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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


app = Flask(__name__)




def fractional_knapsack(profits, weights, W):
    n = len(profits)
    items = [(profits[i], weights[i], profits[i] / weights[i]) for i
in range(n)]
    items.sort(key=lambda x: x[2], reverse=True)


    total_profit = 0.0
    fractions = [0] * n


    for i in range(n):
        if W == 0:
            break
        if items[i][1] <= W:
            W -= items[i][1]
            total_profit += items[i][0]
            fractions[i] = 1
        else:
```

```
            fractions[i] = W / items[i][1]
            total_profit += items[i][0] * fractions[i]
            W = 0

    return items, fractions, total_profit
@app.route('/', methods=['GET', 'POST'])
def index():
    if request.method == 'POST':
        # Get user inputs
        profits = list(map(int,
request.form.get('profits').split(',')))
        weights = list(map(int,
request.form.get('weights').split(',')))
        W = int(request.form.get('capacity'))

        # Calculate knapsack result
        items, fractions, total_profit =
fractional_knapsack(profits, weights, W)

        # Zip items and fractions together for use in the template
        items_with_fractions = list(zip(items, fractions))

        return render_template('index.html',
items_with_fractions=items_with_fractions,
total_profit=total_profit)

    return render_template('index.html')

if __name__ == '__main__':
```

```
    app.run(debug=True)
```

Html code

```
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <title>Fractional Knapsack</title>
</head>
<body>
    <h1>Fractional Knapsack Problem</h1>

    <form method="POST">
        <label for="profits">Profits (comma-separated):</label>
        <input type="text" id="profits" name="profits" required>

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

        <label for="capacity">Capacity:</label>
        <input type="number" id="capacity" name="capacity" required>

        <button type="submit">Calculate</button>
    </form>

    {% if items_with_fractions %}
```

```
        <h2>Results</h2>
        <table border="1">
            <tr>
                <th>Profit</th>
                <th>Weight</th>
                <th>Ratio</th>
                <th>Fraction Taken</th>
            </tr>
            {% for item, fraction in items_with_fractions %}
            <tr>
                <td>{{ item[0] }}</td>
                <td>{{ item[1] }}</td>
                <td>{{ item[2] | round(2) }}</td>
                <td>{{ fraction | round(2) }}</td>
            </tr>
            {% endfor %}
        </table>
        <p><strong>Total Profit:</strong> {{ total_profit }}</p>
    {% endif %}
</body>
</html>
```

Output

Fractional Knapsack Problem

Profits (comma-separated): Weights (comma-separated): Capacity: Calculate

Results

Profit	Weight	Ratio	Fraction Taken
100	10	10.0	1
280	40	7.0	1
120	20	6.0	0.5
120	24	5.0	0

Total Profit: 440.0