Name: Ayush Patel   Enrolment: 22162171038   Class B Batch 55

Institute of Computer Technology
B. Tech Computer Science and Engineering

Sub: Algorithm Analysis and Design

Practical 5

You are working at the cash counter at a fun-fair, and you have three types of coins available to you in infinite quantities (coins are Rs. 1, Rs. 4 and Rs. 6). You are required to calculate the minimum numbers of coins required for changing the value of Rs. 9.

Design the algorithm for the same and implement using the programming language of your choice. Make comparative analysis for various use cases & input size.

Code:

App.py

```python
from flask import Flask, render_template, request
import matplotlib.pyplot as plt
import io
import base64

app = Flask(__name__)

def min_coins(coins, value):
    dp = [float('inf')] * (value + 1)
    dp[0] = 0
    for i in range(1, value + 1):
        for coin in coins:
            if i - coin >= 0:
                dp[i] = min(dp[i], dp[i - coin] + 1)
    return dp[value]

# Index route (homepage)
@app.route('/')
def index():
```

```python
    return render_template('index.html')

# Route for Task 1 page
@app.route('/task1', methods=['GET', 'POST'])
def task1():
    coins = [1, 4, 6]
    result = None
    values = []
    results = []

    if request.method == 'POST':
        value = int(request.form['value'])
        result = min_coins(coins, value)

        # Comparative analysis for different input sizes
        for i in range(1, value + 1):
            values.append(i)
            results.append(min_coins(coins, i))

        # Plotting the graph with green line color
        plt.figure(figsize=(10, 6))
        plt.plot(values, results, marker='o', color='green')
        plt.title('Minimum Coins Required for Different Values')
        plt.xlabel('Value')
        plt.ylabel('Minimum Coins')
        plt.grid(True)

        # Save plot to a string in base64 format
        img = io.BytesIO()
        plt.savefig(img, format='png')
        img.seek(0)
        plot_url = base64.b64encode(img.getvalue()).decode()

        return render_template('task1.html', result=result, value=value,
plot_url=plot_url)

    return render_template('task1.html')

if __name__ == '__main__':
    app.run(debug=True)
```

Task1.html

```html
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Cash Counter - Minimum Coins</title>
    <link rel="stylesheet" href="{{ url_for('static', filename='task1.css') }}">
</head>
<body>
    <div class="container">
        <h1>Cash Counter - Minimum Coins Calculation</h1>
        <form method="POST">
            <label for="value">Enter the value (in Rs.):</label>
            <input type="number" id="value" name="value" required>
            <button type="submit">Calculate</button>
        </form>
        {% if result is not none %}
        <div class="result">
            <h2>Result</h2>
            <p>Minimum number of coins required for Rs. {{ value }}: <strong>{{
result }}</strong></p>
            <h3>Comparative Analysis</h3>
            <img src="data:image/png;base64,{{ plot_url }}" alt="Comparative
Analysis Graph">
        </div>
        {% endif %}
    </div>
</body>
</html>
```
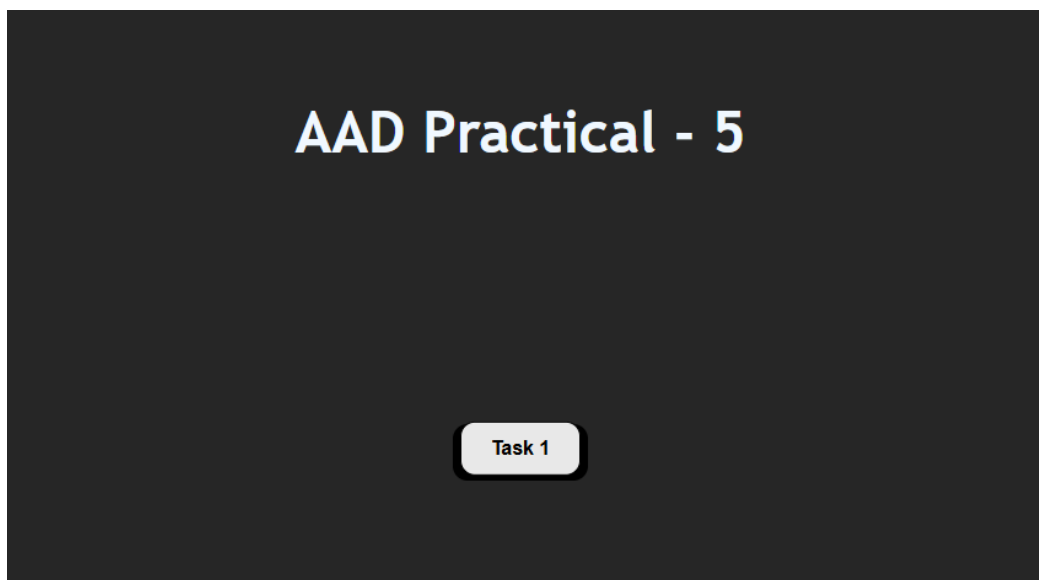
Output:

Cash Counter - Minimum Coins Calculation

Enter the value (in Rs.):

[   ]

[Calculate]

Result

Minimum number of coins required for Rs. 5: **2**

Comparative Analysis

Minimum Coins Required for Different Values