

### DAA 3

```
Enter the number of items: 3
Enter the capacity of the knapsack: 50
Enter details for item 1:
Weight of item 1: 10
Value of item 1: 60
Enter details for item 2:
Weight of item 2: 20
Value of item 2: 100
Enter details for item 3:
Weight of item 3: 30
Value of item 3: 120
```

- **Item 1:** Weight = 10, Value = 60, Value per weight = 6.0
- **Item 2:** Weight = 20, Value = 100, Value per weight = 5.0
- **Item 3:** Weight = 30, Value = 120, Value per weight = 4.0

The items are sorted based on value per weight ratio in descending order: Item 1 → Item 2 → Item 3.

### Knapsack Process:

1. **Item 1** (Weight 10, Value 60) fully fits into the knapsack. Remaining capacity =  $50 - 10 = 40$ . Total value = 60.
2. **Item 2** (Weight 20, Value 100) fully fits into the knapsack. Remaining capacity =  $40 - 20 = 20$ . Total value =  $60 + 100 = 160$ .
3. **Item 3** (Weight 30, Value 120) cannot fully fit. Only 20 units of weight can be taken. The fraction taken has a value of:  $\text{Fractional value} = \frac{20}{30} \times 120 = 80$ . So, 80 value is added. The knapsack is now full. Total value =  $160 + 80 = 240$ .

Thus, the maximum value in the knapsack is **240**.

### 6. Time Complexity

- Sorting the items takes  $O(n \log n)$ , where  $n$  is the number of items.
- The iteration through the items takes  $O(n)$ . Thus, the overall time complexity is  $O(n \log n)$ .