

3.11 A Case Study

A Case Study

- General Crates, Inc. builds custom-designed wooden crates.
- You have been asked to write a program that calculates the:
 - Volume (in cubic feet)
 - Cost
 - Customer price
 - Profit of any crate GCI builds

Variables

Table 3-14

Constant or Variable	Description
COST_PER_CUBIC_FOOT	A named constant, declared as a double and initialized with the value 0.23. This represents the cost to build a crate, per cubic foot.
CHARGE_PER_CUBIC_FOOT	A named constant, declared as a double and initialized with the value 0.5. This represents the amount charged for a crate, per cubic foot.
length	A double variable to hold the length of the crate, which is input by the user.
width	A double variable to hold the width of the crate, which is input by the user.
height	A double variable to hold the height of the crate, which is input by the user.
volume	A double variable to hold the volume of the crate. The value stored in this variable is calculated.
cost	A double variable to hold the cost of building the crate. The value stored in this variable is calculated.
charge	A double variable to hold the amount charged to the customer for the crate. The value stored in this variable is calculated.
Profit	A double variable to hold the profit GCI makes from the crate. The value stored in this variable is calculated.

Program Design

The program must perform the following general steps:

Step 1:

Ask the user to enter the dimensions of the crate

Step 2:

Calculate:

the crate's volume

the cost of building the crate

the customer's charge

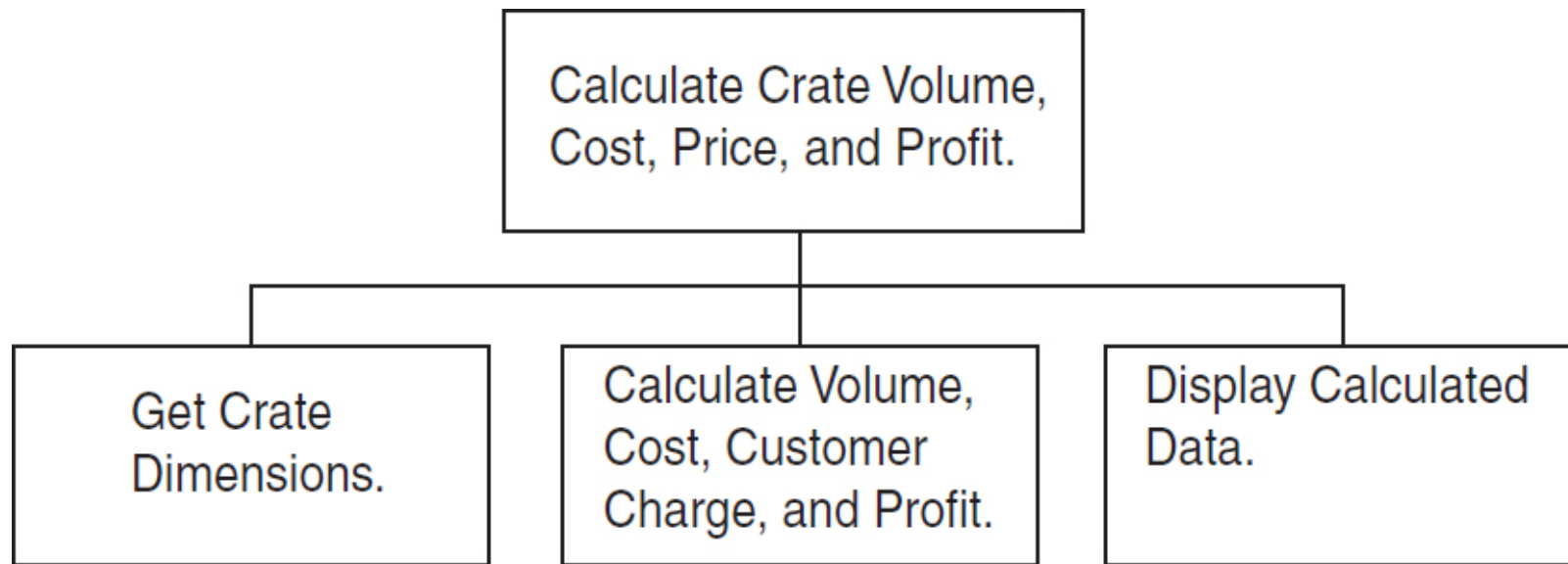
the profit made

Step 3:

Display the data calculated in Step 2.

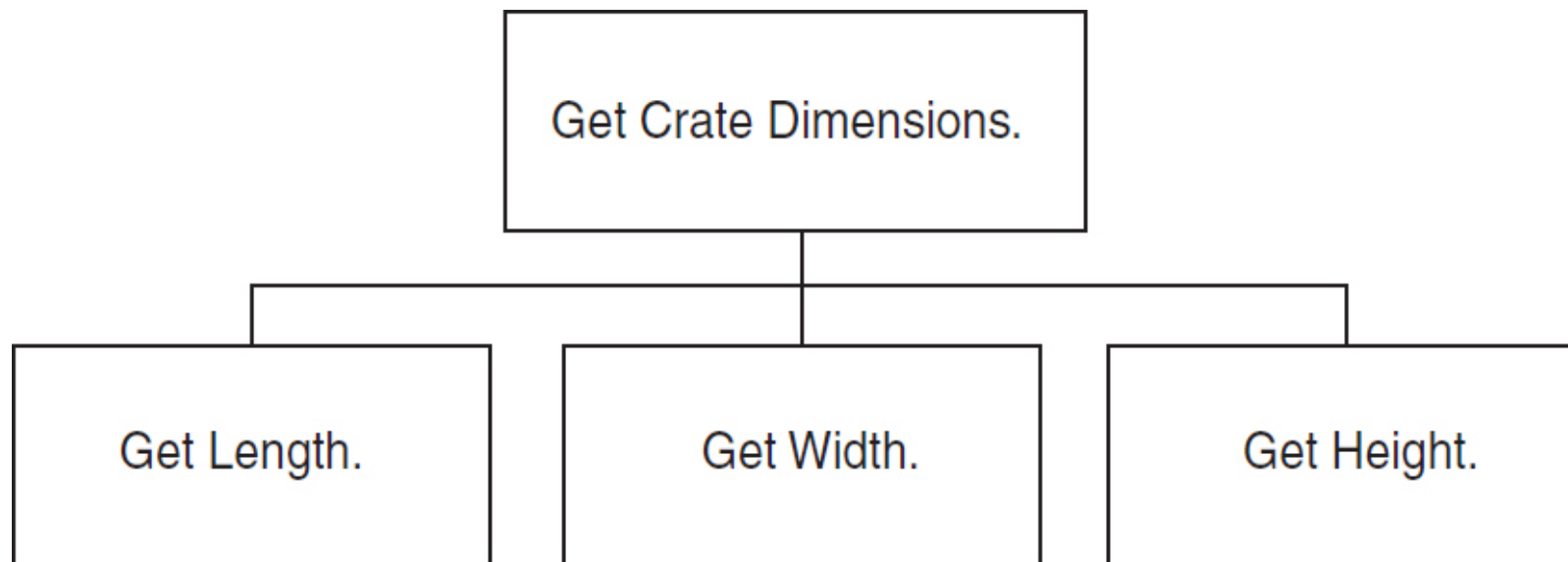
General Hierarchy Chart

Figure 3-7



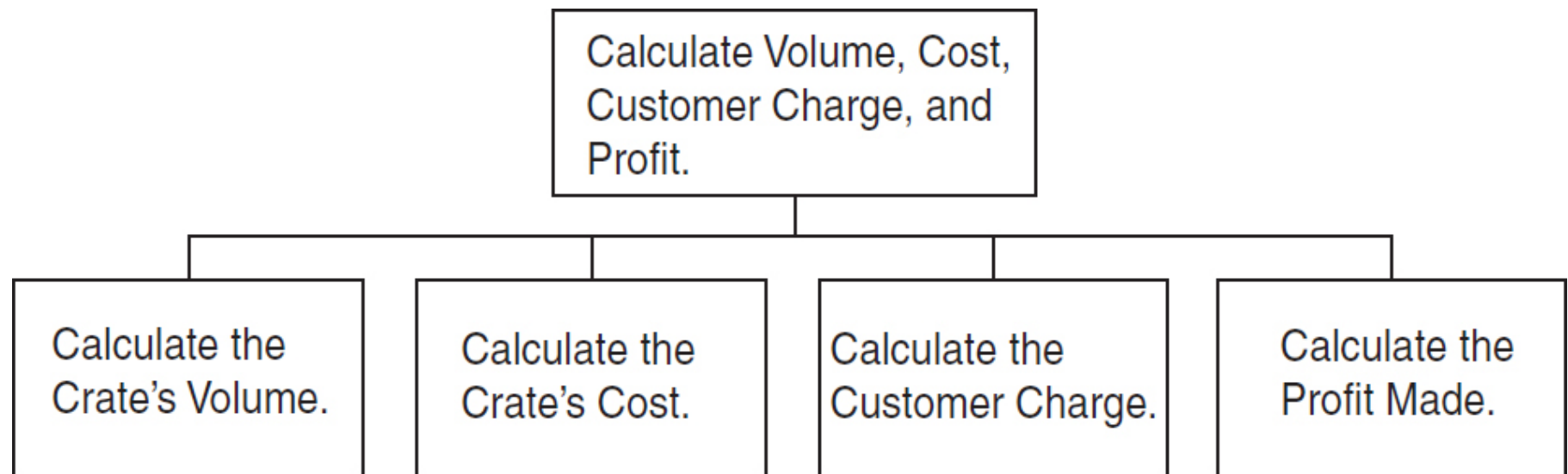
Get Crate Dimensions

Figure 3-8



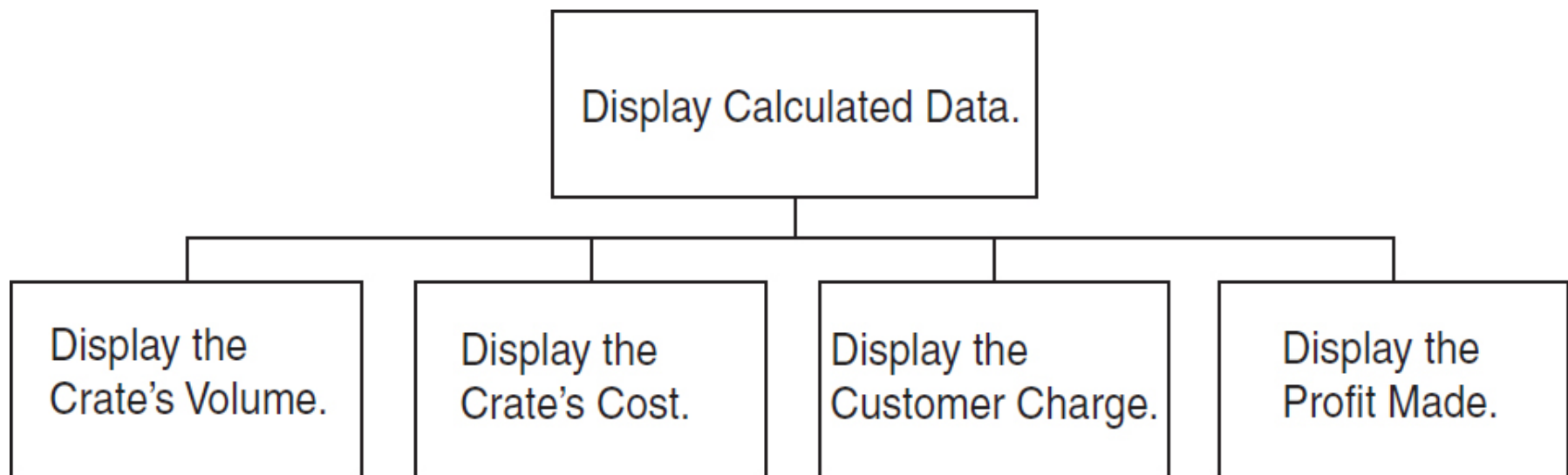
Calculate Volume, Cost, Customer Charge, and Profit

Figure 3-9



Display Calculated Data

Figure 3-10



Pseudocode

Ask the user to input the crate's length.

Ask the user to input the crate's width.

Ask the user to input the crate's height.

Calculate the crate's volume.

Calculate the cost of building the crate.

Calculate the customer's charge for the crate.

Calculate the profit made from the crate.

Display the crate's volume.

Display the cost of building the crate.

Display the customer's charge for the crate.

Display the profit made from the crate.

Calculations

The following formulas will be used to calculate the crate's volume, cost, charge, and profit:

$$\text{volume} = \text{length} \times \text{width} \times \text{height}$$

$$\text{cost} = \text{volume} \times 0.23$$

$$\text{charge} = \text{volume} \times 0.5$$

$$\text{profit} = \text{charge} - \text{cost}$$

The Program (1 of 3)

```
1  // This program is used by General Crates, Inc. to calculate
2  // the volume, cost, customer charge, and profit of a crate
3  // of any size. It calculates this data from user input, which
4  // consists of the dimensions of the crate.
5  #include <iostream>
6  #include <iomanip>
7  using namespace std;
8
9  int main()
10 {
11     // Constants for cost and amount charged
12     const double COST_PER_CUBIC_FOOT = 0.23;
13     const double CHARGE_PER_CUBIC_FOOT = 0.5;
14
15     // Variables
16     double length, // The crate's length
17            width,   // The crate's width
18            height,  // The crate's height
19            volume,  // The volume of the crate
20            cost,    // The cost to build the crate
21            charge,  // The customer charge for the crate
22            profit;  // The profit made on the crate
23
24     // Set the desired output formatting for numbers.
25     cout << setprecision(2) << fixed << showpoint;
26
```

The Program (2 of 3)

```
27      // Prompt the user for the crate's length, width, and height
28      cout << "Enter the dimensions of the crate (in feet):\n";
29      cout << "Length: ";
30      cin >> length;
31      cout << "Width: ";
32      cin >> width;
33      cout << "Height: ";
34      cin >> height;
35
36      // Calculate the crate's volume, the cost to produce it,
37      // the charge to the customer, and the profit.
38      volume = length * width * height;
39      cost = volume * COST_PER_CUBIC_FOOT;
40      charge = volume * CHARGE_PER_CUBIC_FOOT;
41      profit = charge - cost;
42
43      // Display the calculated data.
44      cout << "The volume of the crate is ";
45      cout << volume << " cubic feet.\n";
46      cout << "Cost to build: $" << cost << endl;
47      cout << "Charge to customer: $" << charge << endl;
48      cout << "Profit: $" << profit << endl;
49      return 0;
50 }
```

The Program (3 of 3)

Program Output with Example Input Shown in Bold

```
Enter the dimensions of the crate (in feet):  
Length: 10 [Enter]  
Width: 8 [Enter]  
Height: 4 [Enter]  
The volume of the crate is 320.00 cubic feet.  
Cost to build: $73.60  
Charge to customer: $160.00  
Profit: $86.40
```

Program Output with Different Example Input Shown in Bold

```
Enter the dimensions of the crate (in feet):  
Length: 12.5 [Enter]  
Width: 10.5 [Enter]  
Height: 8 [Enter]  
The volume of the crate is 1050.00 cubic feet.  
Cost to build: $241.50  
Charge to customer: $525.00  
Profit: $283.50
```

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