3 General Crates, Inc.

General Crates, Inc. builds custom-designed wooden crates. With materials and labor, it costs GCI $0.23 per cubic foot to build a crate. In turn, they charge their customers $0.50 per cubic foot for the crate. You have been asked to write a program that calculates the volume (in cubic feet), cost, customer price, and profit of any crate GCI builds.

Variables

Table 3A shows the variables.

Table 3A   Variables Used in the General Crates Program

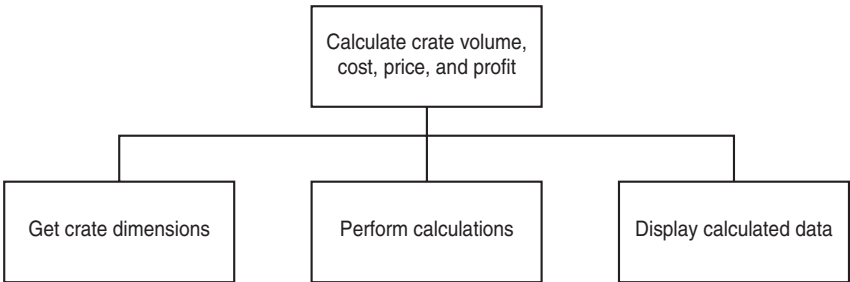| Variable	Description
length	A double variable to hold the length of the crate, which is input by the user.
width	A double variable to hold the width of the crate, which is input by the user.
height	A double variable to hold the height of the crate, which is input by the user.
volume	A double variable 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:

1. Ask the user to enter the dimensions of the crate (the crate's length, width, and height).
2. Calculate the crate's volume, the cost of building the crate, the customer's charge, and the profit made.
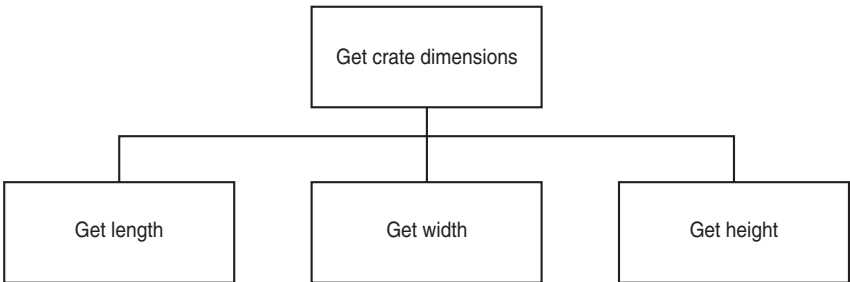3. Display the data calculated in step 2.

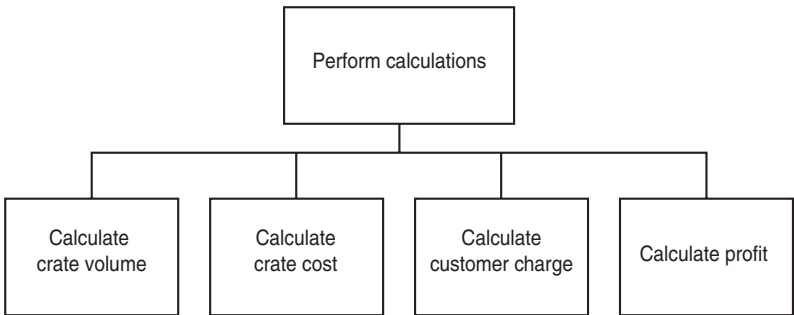A general hierarchy chart for this program is shown in Figure 3A.

Figure 3A

```
              ┌─────────────────────────┐
              │ Calculate crate volume, │
              │  cost, price, and profit│
              └─────────────────────────┘
         ┌───────────�┬───────────────┬──────────────┐
 ┌───────────────┐ ┌───────────────┐ ┌────────────────────┐
 │ Get crate     │ │ Perform       │ │ Display calculated │
 │ dimensions    │ │ calculations  │ │ data               │
 └───────────────┘ └───────────────┘ └────────────────────┘
```

The "Get crate dimensions" step is shown in greater detail in Figure 3B.

Figure 3B

```
              ┌─────────────────────┐
              │ Get crate dimensions│
              └─────────────────────┘
         ┌───────────┬───────────────┬──────────────┐
 ┌───────────────┐ ┌───────────────┐ ┌───────────────┐
 │ Get length    │ │ Get width     │ │ Get height    │
 └───────────────┘ └───────────────┘ └───────────────┘
```

The "Perform calculations" step is shown in greater detail in Figure 3C.

Figure 3C

```
              ┌─────────────────────┐
              │ Perform calculations│
              └─────────────────────┘
      ┌───────────┬───────────┬───────────┐
 ┌──────────┐ ┌──────────┐ ┌──────────────┐ ┌────────────────┐
 │ Calculate│ │ Calculate│ │ Calculate    │ │ Calculate profit│
 │ crate    │ │ crate    │ │ customer     │ │                 │
 │ volume   │ │ cost     │ │ charge       │ │                 │
 └──────────┘ └──────────┘ └──────────────┘ └────────────────┘
```

The "Display calculated data" step is shown in greater detail in Figure 3D.

Figure 3D
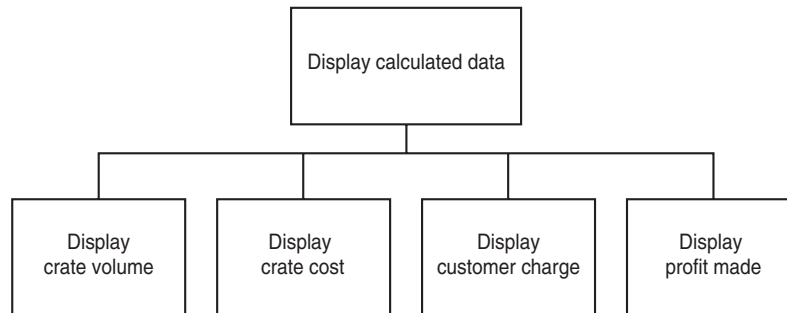
Detailed pseudocode for the program is as follows:

```
Input length // with prompt
Input width  // with prompt
Input height // with prompt
volume = length * width * height
cost = volume * .23
charge = volume * .50
profit = charge — cost
Display volume
Display cost
Display charge
Display profit
```

The Program

The last step is to expand the pseudocode into the final program, which is shown in the following source code listing.

GeneralCrates.cpp

```cpp
1 // This program is used by General Crates, Inc. to calculate
2 // the volume, cost, customer charge, and profit of any crate
3 // to be built, when given its dimensions.
4
5 #include <iostream>
6 #include <iomanip>
7 using namespace std;
8
9 int main()
10 {
11    double length,    // crate length
12           width,     // crate width
13           height,    // crate height
14           volume,    // volume of the crate
15           cost,      // cost to build the crate
16           charge,    // customer charge for the crate
17           profit;    // profit made on the crate
18
```

```
19      cout << fixed << showpoint << setprecision(2);
20
21      // Get crate dimensions
22      cout << "Enter the dimensions of the crate (in feet):\n";
23      cout << "Length: ";
24      cin  >> length;
25      cout << "Width: ";
26      cin  >> width;
27      cout << "Height: ";
28      cin  >> height;
29
30      // Perform calculations
31      volume = length * width * height;
32      cost = volume * 0.23;
33      charge = volume * 0.5;
34      profit = charge - cost;
35
36      // Display calculated data
37      cout << "The volume of the crate is ";
38      cout << volume << " cubic feet.\n";
39      cout << "Cost to build: $" << cost << endl;
40      cout << "Charge to customer: $" << charge << endl;
41      cout << "Profit: $" << profit << endl;
42      return 0;
43 }
```

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
```