A data type defines a set. For example, the set of Boolean values consists of two values \{false, true\}.

A description of a data type includes:
1. a definition of the set of values represented by that type
   Example: The set \(B\) of Boolean values is \(B = \{\text{false, true}\}\)
2. its representation
   Example: Figure 1 illustrates how Boolean values false and true are represented on the computer science department computer, cs.ucok.edu.

   ![Figure 1. Boolean data representation on cs.ucok.edu](image)

3. declaration syntax
   Example: Variable `isprime` in Figure 2 has type `bool`.

   ```
   #include <iostream>
   using namespace std;
   int main()
   {
       bool isprime;
       return 0;
   }
   
   // Figure 2. Example Boolean declaration.
   ```

4. constants
   Example: Variable `isprime` in Figure 3 is initialized to the Boolean constant `false`.

   ```
   #include <iostream>
   using namespace std;
   int main()
   {
       bool isprime=false;
       return 0;
   }
   
   // Figure 3. Example Boolean constant.
   ```

5. operations: Operations on Boolean data include and (\&\&), or (\|\|), not (!), equality (==), and inequality (\(!=\)).
   Example: The program listed in Figure 4 illustrates an example of a Boolean expression. The program in Figure 4 prints `true`.

   ```
   ```
#include <iostream>
using namespace std;

int main()
{
    bool istrue=!false&&true||false;
    if (istrue) cout << "true"; else cout << "false";
    cout << endl;
    return 0;
}

Figure 4. Example Boolean expression.

References:
Boolean Types
Stroustrup p 71, 835,615,610
Horstman and Budd; Big C++; p 136,137

Data Types
Stroustrup p 69-78
Horstman and Budd; Big C++; Chapter 2

Exercises:
1. Write a program that proves deMorgan’s Theorem.
   \[
   \overline{(A + B)} = AB
   \]
   \[
   AB = \overline{A + B}
   \]
2. Write a program that proves \( A + B = B + A \)
3. Write a program that proves \( A + 1 = 1 \)
4. Write a program that proves \( A \cdot 0 = 0 \)