

25.1 LAB: Elements in a range



This section has been set as optional by your instructor.

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 a vector.

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25.1.1: LAB: Elements in a range

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main.cpp

Load default template...

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

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Enter program input (optional)

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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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25.2 LAB: Two smallest numbers



This section has been set as optional by your instructor.

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:

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5
10 5 3 21 2

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 a vector.

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

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25.2.1: LAB: Two smallest numbers

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main.cpp

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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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25.3 LAB: Vector palindrome

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This section has been set as optional by your instructor.

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:

```
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:

```
no
```

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25.3.1: LAB: Vector palindrome

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main.cpp

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Develop mode**Submit mode**

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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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25.4 LAB: Swap ends

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This section has been set as optional by your instructor.

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

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

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25.4.1: LAB: Swap ends

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main.cpp

Load default template...

```
1 #include <iostream>
2 #include <vector>
3 using namespace std;
4
5 int main() {
6     vector<int> userValues(20);
7
8     /* Type your code here. */
9
10    return 0;
11 }
12
```

Develop mode

Submit mode

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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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25.5 LAB: Shift right



This section has been set as optional by your instructor.

Write a program that reads a list of integers from input into a vector and modifies the vector 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 vector and end with a newline.

Ex: If the input is:

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

the output is:

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

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

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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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25.6 LAB: Find mode

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This section has been set as optional by your instructor.

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.

Hint: Use a vector 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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25.6.1: LAB: Find mode

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main.cpp

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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.

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Run program

Input (from above)



main.cpp
(Your program)



Output

Program output displayed here

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25.7 LAB: Nth from end



This section has been set as optional by your instructor.

Write a program that stores a list of positive integers from input into a vector and outputs the Nth number from the end of the vector. A negative integer indicates the end of the input and is not stored in the vector. 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 vector is smaller than N. Assume the vector 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:

1 2 3 4 5 -6

the output is:

-6

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25.7.1: LAB: Nth from end

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main.cpp

[Load default template...](#)

1 #include <iostream>

```
1 #include <iostream>
2 #include <vector>
3 using namespace std;
4
5 int main() {
6     vector<int> userValues(20);
7
8     /* Type your code here. */
9
10    return 0;
11 }
12
```

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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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25.8 LAB: Sum of products



This section has been set as optional by your instructor.

Write a program that reads two lists of integers from input into two vectors 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:

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

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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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25.8.1: LAB: Sum of products

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main.cpp

```
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```

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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.

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Run program

Input (from above)

**main.cpp**
(Your program)

Output

Program output displayed here

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25.9 LAB: Is vector sorted



This section has been set as optional by your instructor.

Write a program that reads a list of integers from input into a vector 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.

Ex: If the input is:

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

the output is:

yes

Ex: If the input is:

6
1 2 3 4 5 2
4 6

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the output is:

no

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25.9.1: LAB: Is vector sorted

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main.cpp

Load default template...

```
1 #include <iostream>
2 #include <vector>
3 using namespace std;
4
5 int main() {
6     vector<int> userValues(20);
7
8     /* Type your code here. */
9
10    return 0;
11 }
12
```

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)

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(Your program)

Output

Program output displayed here

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25.10 LAB: Print 2D array in reverse



This section has been set as optional by your instructor.

Write a program that reads 12 integers into a 2D integer array with 4 rows and 3 columns. The program then outputs the 2D array in reverse order according to both rows and columns.

Ex: If the input is:

```
5 7 3
6 4 3
5 6 9
5 2 8
```

then the output is:

```
8 2 5
9 6 5
3 4 6
3 7 5
```

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For coding simplicity, output a space after every integer, including the last one on each row.

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25.10.1: LAB: Print 2D array in reverse

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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
```

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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)

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(Your program)

Output

Program output displayed here

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25.11 LAB: Matrix multiplication (2D arrays)



This section has been set as optional by your instructor.

A matrix is a rectangle of numbers in rows and columns. A $1 \times N$ matrix has one row and N columns. An $N \times N$ matrix has N rows and N columns.

Multiplying a $1 \times N$ matrix A and an $N \times N$ matrix B produces a $1 \times N$ matrix C . To determine the N th element of C multiply each element of A by each element of the N th column of B and sum the results. Helpful information can be found at [matrix multiplication](#).

Write a program that reads a $1 \times N$ matrix A and an $N \times N$ matrix B from input and outputs the $1 \times N$ matrix product, C . The first integer input is N , followed by one row of N integers for matrix A and then N rows of N integers for matrix B . N can be of any size ≥ 2 .

For coding simplicity, follow each output integer by a space, even the last one. The output ends with a newline.

Ex: If the input is:

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

A contains 2 and 3, the first row of B contains 1 and 2, and the second row of B contains 3 and 4. The first element of C is $(2 * 1) + (3 * 3)$, and the second element of C is $(2 * 2) + (3 * 4)$. The program output is:

```
11 16
```

Note: Store matrices A and C into one-dimensional arrays and matrix B into a two-dimensional array.

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25.11.1: LAB: Matrix multiplication (2D arrays)

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

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25.12 LAB*: Program: Vector statistics



This section has been set as optional by your instructor.

Program Specifications Write a program to calculate the minimum, maximum, mean, median, mode, and whether a vector 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()`. A vector is filled with integers from standard input. The first value indicates how many numbers are to follow and be placed in the vector.

Step 1 (2 pts). Use a loop to process each vector 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
```

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the output is:

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

Step 2 (2 pts). Use a loop to sum all vector 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
```

Step 3 (2 pts). Use a loop to determine if the vector 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:

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

Step 4 (1 pt). `main()` includes a call to `sort()`, which sorts the vector elements into ascending order. Do not sort the vector *before* step 4. After sorting, identify the median. The median is located in the

middle of the vector if the vector'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:

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

Step 5 (3 pts). Challenging! Identify the mode after the vector 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 vector 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

the output is:

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

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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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25.13 LAB*: Program: Credit card debt



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Program Specifications Write a program to search three parallel vectors 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 vectors with customer names, state of residence, and amount of credit card debt for each customer. Using a function is a convenient way to fill vectors 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 vectors 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 vector 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 vectors 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
```

```
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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**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

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