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B. Tech Computer Science and Engineering

Sub: Algorithm Analysis and Design

Practical 9

- A thief is robbing a store and can carry a maximal weight of W into his knapsack. There are n items available in the store and weight of i^{th} item is wi and its profit is pi. What items should the thief take?
- In this context, the items should be selected in such a way that the thief will carry those items for which he will gain maximum profit. Hence, the objective of the thief is to maximize the profit.
- Implement Program for fractional knapsack using Greedy design technique.
  Note: First solve the example:
  W=60

Item	A	B	C	D
Profit	280	100	120	120
Weight	40	10	20	24

Sample Input:-
p=[280,100,120,120]
w=[40,10,20,24]
W=60

Sample Output:-
Profit [100, 280, 120, 120]
Weight [10, 40, 20, 24]
Ratio [10.0, 7.0, 6.0, 5.0]

[1, 1, 0.5, 0]
Total profit : 440.0
Code:

```
from flask import Flask, render_template, request
import numpy as np

app = Flask(__name__)

# Function for fractional knapsack
# Function for fractional knapsack
def fractional_knapsack(profits, weights, capacity):
    # Calculate the ratio of profit to weight for each item
    ratios = [p / w for p, w in zip(profits, weights)]

    # Create list of items with profit, weight, ratio, and index
    items = [(profits[i], weights[i], ratios[i], i) for i in range(len(profits))]

    # Sort items based on the ratio (high to low)
    items.sort(key=lambda x: x[2], reverse=True)

    # Initialize variables for the selected items
    total_profit = 0.0
    selected_items = [0] * len(profits)

    for profit, weight, ratio, idx in items:
        if capacity >= weight:
            # Take the whole item
            capacity -= weight
            total_profit += profit
            selected_items[idx] = 1
        else:
            # Take the fraction of the item
            fraction = capacity / weight
            total_profit += profit * fraction
            selected_items[idx] = fraction
            break

    return total_profit, selected_items, items



@app.route("/", methods=["GET", "POST"])
def index():
    if request.method == "POST":
```

```
        # Get user input for profits, weights, and capacity
        profits = list(map(int, request.form["profits"].split(',')))
        weights = list(map(int, request.form["weights"].split(',')))
        capacity = int(request.form["capacity"])

        # Get the result from fractional knapsack
        total_profit, selected_items, sorted_items = fractional_knapsack(profits,
weights, capacity)

        # Prepare data to pass to the template
        ratios = [item[2] for item in sorted_items]
        sorted_items_data = sorted_items
        selected_data = [round(sel, 2) for sel in selected_items]

        return render_template(
            "p9.html",
            profits=profits,
            weights=weights,
            capacity=capacity,
            total_profit=round(total_profit, 2),
            sorted_items=sorted_items_data,
            ratios=ratios,
            selected_items=selected_data
        )

    return render_template("p9.html")


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

Html file:

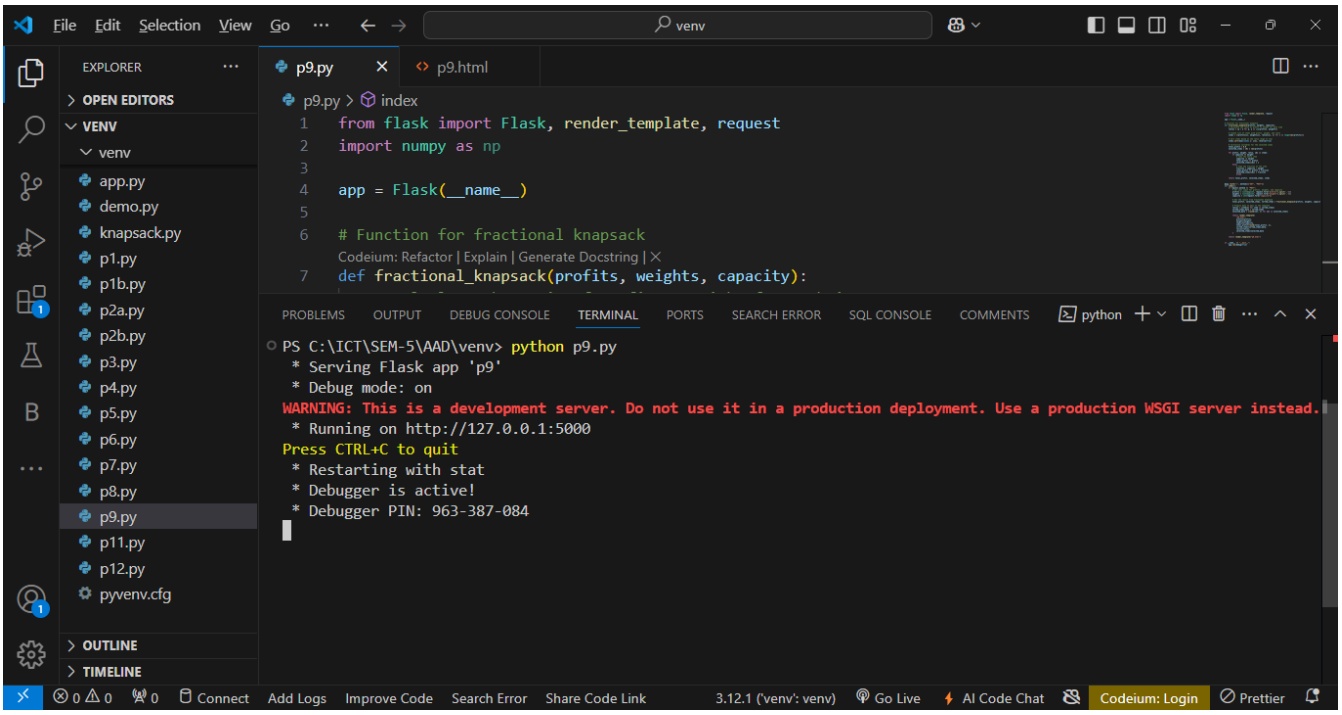
```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Fractional Knapsack Problem</title>
    <style>
        body {
            font-family: Arial, sans-serif;
            background-color: #f4f4f9;
            padding: 20px;
```

```
        }
        .container {
            max-width: 600px;
            margin: 0 auto;
            padding: 20px;
            background-color: #fff;
            border-radius: 8px;
            box-shadow: 0 4px 8px rgba(0, 0, 0, 0.1);
        }
        h1 {
            text-align: center;
            color: #333;
        }
        .form-group {
            margin-bottom: 15px;
        }
        label {
            font-weight: bold;
            color: #555;
        }
        input[type="text"], input[type="number"] {
            width: 100%;
            padding: 8px;
            margin-top: 5px;
            border: 1px solid #ddd;
            border-radius: 4px;
        }
        button {
            background-color: #4CAF50;
            color: white;
            padding: 10px 15px;
            border: none;
            border-radius: 4px;
            cursor: pointer;
            font-size: 16px;
            width: 100%;
        }
        button:hover {
            background-color: #45a049;
        }
        .result {
            margin-top: 20px;
        }
        table {
            width: 100%;
```

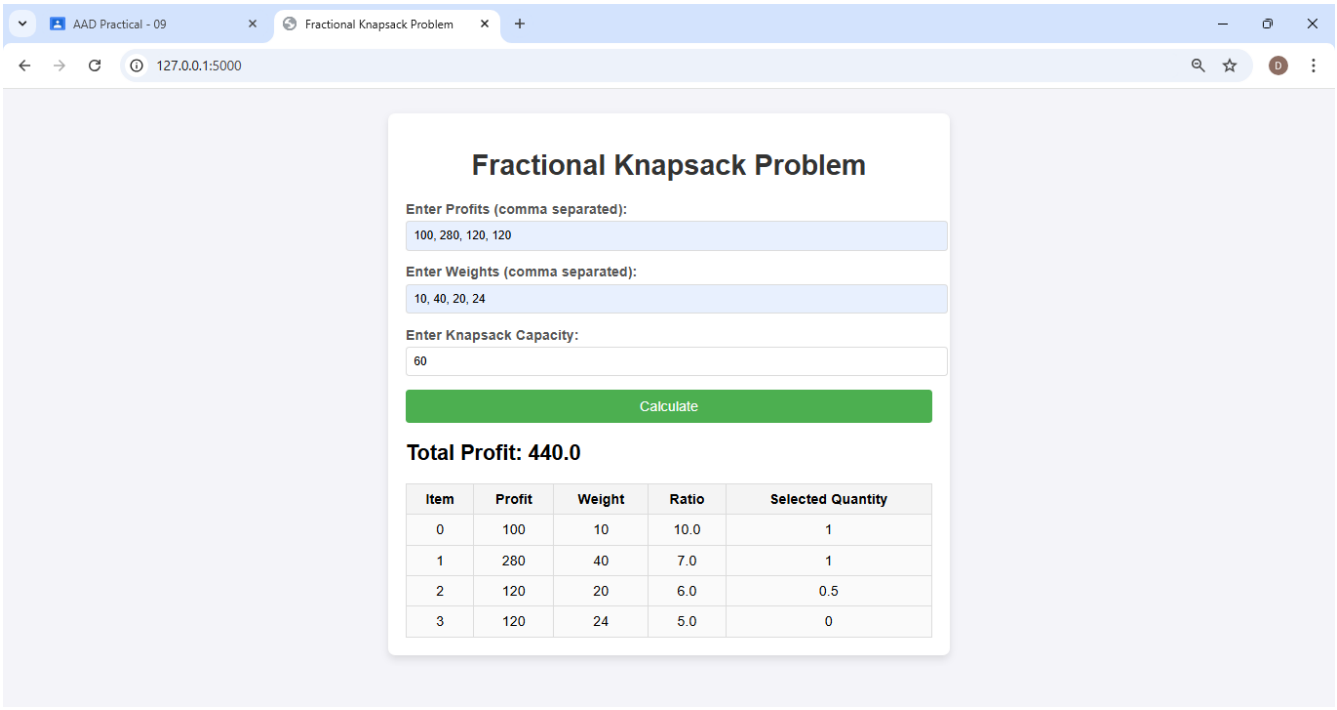
```
            border-collapse: collapse;
            margin-top: 10px;
        }
        table, th, td {
            border: 1px solid #ddd;
            padding: 8px;
            text-align: center;
        }
        th {
            background-color: #f4f4f4;
        }
        td {
            background-color: #fafafa;
        }
    </style>
</head>
<body>
    <div class="container">
        <h1>Fractional Knapsack Problem</h1>
        <form method="POST">
            <div class="form-group">
                <label for="profits">Enter Profits (comma separated):</label>
                <input type="text" id="profits" name="profits" required>
            </div>
            <div class="form-group">
                <label for="weights">Enter Weights (comma separated):</label>
                <input type="text" id="weights" name="weights" required>
            </div>
            <div class="form-group">
                <label for="capacity">Enter Knapsack Capacity:</label>
                <input type="number" id="capacity" name="capacity" required>
            </div>
            <button type="submit">Calculate</button>
        </form>

        {% if total_profit %}
        <div class="result">
            <h2>Total Profit: {{ total_profit }}</h2>
            <table>
                <thead>
                    <tr>
                        <th>Item</th>
                        <th>Profit</th>
                        <th>Weight</th>
                        <th>Ratio</th>
```

```
                    <th>Selected Quantity</th>
                </tr>
            </thead>
            <tbody>
                {% for item in sorted_items %}
                <tr>
                    <td>{{ loop.index0 | string | upper }}</td> <!-- Display
the item name (A, B, C, D) -->
                    <td>{{ item[0] }}</td> <!-- Profit -->
                    <td>{{ item[1] }}</td> <!-- Weight -->
                    <td>{{ item[2] }}</td> <!-- Ratio -->
                    <td>{{ selected_items[loop.index0] }}</td> <!-- Selected
Quantity -->
                </tr>
                {% endfor %}
            </tbody>
        </table>
    </div>
    {% endif %}
</div>
</body>
</html>
```

Screenshots:



Output:


AAD Practical - 09
Fractional Knapsack Problem
127.0.0.1:5000
Fractional Knapsack Problem
Enter Profits (comma separated):
100, 280, 120, 120
Enter Weights (comma separated):
10, 40, 20, 24
Enter Knapsack Capacity:
60
Calculate
Total Profit: 440.0
Item Profit Weight Ratio Selected Quantity
0 100 10 10.0 1
1 280 40 7.0 1
2 120 20 6.0 0.5
3 120 24 5.0 0