

3.6 Detecting ranges with if-else statements

Programmers commonly use the sequential nature of the multi-branch if-else arrangement to detect ranges of numbers. In the following example, the second branch expression is only reached if the first expression is false. So the second branch is taken if `userAge < 16` is *false* (so 16 or greater) AND `userAge` is `< 25`, meaning `userAge` is between 16 - 24 (inclusive).

Figure 3.6.1: Using sequential nature of multi-branch if-else for ranges: Insurance prices.

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

int main() {
    int userAge;
    int insurancePrice;

    cout << "Enter your age: ";
    cin >> userAge;

    if (userAge < 16) {                // Age 15 and under
        cout << "Too young." << endl;
        insurancePrice = 0;
    }
    else if (userAge < 25) {           // Age 16 - 24
        insurancePrice = 4800;
    }
    else if (userAge < 40) {           // Age 25 - 39
        insurancePrice = 2350;
    }
    else {                             // Age 40 and up
        insurancePrice = 2100;
    }

    cout << "Annual price: $" << insurancePrice << endl;

    return 0;
}
```

Enter your age: 19
Annual price: \$4800

...

Enter your age: 27
Annual price: \$2350

...

Enter your age: 15
Too young.
Annual price: \$0

...

Enter your age: 129
Annual price: \$2100

Source: carsdirect.com, 2017

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PARTICIPATION ACTIVITY

3.6.1: Ranges and multi-branch if-else.



Type the range for each branch. Type ranges as: 25 - 29, or type 30+ for all numbers 30 and larger.

```

if (numSales < 10) {
    ...
}
else if (numSales < 20) { // 2nd branch range: ____
    ...
}
else if (numSales < 30) { // 3rd branch range: ____
    ...
}
else { // 4th branch range: ____
    ...
}

```

1) 2nd branch range:

Check

Show answer

Correct

10 - 19

If execution reaches here, the previous expression of `numSales < 10` must have been false, meaning `numSales` is 10 or greater, which coupled with `numSales < 20` specifies range 10 - 19.

2) 3rd branch range:

Check

Show answer

Correct

20 - 29

If execution reaches here, the previous expression of `numSales < 20` must have been false, meaning `numSales` is 20 or greater, which coupled with `numSales < 30` specifies range 20 - 29.

3) 4th branch range:

Check

Show answer

Correct

30+

If execution reaches here, the previous expression of `numSales < 30` must have been false, meaning `numSales` is 30 or greater. No upper limit is specified.

4) What is the range for the last branch below?

```

if (numItems < 0) {
    ...
}
else if (numItems > 100) {
    ...
}
else { // Range: ____
    ...
}

```

Check

Show answer

Correct

0 - 100

The first expression of `numItems < 0` must have been false, meaning `numItems` is 0 or greater. The second expression of `numItems > 100` must have been false, meaning `numItems` is 100 or less. To reach the last else branch, `numItems` must be 0 - 100.

**PARTICIPATION
ACTIVITY**

3.6.2: Complete the multi-branch if-else.

- 1) Second branch: userNum is less than 200

```
if (userNum < 100 ) {  
  
    ...  
  
}  
  
else if (  ) {  
  
    ...  
  
}  
  
else { // userNum >= 200  
  
    ...  
  
}
```

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- 2) Second branch: userNum is positive (non-zero)

```
if (userNum < 0 ) {  
    ...  
}  
  
 {  
    ...  
}  
  
else { // userNum is 0  
    ...  
}
```

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- 3) Second branch: userNum is greater than 105



```
if (userNum < 100 ) {  
    ...  
}  
  
 {  
    ...  
}  
  
else { // userNum is between  
    // 100 and 105  
    ...  
}
```

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- 4) If the final else branch executes, what must userNum have been?



Type "unknown" if appropriate.

```
if (userNum <= 9) {
    ...
}
else if (userNum >= 11) {
    ...
}
else {
    ... // userNum if this executes?
}
```


[Show answer](#)

- 5) Which branch will execute? Valid answers: 1, 2, 3, or none.



```
userNum = 555;

if (userNum < 0) {
    ... // Branch 1
}
else if (userNum == 0) {
    ... // Branch 2
}
else if (userNum < 100) {
    ... // Branch 3
}
```


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CHALLENGE ACTIVITY

3.6.1: Multi-branch if-else statement: Print century.



Write an if-else statement with multiple branches. If givenYear is 2101 or greater, print "Distant future" (without quotes). Else, if givenYear is 2001 or greater (2001-2100), print "21st century". Else, if givenYear is 1901 or greater (1901-2000), print "20th century". Else (1900 or earlier), print "Long ago". Do NOT end with newline.

```
1 #include <iostream>
2 using namespace std;
3
4 int main() {
5     int givenYear;
6
7     cin >> givenYear;
8
9     /* Your solution goes here */
10    if(givenYear >= 2101){
```

```
11     cout << "Distant future";  
12 } else if (givenYear >= 2001){  
13     cout << "21st century";  
14 } else if (givenYear >= 1901){  
15     cout << "20th century";  
16 } else{  
17     cout << "Long ago";  
18 }  
19  
20 return 0;  
21 }
```

Run

✓ All tests passed

✓ Testing with givenYear = 1776

Your output

Long ago

✓ Testing with givenYear = 1901

Your output

20th century

✓ Testing with givenYear = 1948

Your output

20th century

✓ Testing with givenYear = 2000

Your output

20th century

✓ Testing with givenYear = 2001

Your output

21st century

✓ Testing with givenYear = 2101

Your output

Distant future

✓ Testing with givenYear = 2167

Your output

Distant future

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