

§7 File IO

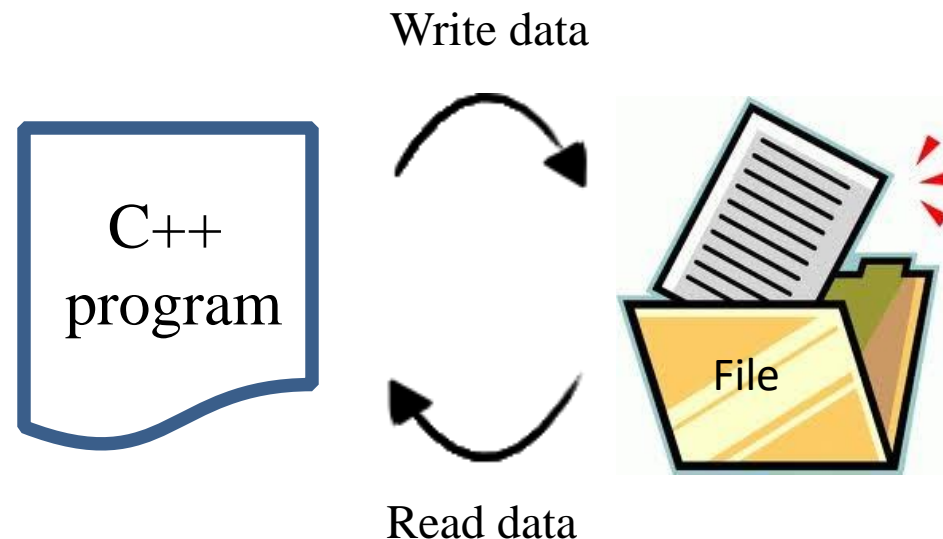
ENGG1111

Computer Programming and Applications

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We are going to learn...

- How to open a file and write content into the file
- How to open a file and read content from the file



Streams

- C++ uses a convenient abstraction called streams to perform input and output operations
 - cin for taking input from keyboard
 - cout for sending output to the screen
- C++ also provides ifstream and ofstream, for reading and writing data from and to files
 - Include the header file

```
#include <fstream>
```

ifstream

ifstream

- Step 1. Declare an ifstream

```
ifstream fin;
```

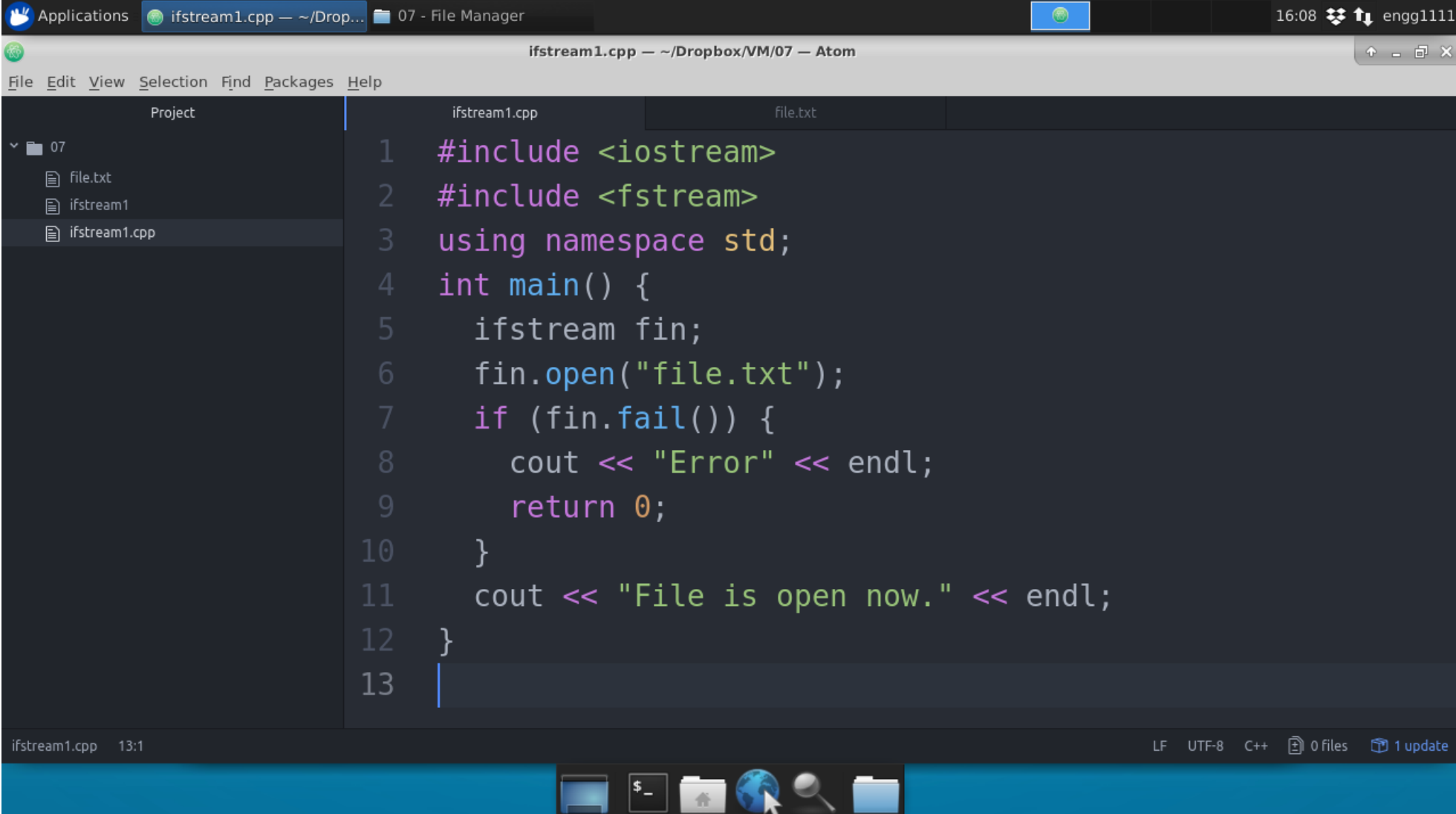
- Step 2. Open the file

```
fin.open("file.txt");
```

- Step 3. Check if the file was opened successfully

```
if (fin.fail())
```

ifstream



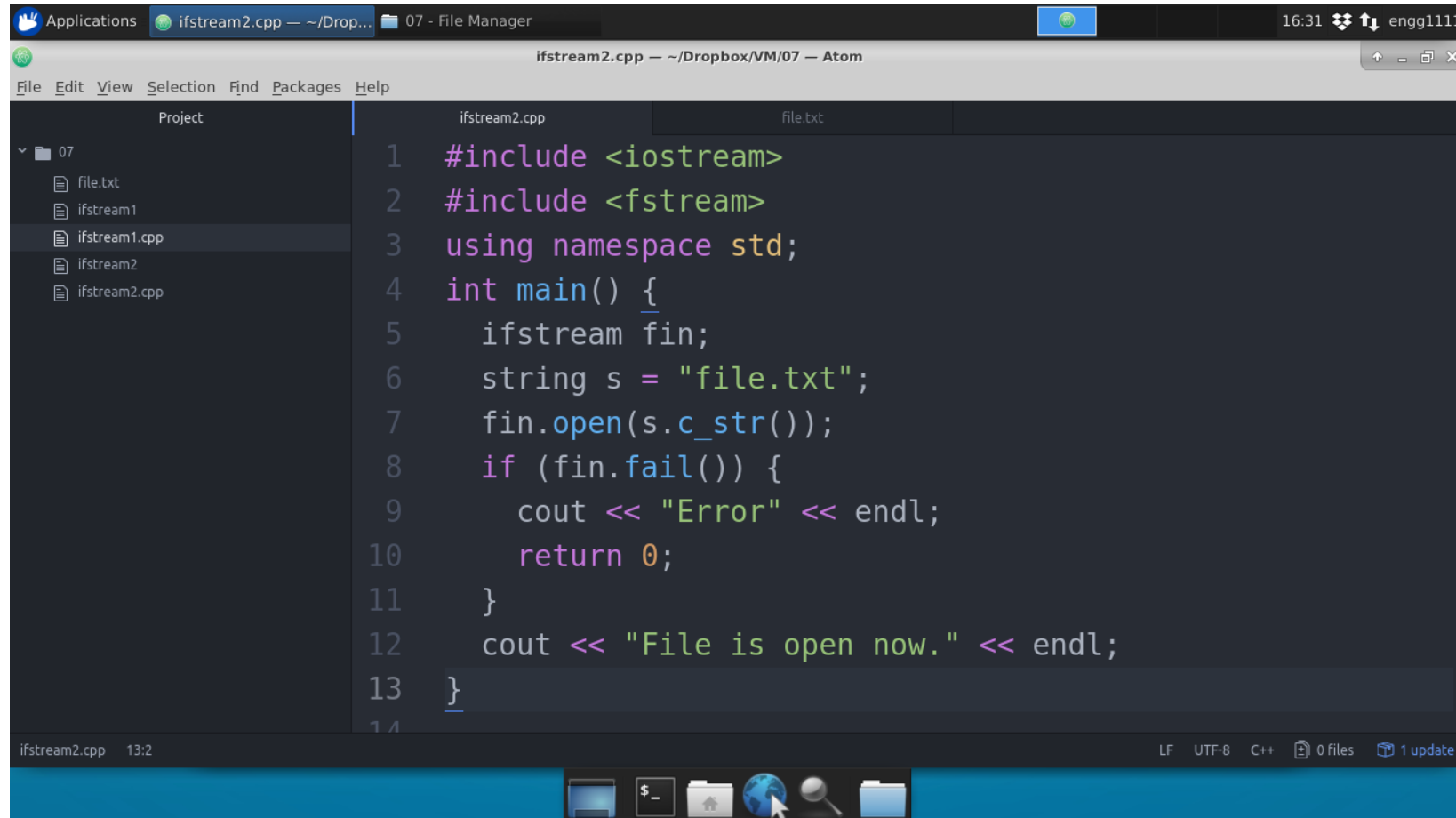
The screenshot shows the Atom code editor with a project named '07'. The file explorer on the left lists 'file.txt', 'ifstream1', and 'ifstream1.cpp'. The main editor window displays the code for 'ifstream1.cpp'.

```
1  #include <iostream>
2  #include <fstream>
3  using namespace std;
4  int main() {
5      ifstream fin;
6      fin.open("file.txt");
7      if (fin.fail()) {
8          cout << "Error" << endl;
9          return 0;
10     }
11     cout << "File is open now." << endl;
12 }
13
```

The status bar at the bottom indicates the file is 'ifstream1.cpp' at line 13, column 1, using LF line endings, UTF-8 encoding, C++ language, with 0 files and 1 update.

ifstream

- We can replace `"/Users/sdirk/Desktop/file.txt"` by a string variable `s`
 - In this case you need to call `fin.open(s.c_str())`

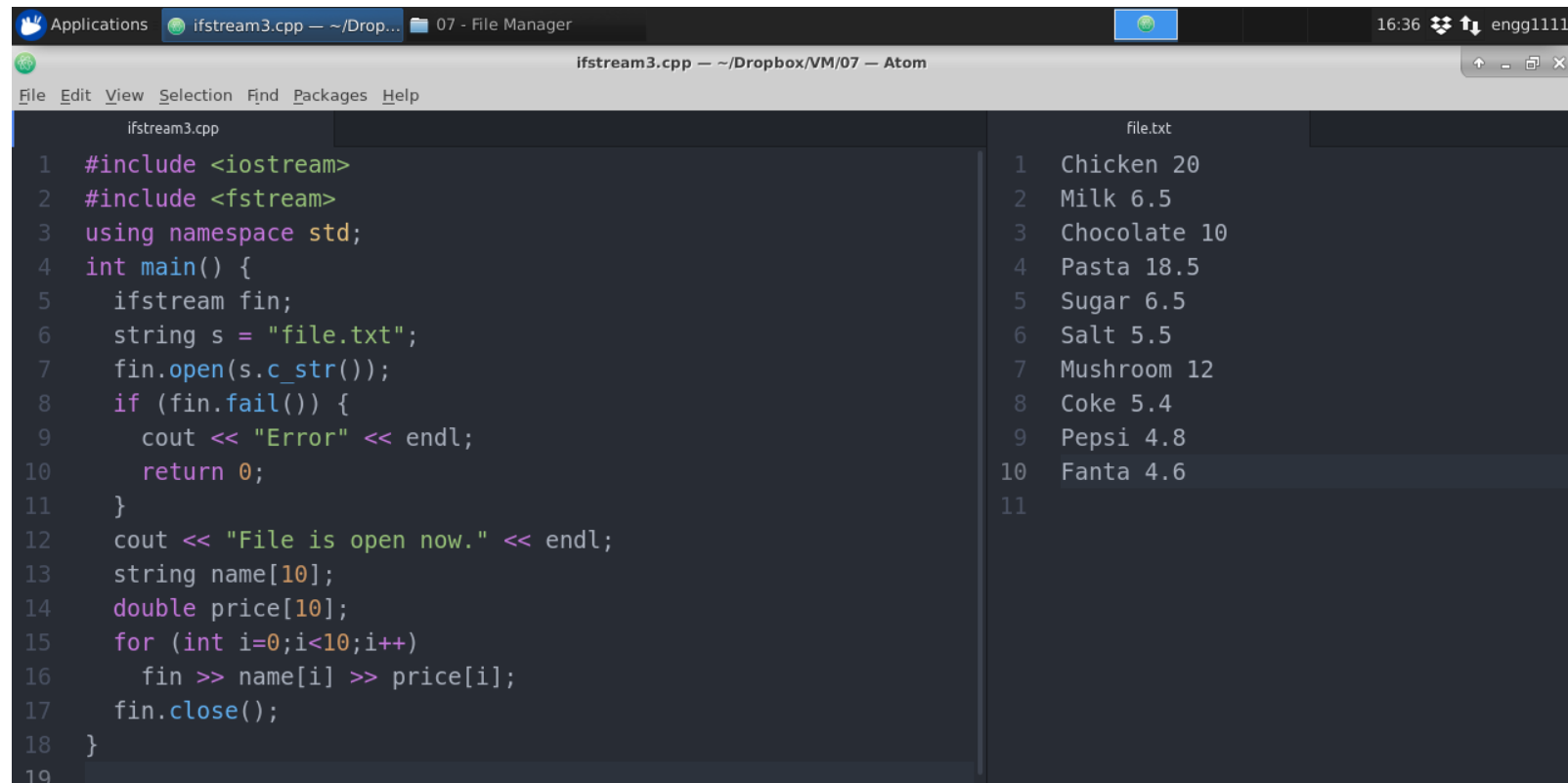


```
1 #include <iostream>
2 #include <fstream>
3 using namespace std;
4 int main() {
5     ifstream fin;
6     string s = "file.txt";
7     fin.open(s.c_str());
8     if (fin.fail()) {
9         cout << "Error" << endl;
10        return 0;
11    }
12    cout << "File is open now." << endl;
13 }
```

ifstream

- Step 4. Read content from the file
- Step 5. Close the file

`fin.close();`



The screenshot shows the Atom code editor with two files open. The left pane shows `ifstream3.cpp` with the following code:

```
1 #include <iostream>
2 #include <fstream>
3 using namespace std;
4 int main() {
5     ifstream fin;
6     string s = "file.txt";
7     fin.open(s.c_str());
8     if (fin.fail()) {
9         cout << "Error" << endl;
10        return 0;
11    }
12    cout << "File is open now." << endl;
13    string name[10];
14    double price[10];
15    for (int i=0;i<10;i++)
16        fin >> name[i] >> price[i];
17    fin.close();
18 }
```

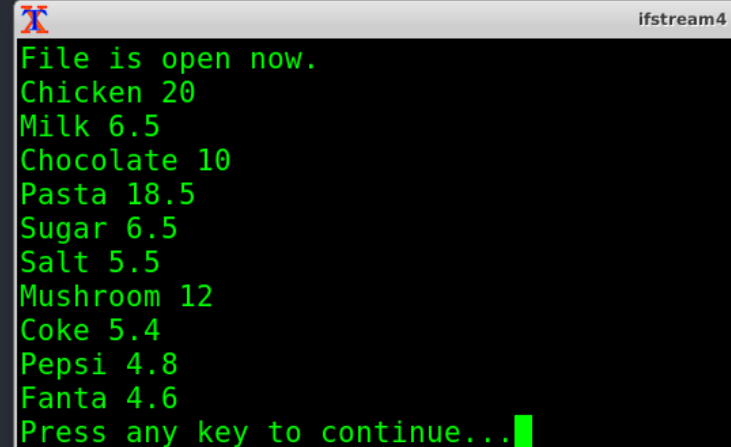
The right pane shows `file.txt` with the following content:

```
1 Chicken 20
2 Milk 6.5
3 Chocolate 10
4 Pasta 18.5
5 Sugar 6.5
6 Salt 5.5
7 Mushroom 12
8 Coke 5.4
9 Pepsi 4.8
10 Fanta 4.6
11
```


Continuously Reading a File

- Note that `fin >> ...` will return true if we can extract content from the file
 - It returns false if there is no more content to extract

```
1  #include <iostream>
2  #include <fstream>
3  using namespace std;
4  int main() {
5      ifstream fin;
6      string s = "file.txt";
7      fin.open(s.c_str());
8  >  if (fin.fail()) {
12     cout << "File is open now." << endl;
13     string name;
14     double price;
15     while (fin >> name >> price)
16         cout << name << " " << price << endl;
17     fin.close();
18 }
19
```



ifstream4

File is open now.
Chicken 20
Milk 6.5
Chocolate 10
Pasta 18.5
Sugar 6.5
Salt 5.5
Mushroom 12
Coke 5.4
Pepsi 4.8
Fanta 4.6
Press any key to continue...

ofstream

ofstream

- Step 1. Declare an ofstream

```
ofstream fout;
```

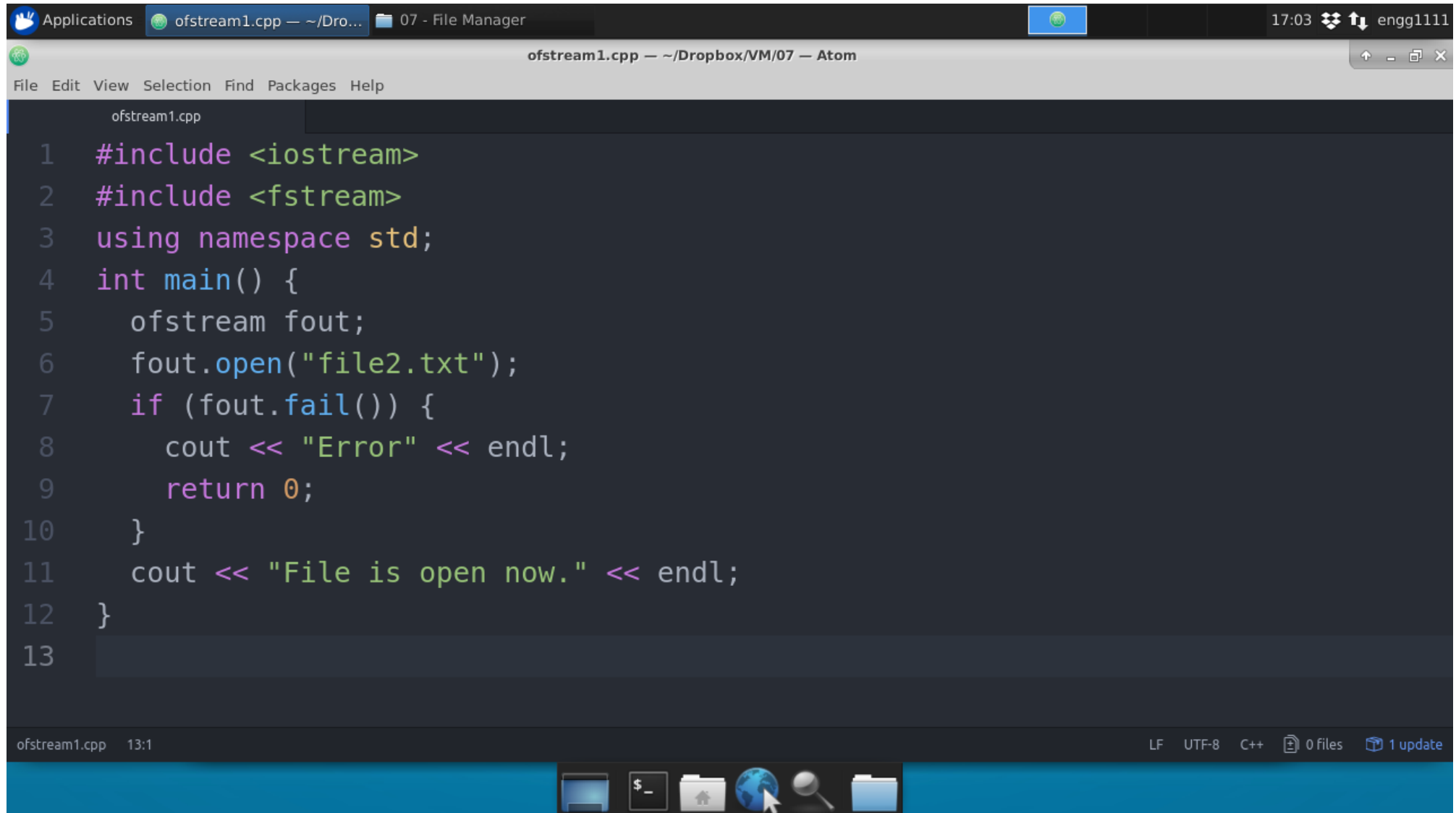
- Step 2. Open the file

```
fout.open("file.txt");
```

- Step 3. Check if the file was opened successfully

```
if (fout.fail())
```

ofstream



The screenshot shows the Atom code editor with a file named `ofstream1.cpp` open. The code is written in C++ and demonstrates the use of the `ofstream` class to open a file named `file2.txt`. The code includes the necessary headers and uses the `std` namespace. The `main` function attempts to open the file, and if it fails, it prints an error message and returns 0. If the file is successfully opened, it prints a confirmation message.

```
ofstream1.cpp
File Edit View Selection Find Packages Help

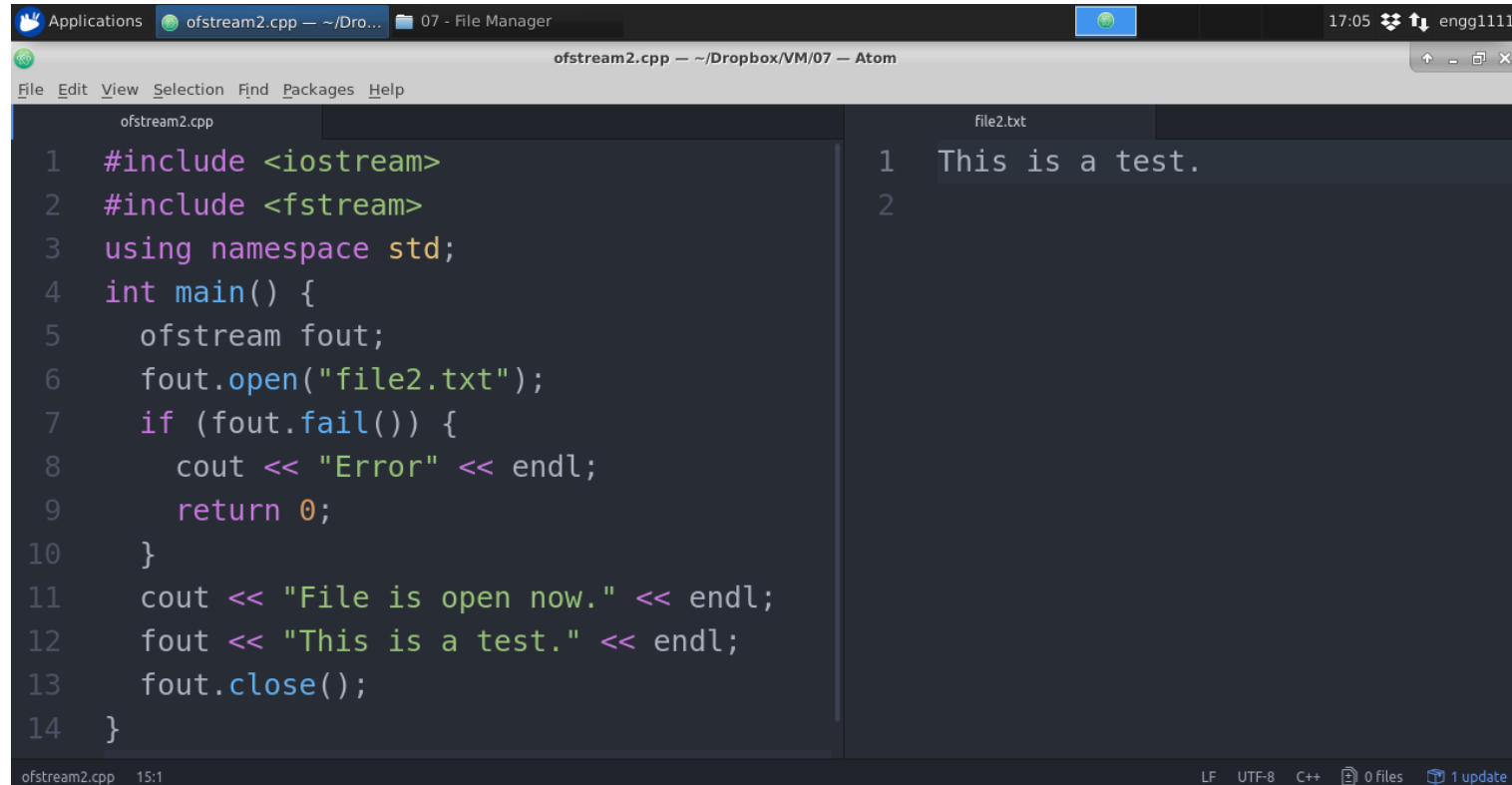
ofstream1.cpp
1  #include <iostream>
2  #include <fstream>
3  using namespace std;
4  int main() {
5      ofstream fout;
6      fout.open("file2.txt");
7      if (fout.fail()) {
8          cout << "Error" << endl;
9          return 0;
10     }
11     cout << "File is open now." << endl;
12 }
13

ofstream1.cpp 13:1
LF UTF-8 C++ 0 files 1 update
```

ofstream

- Step 4. Write content to the file
- Step 5. Close the file

```
fout.close();
```



The screenshot shows the Atom code editor with two files open: `ofstream2.cpp` and `file2.txt`. The `ofstream2.cpp` file contains the following C++ code:

```
1 #include <iostream>
2 #include <fstream>
3 using namespace std;
4 int main() {
5     ofstream fout;
6     fout.open("file2.txt");
7     if (fout.fail()) {
8         cout << "Error" << endl;
9         return 0;
10    }
11    cout << "File is open now." << endl;
12    fout << "This is a test." << endl;
13    fout.close();
14 }
```

The `file2.txt` file contains the following text:

```
1 This is a test.
2
```

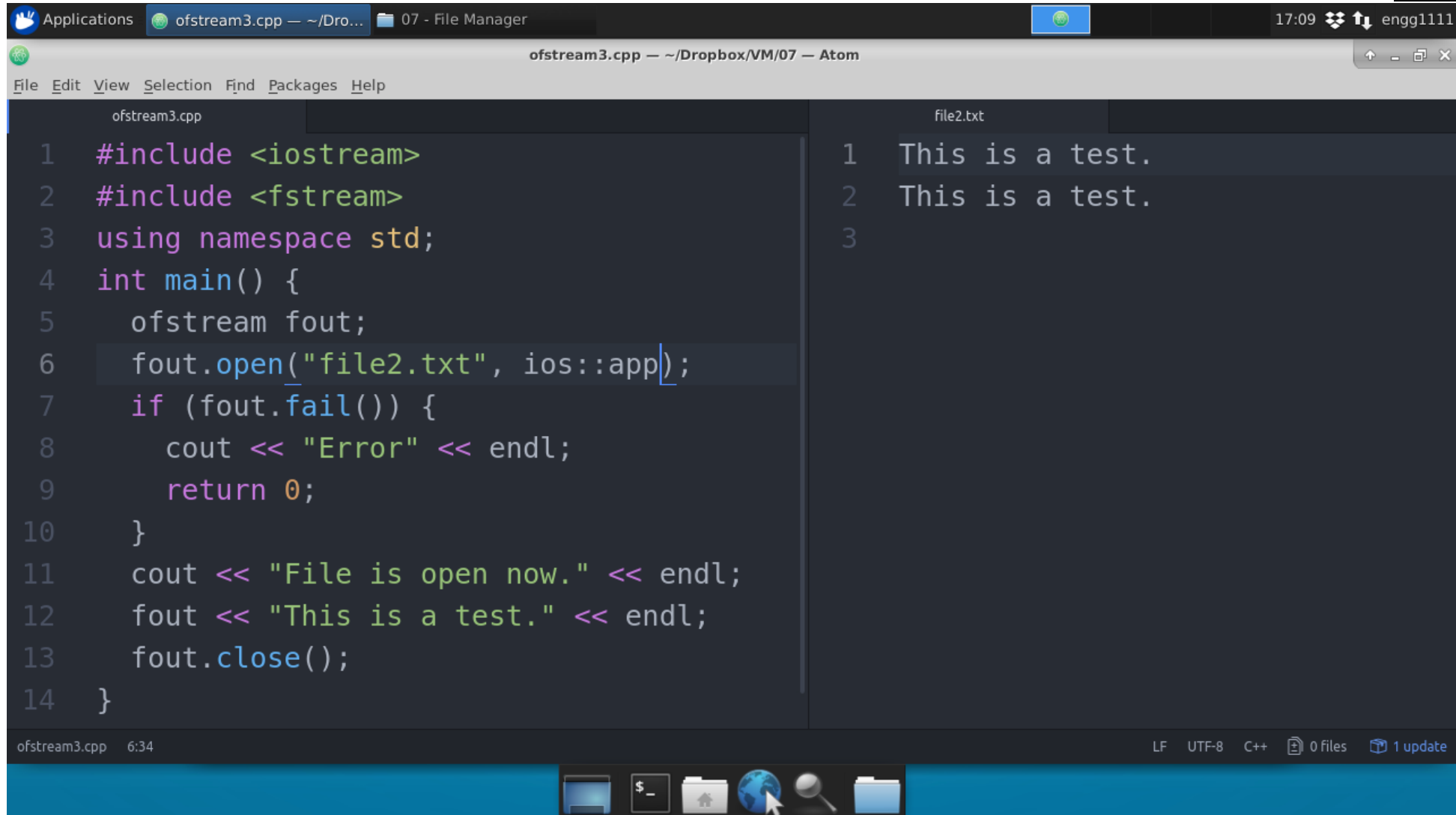
The status bar at the bottom indicates the file is `ofstream2.cpp`, line 15, column 1, using LF line endings, UTF-8 encoding, C++ language, and 0 files with 1 update.

open

- When opening a file for output using the function `open`, a new file will be created if the file does not exist, otherwise the content of the existing file will be erased!
- To keep the content of the existing file and append new data to it, supply the constant value `ios::app` as the second argument to the function `open`

```
fout.open("file.txt", ios::app);
```

ios::app



The screenshot shows the Atom code editor with two files open: `ofstream3.cpp` and `file2.txt`. The `ofstream3.cpp` file contains the following C++ code:

```
1  #include <iostream>
2  #include <fstream>
3  using namespace std;
4  int main() {
5      ofstream fout;
6      fout.open("file2.txt", ios::app);
7      if (fout.fail()) {
8          cout << "Error" << endl;
9          return 0;
10     }
11     cout << "File is open now." << endl;
12     fout << "This is a test." << endl;
13     fout.close();
14 }
```

The `file2.txt` file contains the following text:

```
1  This is a test.
2  This is a test.
3
```

The status bar at the bottom of the editor shows the file name `ofstream3.cpp`, the time `6:34`, and various settings: `LF`, `UTF-8`, `C++`, `0 files`, and `1 update`. The system tray at the bottom of the window shows icons for a terminal, file manager, and other applications.

Example Application

Problem 6, Lab 5

- Recall problem 6 of lab 5

```
1  #include <iostream>
2  using namespace std;
3  int productSelection(string name[], double price[], int numberOfProducts)
4  {
5      for (int i=0;i<numberOfProducts;i++)
6          cout << i << ": " << name[i] << " ($" << price[i] << ")" << endl;
7      cout << "--> ";
8      int productID;
9      cin >> productID;
10     if (productID >= 0 && productID < numberOfProducts)
11         return productID;
12     return productSelection(name, price, numberOfProducts);
13 }
14 double purchase(string name[], double price[], int numberOfProducts) {
15     int productID = productSelection(name, price, numberOfProducts);
16     int quantity;
17     cout << "How many? --> ";
18     cin >> quantity;
19     return price[productID] * quantity;
20 }
21 int main() {
22     const int numberOfProducts = 3;
23     string name[numberOfProducts] = {"Chicken", "Milk", "Chocolate"};
24     double price[numberOfProducts] = {20, 6.5, 10};
25     double total = 0;
26     char input = 'm';
27     while (input == 'm') {
28         total += purchase(name, price, numberOfProducts);
29         cout << "Enter 'm' to purchase more! --> ";
30         cin >> input;
31     }
32     cout << "Total: $" << total << endl;
33 }
```

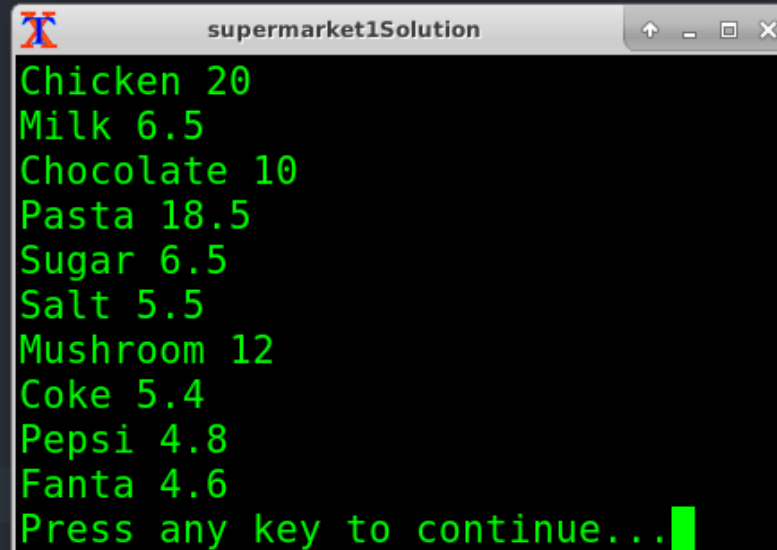
Task

```
1  #include <iostream>
2  using namespace std;
3  void readProducts(string name[], double price[], int numberOfProducts) {
4      //TODO: read products.txt
5  }
6  int main() {
7      const int numberOfProducts = 10;
8      string name[numberOfProducts] = {};
9      double price[numberOfProducts] = {};
10     readProducts(name, price, numberOfProducts);
11     for (int i=0;i<numberOfProducts;i++)
12         cout << name[i] << " " << price[i] << endl;
13 }
```

```
1  Chicken 20
2  Milk 6.5
3  Chocolate 10
4  Pasta 18.5
5  Sugar 6.5
6  Salt 5.5
7  Mushroom 12
8  Coke 5.4
9  Pepsi 4.8
10 Fanta 4.6
11
```

Task - Solution

```
1  #include <iostream>
2  #include <fstream>
3  using namespace std;
4  void readProducts(string name[], double price[], int numberOfProducts) {
5      ifstream fin;
6      fin.open("products.txt");
7      if (fin.fail()) cout << "Error" << endl;
8      for (int i=0;i<numberOfProducts;i++) {
9          fin >> name[i] >> price[i];
10     }
11     fin.close();
12 }
13 > int main() {
21
```



```
supermarket1Solution
Chicken 20
Milk 6.5
Chocolate 10
Pasta 18.5
Sugar 6.5
Salt 5.5
Mushroom 12
Coke 5.4
Pepsi 4.8
Fanta 4.6
Press any key to continue...
```

```
1  Chicken 20
2  Milk 6.5
3  Chocolate 10
4  Pasta 18.5
5  Sugar 6.5
6  Salt 5.5
7  Mushroom 12
8  Coke 5.4
9  Pepsi 4.8
10 Fanta 4.6
11
```

Example - Continued

supermarket2.cpp

```
1  #include <iostream>
2  #include <fstream>
3  using namespace std;
4  void createReceipt(double total) {
5      ofstream fout;
6      fout.open("receipts.txt", ios::app);
7      if (fout.fail()) {
8          cout << "Error";
9      } else {
10         fout << "Welcome to ENGG111 supermarket" << endl;
11         fout << "---" << endl;
12         fout << "Purchase total: $ " << total << endl;
13         fout << "---" << endl;
14         fout << "Thank you ~ Please come again" << endl;
15     }
16 }
17 > int main() {
```

receipts.txt

```
1  Welcome to ENGG111 supermarket
2  ---
3  Purchase total: $ 42
4  ---
5  Thank you ~ Please come again
6  Welcome to ENGG111 supermarket
7  ---
8  Purchase total: $ 42
9  ---
10 Thank you ~ Please come again
11
```

Example - Continued

```
1  #include <iostream>
2  #include <fstream>
3  using namespace std;
4  > void createReceipt(double total) {
17 > void readProducts(string name[], double price[], int numberOfProducts) {
26 > int productSelection(string name[], double price[], int numberOfProducts) {
36 > double purchase(string name[], double price[], int numberOfProducts) {
43 int main() {
44     const int numberOfProducts = 10;
45     string name[numberOfProducts] = {};
46     double price[numberOfProducts] = {};
47     readProducts(name, price, numberOfProducts);
48     double total = 0;
49     char input = 'm';
50     while (input == 'm') {
51         total += purchase(name, price, numberOfProducts);
52         cout << "Enter 'm' to purchase more! --> ";
53         cin >> input;
54     }
55     cout << "Total: $" << total << endl;
56     createReceipt(total);
57 }
```