Institute of Computer Technology

B. Tech Computer Science and Engineering

Practical 05

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.

App.py

```
from flask import Flask, request, render_template


app = Flask(__name__)


def min_coins(amount, coins):
    dp = [[float('inf')] * (amount + 1) for _ in range(len(coins))]



    for i in range(len(coins)):
        dp[i][0] = 0



    for i in range(len(coins)):
        for j in range(1, amount + 1):
            if j >= coins[i]:
                dp[i][j] = min(dp[i][j], 1 + dp[i][j - coins[i]])
            if i > 0:
                dp[i][j] = min(dp[i][j], dp[i - 1][j])
```

```
    used_coins = []
    j = amount
    for i in range(len(coins) - 1, -1, -1):
        while j >= coins[i] and dp[i][j] == 1 + dp[i][j - coins[i]]:
            used_coins.append(coins[i])
            j -= coins[i]

    matrix = [dp[i] for i in range(len(coins))]
    return {
        'min_coins': dp[-1][amount] if dp[-1][amount] != float('inf') else '∞',
        'matrix': matrix,
        'used_coins': used_coins,
        'denominations': coins
    }

@app.route('/', methods=['GET', 'POST'])
def index():
    result = None
    if request.method == 'POST':
        try:
            coins = list(map(int, request.form['coins'].split()))
            amount = int(request.form['amount'])
            if amount < 0:
                raise ValueError("Amount must be non-negative.")
            result = min_coins(amount, coins)
        except ValueError as e:
            return f"Invalid input: {e}", 400
    return render_template('index.html', result=result)
```

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

Index.html

```
<!DOCTYPE html>
<html>
<head>
    <title>Coin Change Problem</title>
    <style>
        body {
            font-family: 'Segoe UI', Tahoma, Geneva, Verdana, sans-serif;
            margin: 20px;
            background-color: #f9f9f9;
            color: #333;
        }
        h1 {
            color: #444;
        }
        form {
            margin-bottom: 20px;
        }
        input[type="text"], input[type="number"] {
            padding: 10px;
            margin-right: 10px;
            border: 2px solid #ddd;
            border-radius: 5px;
            font-size: 16px;
```

```
    }
    input[type="text"] {
        width: 300px;
    }
    button {
        padding: 10px 20px;
        border: none;
        border-radius: 5px;
        background-color: #007bff;
        color: #fff;
        cursor: pointer;
        font-size: 16px;
    }
    button:hover {
        background-color: #0056b3;
    }
    table {
        width: 100%;
        border-collapse: collapse;
        margin-top: 20px;
    }
    th, td {
        padding: 12px;
        border: 1px solid #ddd;
        text-align: center;
        font-size: 16px;
    }
    th {
        background-color: #f2f2f2;
```

```
        }
        tr:nth-child(even) {
            background-color: #f9f9f9;
        }
        .used-coins {
            margin-top: 20px;
        }
        .used-coins span {
            display: inline-block;
            padding: 8px 12px;
            border: 1px solid #ddd;
            border-radius: 20px;
            background-color: #d1ecf1;
            margin: 5px;
            font-size: 16px;
            color: #0c5460;
        }
    </style>
</head>
<body>
    <h1>Coin Change Problem</h1>
    <form method="POST">
        <label for="coins">Enter coin denominations (separated by space):</label>
        <input type="text" id="coins" name="coins" required>
        <label for="amount">Enter the amount:</label>
        <input type="number" id="amount" name="amount" required>
        <button type="submit">Calculate</button>
    </form>
    {% if result %}
```

```
<h2>Results</h2>
<h3>Minimum Coins Required: {{ result.min_coins }}</h3>
<div class="used-coins">
  <h3>Coins Used:</h3>
  {% for coin in result.used_coins %}
  <span>{{ coin }}</span>
  {% endfor %}
</div>
<h3>Coin Change Table:</h3>
<table>
  <thead>
    <tr>
      <th>Denomination</th>
      {% for j in range(0, result.matrix[0]|length) %}
      <th>{{ j }}</th>
      {% endfor %}
    </tr>
  </thead>
  <tbody>
    {% for row in result.matrix %}
    <tr>
      <th>{{ result.denominations[loop.index0] }}</th>
      {% for value in row %}
      <td>{{ value }}</td>
      {% endfor %}
    </tr>
    {% endfor %}
  </tbody>
</table>
```

```
    {% endif %}
</body>
</html>
```