Institute of Computer Technology

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, request, render_template_string

app = Flask(__name__)

# Fractional Knapsack function
def fractional_knapsack(profits, weights, capacity):
    n = len(profits)
    ratio = [(profits[i] / weights[i], i) for i in range(n)]
    ratio.sort(reverse=True, key=lambda x: x[0])  # Sort by profit/weight ratio in descending order

    total_profit = 0
    selected_items = [0] * n  # Initialize items selected

    for r, i in ratio:
        if weights[i] <= capacity:
            selected_items[i] = 1  # Take the whole item
            total_profit += profits[i]
            capacity -= weights[i]
        else:
            selected_items[i] = capacity / weights[i]  # Take a fraction of the item
            total_profit += profits[i] * (capacity / weights[i])
            break

    return total_profit, selected_items

# Route to display form and result
@app.route('/', methods=['GET', 'POST'])
```

```
def knapsack():
    if request.method == 'POST':
        profits = list(map(int, request.form['profit'].split(',')))
        weights = list(map(int, request.form['weight'].split(',')))
        capacity = int(request.form['capacity'])


        total_profit, selected_items = fractional_knapsack(profits, weights, capacity)
        return render_template_string(result_html, profits=profits, weights=weights,
                                      selected_items=selected_items, total_profit=total_profit)
    return render_template_string(index_html)


# HTML for input form with Bootstrap
index_html = '''
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Fractional Knapsack</title>
    <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.3.0-alpha1/dist/css/bootstrap.min.css"
rel="stylesheet">
</head>
<body class="bg-light">
    <div class="container mt-5">
        <div class="card">
            <div class="card-body">
                <h2 class="card-title text-center">Fractional Knapsack Problem</h2>
                <form method="POST" class="mt-4">
                    <div class="mb-3">
                        <label class="form-label">Enter Profits (comma separated):</label>
                        <input type="text" name="profit" class="form-control" required placeholder="e.g. 280,
100, 120, 120">
```

```
            </div>
            <div class="mb-3">
              <label class="form-label">Enter Weights (comma separated):</label>
              <input type="text" name="weight" class="form-control" required placeholder="e.g. 40, 10, 20, 24">
            </div>
            <div class="mb-3">
              <label class="form-label">Enter Knapsack Capacity:</label>
              <input type="number" name="capacity" class="form-control" required placeholder="e.g. 60">
            </div>
            <button type="submit" class="btn btn-primary w-100">Calculate</button>
          </form>
        </div>
      </div>
    </div>
</body>
</html>
'''

# HTML for displaying result with Bootstrap
result_html = '''
<!DOCTYPE html>
<html lang="en">
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Knapsack Result</title>
    <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.3.0-alpha1/dist/css/bootstrap.min.css" rel="stylesheet">
</head>
<body class="bg-light">
```

```
<div class="container mt-5">
  <div class="card">
    <div class="card-body">
      <h2 class="card-title text-center">Knapsack Result</h2>
      <table class="table table-striped mt-4">
        <thead>
          <tr>
            <th scope="col">Item</th>
            <th scope="col">Profit</th>
            <th scope="col">Weight</th>
            <th scope="col">Fraction Taken</th>
          </tr>
        </thead>
        <tbody>
          {% for i in range(profits|length) %}
          <tr>
            <th scope="row">{{ i+1 }}</th>
            <td>{{ profits[i] }}</td>
            <td>{{ weights[i] }}</td>
            <td>{{ selected_items[i] }}</td>
          </tr>
          {% endfor %}
        </tbody>
      </table>
      <h3 class="text-center mt-4">Total Profit: {{ total_profit }}</h3>
      <div class="text-center mt-4">
        <a href="/" class="btn btn-primary">Go Back</a>
      </div>
    </div>
  </div>
</div>
```

```
</body>

</html>

'''


if __name__ == '__main__':

    app.run(debug=True)
```