

# 33.1 LAB: Output numbers in reverse (Arrays)

Write a program that reads a list of integers and outputs those integers in reverse. The input begins with an integer indicating the number of integers that follow. For coding simplicity, follow each output integer by a comma, including the last one. Assume that the list will always contain less than 20 integers.

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Ex: If the input is:

```
5  
2 4 6 8 10
```

the output is:

```
10,8,6,4,2,
```

Hint: First read the integers into an array, then output the array in reverse.

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## 33.1.1: LAB: Output numbers in reverse (Arrays)

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main.cpp

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**Enter program input (optional)**

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**Run program**

Input (from above)

**main.cpp**

(Your program)

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Program output displayed here

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## 33.2 LAB: Middle item (Arrays)

Given a sorted list of integers, output the middle integer. A negative number indicates the end of the input (the negative number is not a part of the sorted list). Assume the number of integers is always odd.

Ex: If the input is:

2 3 4 8 11 -1

the output is:

Middle item: 4

The maximum number of list values for any test case should not exceed 9. If exceeded, output "Too many numbers".

Hint: First read the data into an array. Then, based on the number of items, find the middle item.

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33.2.1: LAB: Middle item (Arrays)

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main.cpp

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```
1 #include <iostream>
2 using namespace std;
3
4 int main() {
5
6     /* Type your code here. */
7
8     return 0;
9 }
10
```

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**Enter program input (optional)**

If your code requires input values, provide them here.

**Run program**

Input (from above)

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(Your program)

Output

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## 33.3 LAB: Output values below an amount (Arrays)

Write a program that first gets a list of integers from input. The input begins with an integer indicating the number of integers that follow. Then, get the last value from the input, which indicates a threshold. Output all integers less than or equal to that last threshold value.

Ex: If the input is:

```
5  
50 60 140 200 75  
100
```

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the output is:

```
50,60,75,
```

The 5 indicates that there are five integers in the list, namely 50, 60, 140, 200, and 75. The 100 indicates that the program should output all integers less than or equal to 100, so the program outputs 50, 60, and 75.

For coding simplicity, follow every output value by a comma, including the last one.

Such functionality is common on sites like Amazon, where a user can filter results.

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33.3.1: LAB: Output values below an amount (Arrays)

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box, then click **Run program** and observe the program's output in the second box.

### Enter program input (optional)

If your code requires input values, provide them here.

**Run program**

Input (from above)

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(Your program)

Output

### Program output displayed here

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## 33.4 LAB: Adjust list by normalizing (Arrays)

When analyzing data sets, such as data for human heights or for human weights, a common step is to adjust the data. This adjustment can be done by normalizing to values between 0 and 1, or throwing away outliers.

For this program, adjust the values by dividing all values by the largest value. The input begins with an integer indicating the number of floating-point values that follow. Assume that the list will always contain less than 20 positive floating-point values.

Output each floating-point value with two digits after the decimal point, which can be achieved by executing

```
cout << fixed << setprecision(2);
```

 once before all other cout statements.

Ex: If the input is:

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```
5
30.0 50.0 10.0 100.0 65.0
```

the output is:

```
0.30 0.50 0.10 1.00 0.65
```

The 5 indicates that five floating-point values are in the list, namely 30.0, 50.0, 10.0, 100.0, and 65.0. 100.0 is the largest value in the list, so each value is divided by 100.0.

For coding simplicity, follow every output value by a space, including the last one.

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## 33.4.1: LAB: Adjust list by normalizing (Arrays)

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main.cpp

```
1 #include <iostream>
2 #include <iomanip>
3 using namespace std;
4
5 int main() {
6
7     // Type your code here.
8
9     return 0;
10 }
11
```

**Develop mode****Submit mode**

Run your program as often as you'd like, before submitting for grading. Below, type any needed input values in the first box, then click **Run program** and observe the program's output in the second box.

**Enter program input (optional)**

If your code requires input values, provide them here.

**Run program**

Input (from above)

**main.cpp**

(Your program)

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Output

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## 33.5 LAB: Word frequencies (Arrays)

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Write a program that reads a list of words. Then, the program outputs those words and their frequencies. The input begins with an integer indicating the number of words that follow. Assume that the list will always contain fewer than 20 words.

Ex: If the input is:

```
5
hey hi Mark hi mark
```

the output is:

```
hey - 1
hi - 2
Mark - 1
hi - 2
mark - 1
```

Hint: Use two arrays, one array for the strings and one array for the frequencies.

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LAB ACTIVITY

33.5.1: LAB: Word frequencies (Arrays)

0 / 10



main.cpp

[Load default template...](#)

```
1 #include <iostream>
2 #include <string>
3 using namespace std;
4
5 int main() {
6
7     /* Type your code here. */
8
9     return 0;
10 }
11
```

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**Enter program input (optional)**

If your code requires input values, provide them here.

**Run program**

Input (from above)

**main.cpp**  
(Your program)

Output

**Program output displayed here**

Coding trail of your work

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## 33.6 LAB: Contains the character (Arrays)

Write a program that reads an integer, a list of words, and a character. The integer signifies how many words are in the list. The output of the program is every word in the list that contains the character at least once. For coding simplicity, follow each output word by a comma, even the last one. Add a newline to the end of the last output. Assume the list contains at most 20 words, and at least one word in the list will contain the given character.

Ex: If the input is:

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```
4
hello zoo sleep drizzle
z
```

then the output is:

zoo, drizzle,

To achieve the above, first read the list into an array. Keep in mind that the character 'a' is not equal to the character 'A'.

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## 33.6.1: LAB: Contains the character (Arrays)

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main.cpp

[Load default template...](#)

```
1 #include <iostream>
2 using namespace std;
3
4 int main() {
5
6     /* Type your code here. */
7
8     return 0;
9 }
10
```

[Develop mode](#)[Submit mode](#)

Run your program as often as you'd like, before submitting for grading. Below, type any needed input values in the first box, then click **Run program** and observe the program's output in the second box.

Enter program input (optional)

If your code requires input values, provide them here.

[Run program](#)

Input (from above) →

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(Your program)

→ Output

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## 33.7 LAB: Elements in a range (Arrays)

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Write a program that first gets a list of integers from input. The input begins with an integer indicating the number of integers that follow. That list is followed by two more integers representing lower and upper bounds of a range. Your program should output all integers from the list that are within that range (inclusive of the bounds). For coding simplicity, follow each output integer by a comma, even the last one. The output ends with a newline.

Ex: If the input is:

```
5
25 51 0 200 33
0 50
```

then the output is:

```
25,0,33,
```

(The bounds are 0-50, so 51 and 200 are out of range and thus not output.)

To achieve the above, first read the list of integers into an array.

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33.7.1: LAB: Elements in a range (Arrays)

0 / 10



main.cpp

[Load default template...](#)

```
1 #include <iostream>
2 using namespace std;
3
4 int main() {
5
6     /* Type your code here. */
7
8     return 0;
9 }
10
```

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**Enter program input (optional)**

If your code requires input values, provide them here.

**Run program**

Input (from above)

**main.cpp**  
(Your program)

Output

**Program output displayed here**

Coding trail of your work

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## 33.8 LAB: Two smallest numbers (Arrays)

Write a program that reads a list of integers, and outputs the two smallest integers in the list, in ascending order. The input begins with an integer indicating the number of integers that follow.

Ex: If the input is:

```
5
10 5 3 21 2
```

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the output is:

```
2 and 3
```

You can assume that the list of integers will have at least 2 values.

To achieve the above, first read the integers into an array.

Hint: Make sure to initialize the second smallest and smallest integers properly.

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## 33.8.1: LAB: Two smallest numbers (Arrays)

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main.cpp

```
1 #include <iostream>
2 using namespace std;
3
4 int main() {
5
6     /* Type your code here. */
7
8     return 0;
9 }
10
```

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**Enter program input (optional)**

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**Run program**

Input (from above)

**main.cpp**  
(Your program)

Output

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## 33.9 LAB: Swap ends (Arrays)

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Write a program that reads a list of integers from input and outputs the list with the first and last numbers swapped. The input begins with an integer indicating the number of values that follow. Assume the list contains fewer than 20 integers.

Ex: If the input is:

```
8  
1 2 3 4 5 6 7 8
```

the output is:

```
8 2 3 4 5 6 7 1
```

For coding simplicity, follow every output value by a space, including the last one. The output ends with a newline.

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33.9.1: LAB: Swap ends (Arrays)

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### Enter program input (optional)

If your code requires input values, provide them here.

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**Run program**

Input (from above)



**main.cpp**  
(Your program)



Output

### Program output displayed here

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## 33.10 LAB: Shift right (Arrays)

Write a program that reads a list of integers from input into an array and modifies the array by shifting each element to the right one position and by shifting the last element to the first position. The input begins with an integer indicating the number of values that follow. Output the modified array and end with a newline. Assume the array contains at most 20 integers.

Ex: If the input is:

```
6
2 4 6 8 10 12
```

the output is:

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```
12 2 4 6 8 10
```

For coding simplicity, follow every output value by a space, including the last one.

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## 33.10.1: LAB: Shift right (Arrays)

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## main.cpp

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## Enter program input (optional)

If your code requires input values, provide them here.

**Run program**

Input (from above)

**main.cpp**  
(Your program)

Output

## Program output displayed here

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# 33.11 LAB: Find mode (Arrays)

Write a program that reads a list of integers from input and identifies the mode (the value that appears most often). The input is a sequence of integers that ends with -1. All other integers in the list are between 1 and 20 (inclusive). Total number of integers in the list is unknown. Output the mode and end with a newline. Assume that the list is not empty and only one mode exists.

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Hint: Use an array to count the number of occurrences of 1-20. See comment in starter code.

Ex: If the input is:

```
5 9 2 2 1 4 5 5 -1
```

the output is:

```
5
```

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33.11.1: LAB: Find mode (Arrays)

0 / 10



main.cpp

[Load default template...](#)

```
1 #include <iostream>
2 using namespace std;
3
4 int main() {
5     /* numCount counts the number of occurrences for values 1-20 in the corres-
6     Items in index 0 are ignored */
7     int numCount[21] = { 0 };
8
9     /* Type your code here. */
10
11    return 0;
12 }
```

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Enter program input (optional)

If your code requires input values, provide them here.

**Run program**

Input (from above)

**main.cpp**  
(Your program)

→ Output

Program output displayed here

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## 33.12 LAB: Nth from end (Arrays)

Write a program that stores a list of positive integers from input into an array and outputs the Nth number from the end of the array. A negative integer indicates the end of the input and is not stored in the array. Convert the negative integer read at the end to positive and use as N. Output the negative integer read at the end if the size of the array is smaller than N. Assume the arrays will always contain fewer than 20 integers.

Ex: If the input is:

1 5 9 7 5 -3

the output is:

9

Ex: If the input is:

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1 2 3 4 5 -6

the output is:

-6

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## main.cpp

[Load default template...](#)

```
1 #include <iostream>
2 using namespace std;
3
4 int main() {
5     int userValues[20];
6
7     /* Type your code here. */
8
9     return 0;
10}
11
```

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Enter program input (optional)

If your code requires input values, provide them here.

[Run program](#)

Input (from above)



main.cpp  
(Your program)



Output

Program output displayed here

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## 33.13 LAB: Sum of products (Arrays)

Write a program that reads two lists of integers from input into two arrays and outputs the sum of multiplying the corresponding list items. The program first reads an integer representing the length of each list, followed by two lists of integers.

Ex: If the input is:

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```
3
1 2 3
3 2 1
```

the program calculates  $(1 * 3) + (2 * 2) + (3 * 1)$  and outputs

```
10
```

Ex: If the input is:

```
4
2 3 4 5
1 1 1 1
```

the program calculates  $(2 * 1) + (3 * 1) + (4 * 1) + (5 * 1)$  and outputs

```
14
```

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33.13.1: LAB: Sum of products (Arrays)

0 / 10



main.cpp

[Load default template...](#)

```
1 #include <iostream>
2 using namespace std;
3
4 int main() {
5     int size;
6
7     cin >> size;
8     int listA[size]; // List A
9     int listB[size]; // List B
10
11    /* Type your code here. */
12}
```

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```
13     return 0;  
14 }  
15 |
```

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Enter program input (optional)

If your code requires input values, provide them here.

**Run program**

Input (from above)

**main.cpp**  
(Your program)

Output

Program output displayed here

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## 33.14 LAB: Is array sorted

Write a program that reads a list of integers from input into an array and outputs "yes" if the list is sorted in ascending order between two provided positions. Otherwise, output "no". The first input specifies the number of items in the list. The next set of inputs is the list. The last two inputs are the start and end positions (inclusive). Assume the list contains less than 20 integers and position 1 is the first element.

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Ex: If the input is:

```
8  
5 6 7 4 3 2 1 0  
1 3
```

the output is:

Ex: If the input is:

```
6  
1 2 3 4 5 2  
4 6
```

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the output is:

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33.14.1: LAB: Is array sorted

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main.cpp

[Load default template...](#)

```
1 #include <iostream>  
2 using namespace std;  
3  
4 int main() {  
5     int userValues[20];  
6  
7     /* Type your code here. */  
8  
9     return 0;  
10 }  
11
```

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Run your program as often as you'd like, before submitting for grading. Below, type any needed input values in the first box, then click **Run program** and observe the program's output in the second box.

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Enter program input (optional)

If your code requires input values, provide them here.

**Run program**

Input (from above)

**main.cpp**  
(Your program)

Output

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## 33.15 LAB\*: Program: Array statistics

**Program Specifications** Write a program to calculate the minimum, maximum, mean, median, mode, and whether an array is a palindrome.

Note: This program is designed for *incremental development*. Complete each step and submit for grading before starting the next step. Only a portion of tests pass after each step but confirm progress.

**Step 0.** Review the starter code in main(). An array is filled with integers from standard input. The first value indicates how many numbers are to follow and be placed in the array.

**Step 1 (2 pts).** Use a loop to process each array element and output the minimum and maximum values. Submit for grading to confirm one test passes.

Ex: If input is:

```
6
4 1 5 4 99 17
```

the output is:

```
Minimum: 1
Maximum: 99
```

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**Step 2 (2 pts).** Use a loop to sum all array elements and calculate the mean (or average). Output the mean with one decimal place using `cout << fixed << setprecision(1);` once before all other cout statements. Submit for grading to confirm two tests pass.

Ex: If input is:

```
6  
4 1 5 4 99 17
```

the output is:

```
Minimum: 1  
Maximum: 99  
Mean: 21.7
```

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**Step 3 (2 pts).** Use a loop to determine if the array is a palindrome, meaning values are the same from front to back and back to front. Output "true" or "false". Submit for grading to confirm three tests pass.

Ex: If input is:

```
9  
1 2 3 4 5 4 3 2 1
```

the output is:

```
Minimum: 1  
Maximum: 5  
Mean: 2.8  
Palindrome: true
```

**Step 4 (1 pt).** main() includes a call to sort(), which sorts the array elements into ascending order. Do not sort the array *before* step 4. After sorting, identify the median. The median is located in the middle of the array if the array's size is odd. Otherwise, the median is the average of the middle two values. Output the median with one decimal place. Submit for grading to confirm four tests pass.

Ex: If input is:

```
6  
2 2 5 6 7 7
```

the output is:

```
Minimum: 2  
Maximum: 7  
Mean: 4.8  
Palindrome: false  
Median: 5.5
```

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**Step 5 (3 pts). Challenging!** Identify the mode after the array is sorted in ascending order. The mode is the value that appears most frequently. Assume only one mode exists. Hint: Use a loop to process

each array element, looking for the longest sequence of identical values. Submit for grading to confirm all tests pass.

Ex: If input is:

```
9  
1 2 2 2 3 3 4 5 6
```

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the output is:

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```
Minimum: 1  
Maximum: 6  
Mean: 3.1  
Palindrome: false  
Median: 3.0  
Mode: 2
```

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LAB  
ACTIVITY

33.15.1: LAB\*: Program: Array statistics

0 / 10



main.cpp

Load default template...

```
1 #include <iostream>  
2 #include <iomanip> // for setprecision()  
3 #include <algorithm> // for sort()  
4 using namespace std;  
5  
6 int main() {  
7     int count;  
8     int i;  
9  
10    // Step 0: Input values  
11    cin >> count;  
12    int nums[count];  
13    for (i = 0; i < count; ++i) {  
14        cin >> nums[i];  
15    }
```

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Develop mode

Submit mode

Run your program as often as you'd like, before submitting for grading. Below, type any needed input values in the first box, then click **Run program** and observe the program's output in the second box.

Enter program input (optional)

If your code requires input values, provide them here.

**Run program**

Input (from above)

**main.cpp**  
(Your program)

→ Output

Program output displayed here

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Coding trail of your work

[What is this?](#)

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## 33.16 LAB\*: Program: Credit card debt (Arrays)

**Program Specifications** Write a program to search three parallel arrays containing customer credit card debt information. Identify statistics such as the number of customer names that begin with 'S', the number of customers with no debt, and the number of customers that live in a specific state.

Note: This program is designed for *incremental development*. Complete each step and submit for grading before starting the next step. Only a portion of tests pass after each step but confirm progress.

**Step 0.** Review the starter code in main(). The number of requested customers is input (integer). A function is called that reads data from a text file and fills three parallel arrays with customer names, state of residence, and amount of credit card debt for each customer. Using a function is a convenient way to fill arrays with hundreds of elements. Functions and reading data from text files are described in other sections of the book.

**Step 1.** Input a debt limit (integer), first letter of customer's name (char), and state abbreviation (string). Note that the number of customers is already input during Step 0.

**Step 2 (2 pts).** Use a loop to process each element of the names and debt arrays to identify the customer with the highest debt. Output a report header, number of customers, and the person's name with the highest debt. Submit for grading to confirm two tests pass.

Ex: If input is:

1000 250 P LA

the output is:

```
U.S. Report  
Customers: 1000  
Highest debt: Sullivan
```

**Step 3 (2 pts).** Use a loop to process each element of the names array to count all customer names that begin with the specified letter. Ex: How many customer names begin with 'B' or 'L'? Output the number of customer names that start with the specified letter. Submit for grading to confirm four tests pass.

Ex: If input is:

```
1000 250 P TX
```

the output is:

```
U.S. Report  
Customers: 1000  
Highest debt: Sullivan  
Customer names that start with 'P': 57
```

**Step 4 (2 pts).** Use a loop to process each element of the names and debt arrays to count the number of customers that have debt higher than the specified debt limit and the number of customers that have no debt. Output all results. Submit for grading to confirm six tests pass.

Ex: If input is:

```
2000 250 P TX
```

the output is:

```
U.S. Report  
Customers: 2000  
Highest debt: Sullivan  
Customer names that start with 'P': 111  
Customers with debt over $250: 1562  
Customers debt free: 438
```

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**Step 5 (4 pts).** Repeat steps 2 - 4 for all customers living in the specified state. Output all results including a header for the state report. Submit for grading to confirm all tests pass.

Ex: If input is:

```
8000 8000 A CA
```

the output is:

```
U.S. Report
Customers: 8000
Highest debt: Anderson
Customer names that start with 'A': 261
Customers with debt over $8000: 2480
Customers debt free: 1697
```

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```
CA Report
Customers: 851
Highest debt: Duenas
Customer names that start with 'A': 38
Customers with debt over $8000: 268
Customers debt free: 176
```

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LAB  
ACTIVITY

33.16.1: LAB\*: Program: Credit card debt (Arrays)

0 / 10



Downloadable files

CustomerData.csv

[Download](#)

main.cpp

[Load default template...](#)

```
1 #include <iostream>
2 #include <fstream>
3 #include <string>
4 using namespace std;
5
6 // Read customer information from external file
7 // Make no changes to the following code
8 void ReadCustomerData(string names[], string states[], double debt[], int si
9   ifstream inFS;
10
11 // Read all data from file into three parallel arrays
12 try {
13   inFS.open("CustomerData.csv");
14
15   for (int index = 0; index < size; ++index) {
16     string name;
17     string state;
18     double debtValue;
19
20     inFS >> name >> state >> debtValue;
21
22     names[index] = name;
23     states[index] = state;
24     debt[index] = debtValue;
25   }
26 }
```

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[Develop mode](#)

[Submit mode](#)

Run your program as often as you'd like, before submitting for grading. Below, type any needed input values in the first

box, then click **Run program** and observe the program's output in the second box.

### Enter program input (optional)

If your code requires input values, provide them here.

**Run program**

Input (from above)

MD**main.cpp**35Spring2024 → Output  
(Your program)

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### Program output displayed here

Coding trail of your work

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## 33.17 LAB: Warm up: People's weights (Arrays)

Output each floating-point value with two digits after the decimal point, which can be achieved by executing

```
cout << fixed << setprecision(2);
```

 once before all other cout statements.

(1) Prompt the user to enter five numbers, being five people's weights. Store the numbers in an array of doubles. Output the array's numbers on one line, each number followed by one space. (2 pts)

Ex:

```
Enter weight 1:  
236.0  
Enter weight 2:  
89.5  
Enter weight 3:  
142.0  
Enter weight 4:  
166.3  
Enter weight 5:
```

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93.0

You entered: 236.00 89.50 142.00 166.30 93.00

(2) Also output the total weight, by summing the array's elements. (1 pt)

(3) Also output the average of the array's elements. (1 pt)

(4) Also output the max array element. (2 pts)

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Ex:

```
Enter weight 1:  
236.0  
Enter weight 2:  
89.5  
Enter weight 3:  
142.0  
Enter weight 4:  
166.3  
Enter weight 5:  
93.0  
You entered: 236.00 89.50 142.00 166.30 93.00  
  
Total weight: 726.80  
Average weight: 145.36  
Max weight: 236.00
```

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## LAB ACTIVITY

## 33.17.1: LAB: Warm up: People's weights (Arrays)

0 / 6



main.cpp

Load default template...

```
1 #include <iostream>  
2 #include <iomanip> // For setprecision  
3 using namespace std;  
4  
5 int main() {  
6  
7     /* Type your code here. */  
8  
9     return 0;  
10 }
```

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**Develop mode****Submit mode**

Run your program as often as you'd like, before submitting for grading. Below, type any needed input values in the first box, then click **Run program** and observe the program's output in the second box.

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Enter program input (optional)

If your code requires input values, provide them here.

**Run program**

Input (from above)

**main.cpp**  
(Your program)

Output

Program output displayed here

Coding trail of your work

[What is this?](#)

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## 33.18 LAB: Array palindrome

Write a program that reads a list of integers from input and determines if the list is a palindrome (values are identical from first to last and last to first). The input begins with an integer indicating the length of the list that follows. Assume that the list will always contain fewer than 20 integers. Output "yes" if the list is a palindrome and "no" otherwise. The output ends with a newline.

Ex: If the input is:

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```
6
1 5 9 9 5 1
```

the output is:

```
yes
```

Ex: If the input is:

```
5
1 2 3 4 5
```

the output is:

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LAB ACTIVITY | 33.18.1: LAB: Array palindrome 0 / 10

main.cpp Load default template...

```
1 #include <iostream>
2 using namespace std;
3
4 int main() {
5
6     // Type your code here.
7
8     return 0;
9 }
```

Develop mode

Submit mode

Run your program as often as you'd like, before submitting for grading. Below, type any needed input values in the first box, then click **Run program** and observe the program's output in the second box.

Enter program input (optional)

If your code requires input values, provide them here.

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Run program

Input (from above)



main.cpp  
(Your program)



Output

Program output displayed here

Coding trail of your work [What is this?](#)

History of your effort will appear here once you begin working  
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