Fractional Knapsack:

OUTPUT:

```
===== Emergency Relief Supply Distribution =====
Enter number of relief items: 5

Enter details for each item:
(Name Weight Value Divisible[1 for Yes, 0 for No])
Item 1: Food 30 120 1
Item 2: Water 20 100 1
Item 3: Medicine 10 200 0
Item 4: Blanket 15 90 0
Item 5: Sanitizer 5 50 1

Enter boat weight capacity (kg): 50

--- Selected Items for Transport ---
Item           Taken(kg)   Value       Type
-------------------------------------------------
Medicine       10          200         Whole
Sanitizer      5           50          Divisible
Blanket        15          90          Whole
Water          20          100         Divisible

Total Utility Value: 440.00
Total Weight Loaded: 50.00 / 50.00 kg

Operation Summary: Relief supplies successfully optimized for transport.
```

Definition:
The **Fractional Knapsack Problem** is a classic **optimization problem** in computer science where the goal is to maximize the total value of items in a knapsack of limited capacity. Unlike the 0/1 Knapsack, **items can be broken into fractions**, allowing partial selection to fully utilize the knapsack.

Key Concepts:

1. **Weight (wi)** – How heavy the item is.
2. **Value (vi)** – Utility or importance of the item.
3. **Value-to-weight ratio (vi/wi)** – Determines item priority for selection.

Algorithm (Greedy Approach):

1. Calculate the **value-to-weight ratio** for each item.

2. **Sort items** in descending order of ratio.
3. Start adding items to the knapsack:
    - If the item fits entirely, take it.
    - If it doesn't fit, take a **fraction** that fills the remaining capacity.
4. Continue until the knapsack is full.

Time Complexity:

- Sorting: **O(n log n)**
- Selection: **O(n)**
- **Total:** O(n log n)

Applications:

- Resource allocation with limited capacity
- Emergency supply distribution
- Financial portfolio optimization
- Cargo loading optimization