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B. Tech Computer Science and Engineering

Sub: Algorithm Analysis and Design

Practical 7

A thief carrying a single knapsack with limited (W = 5) capacity. The museum you stole had (n=4) artefacts that you could steal. Unfortunately, you might not be able to steal the entire artefact because of your limited knapsack capacity.

Help the thief to cherry pick the artefact in order to maximise the total value (<=W) of the artefacts you stole.

First solve the given below example:
Let n = 4, W=5

(P1, P2, P3, P4) = (3,4,5,6)
(w1, w2, w3, w4) = (2,3,4,5)

App.py:

```
from flask import Flask, render_template, request

app = Flask(__name__)

def knapsack_optimizer(items, capacity, weights, values):
    result_table = [[0 for x in range(capacity + 1)] for x in range(items
+ 1)]

    for i in range(1, items + 1):
        for j in range(capacity + 1):
            if weights[i-1] <= j:
                result_table[i][j] = max(result_table[i-1][j], values[i-1]
+ result_table[i-1][j - weights[i-1]])
            else:
                result_table[i][j] = result_table[i-1][j]

    optimal_value = result_table[items][capacity]
```

```
    return result_table, optimal_value

@app.route('/', methods=['GET', 'POST'])
def index():
    if request.method == 'POST':
        capacity = int(request.form['bag_capacity'])
        items = int(request.form['item_count'])

        values = list(map(int, request.form['item_values'].split(',')))
        weights = list(map(int, request.form['item_weights'].split(',')))

         result_table, optimal_value = knapsack_optimizer(items, capacity,
weights, values)

          return render_template('index.html', result_table=result_table,
optimal_value=optimal_value,        values=values,        weights=weights,
capacity=capacity, items=items)

    return render_template('index.html')

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

Index.html

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Knapsack Optimizer</title>
    <style>
        body {
            font-family: 'Verdana', sans-serif;
            margin: 30px;
            background-color: #eef2f7;
        }
        h1 {
```

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```
            color: #2c3e50;
        }
        form {
            margin-bottom: 25px;
        }
        input[type="text"], input[type="number"] {
            padding: 12px;
            width: 280px;
            margin: 8px 0;
            border-radius: 5px;
            border: 1px solid #ccc;
        }
        input[type="submit"] {
            padding: 12px 25px;
            background-color: #28a745;
            color: white;
            border: none;
            border-radius: 5px;
            cursor: pointer;
        }
        table {
            border-collapse: collapse;
            width: 70%;
            margin-top: 25px;
        }
        table, th, td {
            border: 1px solid #ddd;
            padding: 12px;
            text-align: center;
        }
        th {
            background-color: #4caf50;
            color: white;
        }
        td {
            background-color: #fafafa;
        }
    </style>
</head>
<body>
```

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```
    <h1>Knapsack Optimizer</h1>

    <form method="POST">
        <label for="bag_capacity">Bag Capacity:</label><br>
              <input  type="number"  id="bag_capacity"  name="bag_capacity"
required><br>

        <label for="item_count">Number of Items:</label><br>
                 <input  type="number"  id="item_count"  name="item_count"
required><br>

                                <label    for="item_values">Enter    Values
(comma-separated):</label><br>
                 <input  type="text"  id="item_values"  name="item_values"
required><br>

                               <label    for="item_weights">Enter    Weights
(comma-separated):</label><br>
               <input  type="text"  id="item_weights"  name="item_weights"
required><br>

        <input type="submit" value="Optimize">
    </form>

    {% if optimal_value %}
        <h2>Results</h2>
        <p><strong>Optimal Value:</strong> {{ optimal_value }}</p>

        <h3>Knapsack Table</h3>
        <table>
            <thead>
                <tr>
                    <th>Item/Weight</th>
                    {% for i in range(capacity + 1) %}
                    <th>{{ i }}</th>
                    {% endfor %}
                </tr>
            </thead>
            <tbody>
```

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```
                {% for i in range(items + 1) %}
                <tr>
                    <td>Item {{ i }}</td>
                    {% for j in range(capacity + 1) %}
                    <td>{{ result_table[i][j] }}</td>
                    {% endfor %}
                </tr>
                {% endfor %}
            </tbody>
        </table>
    {% endif %}

</body>
</html>
```

Output: