Us
ers/user/Documents/aiac/Assignment1.py
The factorial of 5 is 120.
● user@Users-Laptop aiac % cd /Users/user/Documents/aiac ; /usr/bin/env /usr/local/bin/python3 /Users/user/.vscode/e
xtensions/ms-python.debugpy-2025.18.0-darwin-arm64/bundled/libs/debugpy/adapter/../../debugpy/launcher 50901 -- /Us
ers/user/Documents/aiac/Assignment1.py
The factorial of 0 is 1.
● user@Users-Laptop aiac % cd /Users/user/Documents/aiac ; /usr/bin/env /usr/local/bin/python3 /Users/user/.vscode/e
xtensions/ms-python.debugpy-2025.18.0-darwin-arm64/bundled/libs/debugpy/adapter/../../debugpy/launcher 50921 -- /Us
ers/user/Documents/aiac/Assignment1.py
The factorial of -3 is Factorial is not defined for negative numbers..
```

## Question 3: Few-Shot Prompting - Armstrong Number

### Few-Shot Prompt

“Write a Python function to check Armstrong numbers.  
Examples:  
153 → Armstrong Number  
370 → Armstrong Number  
123 → Not an Armstrong Number”

## AI-Generated Code

```

29 #Write a Python function to check Armstrong numbers.
30 # Examples:
31 # 153 → Armstrong Number
32 # 370 → Armstrong Number
33 # 123 → Not an Armstrong Number
34 def is_armstrong(number):
35     # Convert the number to string to easily iterate over digits
36     str_num = str(number)
37     num_digits = len(str_num)
38     sum_of_powers = sum(int(digit) ** num_digits for digit in str_num)
39     return sum_of_powers == number
40 # Test the function
41 test_number = 0
42 if is_armstrong(test_number):
43     print(f"{test_number} is an Armstrong Number.")
44 else:
45     print(f"{test_number} is Not an Armstrong Number.")
46
47

```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```

● user@Users-Laptop aiac % cd /Users/user/Documents/aiac ; /usr/bin/env /usr/local/bin/python3 /Users/user/.vscode/e
xtensions/ms-python.debugpy-2025.18.0-darwin-arm64/bundled/libs/debugpy/adapter/../../debugpy/launcher 51007 -- /Us
ers/user/Documents/aiac/Assignment1.py
153 is an Armstrong Number.
● user@Users-Laptop aiac % cd /Users/user/Documents/aiac ; /usr/bin/env /usr/local/bin/python3 /Users/user/.vscode/e
xtensions/ms-python.debugpy-2025.18.0-darwin-arm64/bundled/libs/debugpy/adapter/../../debugpy/launcher 51047 -- /Us
ers/user/Documents/aiac/Assignment1.py
370 is an Armstrong Number.
● user@Users-Laptop aiac % cd /Users/user/Documents/aiac ; /usr/bin/env /usr/local/bin/python3 /Users/user/.vscode/e
xtensions/ms-python.debugpy-2025.18.0-darwin-arm64/bundled/libs/debugpy/adapter/../../debugpy/launcher 51073 -- /Us
ers/user/Documents/aiac/Assignment1.py
123 is Not an Armstrong Number.
● user@Users-Laptop aiac % cd /Users/user/Documents/aiac ; /usr/bin/env /usr/local/bin/python3 /Users/user/.vscode/e
xtensions/ms-python.debugpy-2025.18.0-darwin-arm64/bundled/libs/debugpy/adapter/../../debugpy/launcher 51096 -- /Us
ers/user/Documents/aiac/Assignment1.py
0 is an Armstrong Number.

```

## Question 4 : Context-Managed Prompting - Number Classification

### Context-Managed Prompt

“Write an optimized Python program that classifies a number as Prime, Composite, or Neither. Ensure input validation and efficiency.”

```
48 #Write an optimized Python program that classifies a number as Prime, Composite, or Neither.
49 # Ensure input validation and efficiency.
50 def classify_number(number):
51     if not isinstance(number, int) or number < 0:
52         return "Input must be a non-negative integer."
53     if number == 0 or number == 1:
54         return "Neither Prime nor Composite"
55     if number == 2:
56         return "Prime"
57     if number % 2 == 0:
58         return "Composite"
59
60     for i in range(3, int(number**0.5) + 1, 2):
61         if number % i == 0:
62             return "Composite"
63
64     return "Prime"
65
66 # Test the function
67 test_number = -5
68 result = classify_number(test_number)
69 print(f"{test_number} is classified as: {result}.")
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
user@Users-Laptop aiac % cd /Users/user/Documents/aiac ; /usr/bin/env /usr/local/bin/python3 /Users/user/.vscode/
xtensions/ms-python.debugpy-2025.18.0-darwin-arm64/bundled/libs/debugpy/adapter/../../debugpy/launcher 51209 -- /Us
ers/user/Documents/aiac/Assignment1.py
2 is classified as: Prime.
user@Users-Laptop aiac % cd /Users/user/Documents/aiac ; /usr/bin/env /usr/local/bin/python3 /Users/user/.vscode/
xtensions/ms-python.debugpy-2025.18.0-darwin-arm64/bundled/libs/debugpy/adapter/../../debugpy/launcher 51230 -- /Us
ers/user/Documents/aiac/Assignment1.py
9 is classified as: Composite.
user@Users-Laptop aiac % cd /Users/user/Documents/aiac ; /usr/bin/env /usr/local/bin/python3 /Users/user/.vscode/
xtensions/ms-python.debugpy-2025.18.0-darwin-arm64/bundled/libs/debugpy/adapter/../../debugpy/launcher 51252 -- /Us
ers/user/Documents/aiac/Assignment1.py
1 is classified as: Neither Prime nor Composite.
user@Users-Laptop aiac % cd /Users/user/Documents/aiac ; /usr/bin/env /usr/local/bin/python3 /Users/user/.vscode/
xtensions/ms-python.debugpy-2025.18.0-darwin-arm64/bundled/libs/debugpy/adapter/../../debugpy/launcher 51278 -- /Us
ers/user/Documents/aiac/Assignment1.py
-5 is classified as: Input must be a non-negative integer..
```

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## Question 5: Zero-Shot Prompting - Perfect Number

### Zero-Shot Prompt

“Write a Python function to check whether a given number is a perfect number.”

### AI-Generated Code

```
70 #Write a Python function to check whether a given number is a perfect number.
71 def is_perfect_number(number):
72     if number <= 0:
73         return "Input must be a positive integer."
74
75     sum_of_divisors = sum(i for i in range(1, number) if number % i == 0)
76     return sum_of_divisors == number
77
78 # Test the function
79 test_number = 10
80 if is_perfect_number(test_number):
81     print(f"{test_number} is a Perfect Number.")
82 else:
83     print(f"{test_number} is Not a Perfect Number.")
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
user@Users-Laptop aiac % cd /Users/user/Documents/aiac ; /usr/bin/env /usr/local/bin/python3 /Users/user/.vscode/
xtensions/ms-python.debugpy-2025.18.0-darwin-arm64/bundled/libs/debugpy/adapters/..../debugpy/launcher 51365 -- /Us
ers/user/Documents/aiac/Assignment1.py
6 is a Perfect Number.
user@Users-Laptop aiac % cd /Users/user/Documents/aiac ; /usr/bin/env /usr/local/bin/python3 /Users/user/.vscode/
xtensions/ms-python.debugpy-2025.18.0-darwin-arm64/bundled/libs/debugpy/adapters/..../debugpy/launcher 51387 -- /Us
ers/user/Documents/aiac/Assignment1.py
28 is a Perfect Number.
user@Users-Laptop aiac % cd /Users/user/Documents/aiac ; /usr/bin/env /usr/local/bin/python3 /Users/user/.vscode/
xtensions/ms-python.debugpy-2025.18.0-darwin-arm64/bundled/libs/debugpy/adapters/..../debugpy/launcher 51410 -- /Us
ers/user/Documents/aiac/Assignment1.py
10 is Not a Perfect Number.
```

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## Question 6: Few-Shot Prompting - Even or Odd with Validation

### Few-Shot Prompt

“Write a Python program to classify numbers.  
Examples:  
8 → Even  
15 → Odd  
0 → Even”

### AI-Generated Code

```

84 #Write a Python program to classify numbers.
85 # Examples:
86 # 8 → Even
87 # 15 → Odd
88 # 0 → Even
89
90 def classify_number(number):
91     if not isinstance(number, int):
92         return "Input must be an integer."
93     if number % 2 == 0:
94         return "Even"
95     else:
96         return "Odd"
97 # Test the function
98 test_number = 3.5
99 result = classify_number(test_number)
100 print(f"{test_number} is classified as: {result}.")
101

```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

```

> ▾ TERMINAL
user@Users-Laptop aiac % cd /Users/user/Documents/aiac ; /usr/bin/env /usr/local/bin/python3 /Users/user/.vscode/extensions/ms-python.debugpy-2025.18.0-darwin-arm64/bundled/libs/debugpy/adapter/../../debugpy/launcher 51506 -- /Users/user/Documents/aiac/Assignment1.py
18 is classified as: Even.
user@Users-Laptop aiac % cd /Users/user/Documents/aiac ; /usr/bin/env /usr/local/bin/python3 /Users/user/.vscode/extensions/ms-python.debugpy-2025.18.0-darwin-arm64/bundled/libs/debugpy/adapter/../../debugpy/launcher 51527 -- /Users/user/Documents/aiac/Assignment1.py
15 is classified as: Odd.
user@Users-Laptop aiac % cd /Users/user/Documents/aiac ; /usr/bin/env /usr/local/bin/python3 /Users/user/.vscode/extensions/ms-python.debugpy-2025.18.0-darwin-arm64/bundled/libs/debugpy/adapter/../../debugpy/launcher 51553 -- /Users/user/Documents/aiac/Assignment1.py
0 is classified as: Even.

```

## Conclusion

Zero-shot prompting works for simple logic but lacks validation.

One-shot prompting improves correctness.

Few-shot prompting produces the most structured and accurate code.

Context-managed prompts deliver optimized and production-ready solutions.