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Institute of Computer Technology
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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:

Python.py

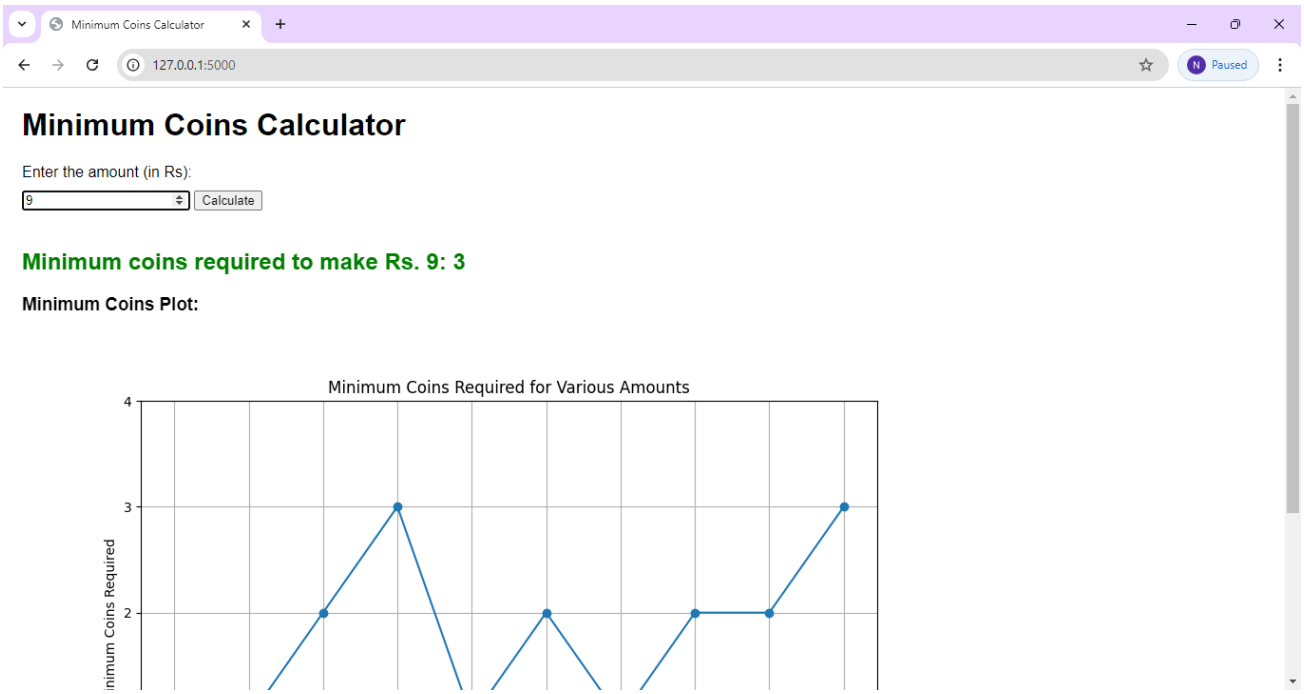
```python
from flask import Flask, request, render_template, send_file
import matplotlib.pyplot as plt
import numpy as np
import os

app = Flask(__name__)

def min_coins(coins, target):
    """Calculate the minimum number of coins needed to make the target amount."""
    dp = [float('inf')] * (target + 1)
    dp[0] = 0  # Base case: 0 coins needed to make 0 amount

    for coin in coins:
        for amount in range(coin, target + 1):
```

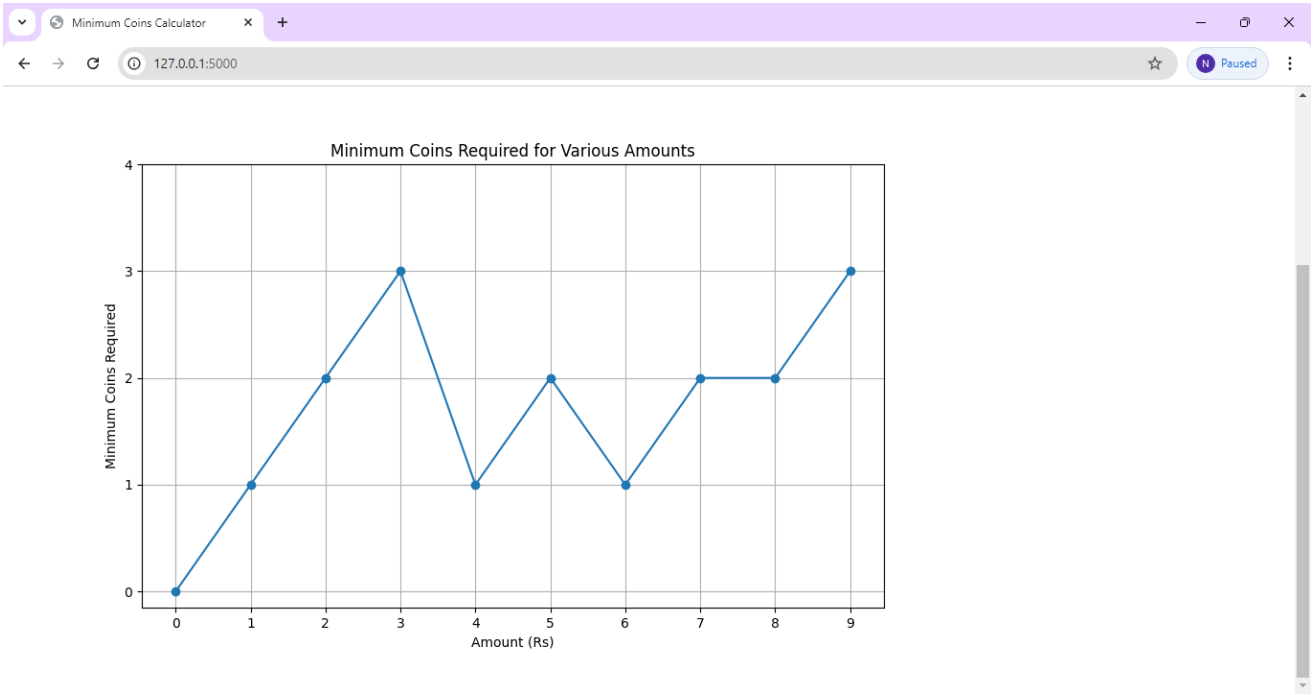
```
            dp[amount] = min(dp[amount], dp[amount - coin] + 1)

    return dp[target] if dp[target] != float('inf') else -1

def plot_min_coins(coins, max_amount):
    """Plot the minimum coins required for each amount up to max_amount."""
    amounts = list(range(max_amount + 1))
    min_coins_list = [min_coins(coins, amount) for amount in amounts]

    plt.figure(figsize=(10, 6))
    plt.plot(amounts, min_coins_list, marker='o')
    plt.title('Minimum Coins Required for Various Amounts')
    plt.xlabel('Amount (Rs)')
    plt.ylabel('Minimum Coins Required')
    plt.grid()
    plt.xticks(amounts)
    plt.yticks(range(max(min_coins_list) + 2))  # Adjust the y-axis for better
visibility
    plt.savefig('static/min_coins_plot.png')
    plt.close()

@app.route('/', methods=['GET', 'POST'])
def index():
    """Render the index page and handle form submission."""
    if request.method == 'POST':
        try:
            amount = int(request.form['amount'])
            coins = [1, 4, 6]
            result = min_coins(coins, amount)

            # Generate plot for all amounts up to the input amount
            plot_min_coins(coins, amount)

            return render_template('index.html', result=result, amount=amount)
        except ValueError:
            return render_template('index.html', result="Invalid input. Please
enter a valid number.")

    return render_template('index.html', result=None)

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

.html:

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Minimum Coins Calculator</title>
    <style>
        body { font-family: Arial, sans-serif; margin: 20px; }
        label { display: block; margin-bottom: 10px; }
        input { margin-bottom: 20px; }
        h2 { color: green; }
    </style>
</head>
<body>
    <h1>Minimum Coins Calculator</h1>
    <form method="POST">
        <label for="amount">Enter the amount (in Rs):</label>
        <input type="number" id="amount" name="amount" required>
        <button type="submit">Calculate</button>
    </form>

    {% if result is not none %}
        <h2>Minimum coins required to make Rs. {{ amount }}: {{ result }}</h2>
        <h3>Minimum Coins Plot:</h3>
        <img src="{{ url_for('static', filename='min_coins_plot.png') }}"
alt="Minimum Coins Plot">
    {% endif %}
</body>
</html>
```

OUTPUT:


Minimum Coins Calculator
127.0.0.1:5000
Paused
Minimum Coins Calculator
Enter the amount (in Rs):
9
Calculate
Minimum coins required to make Rs. 9: 3
Minimum Coins Plot:
Minimum Coins Required for Various Amounts
Minimum Coins Required
4
3
2


Minimum Coins Calculator
127.0.0.1:5000
Paused
Minimum Coins Required for Various Amounts
Minimum Coins Required
Amount (Rs)
0
1
2
3
4
5
6
7
8
9