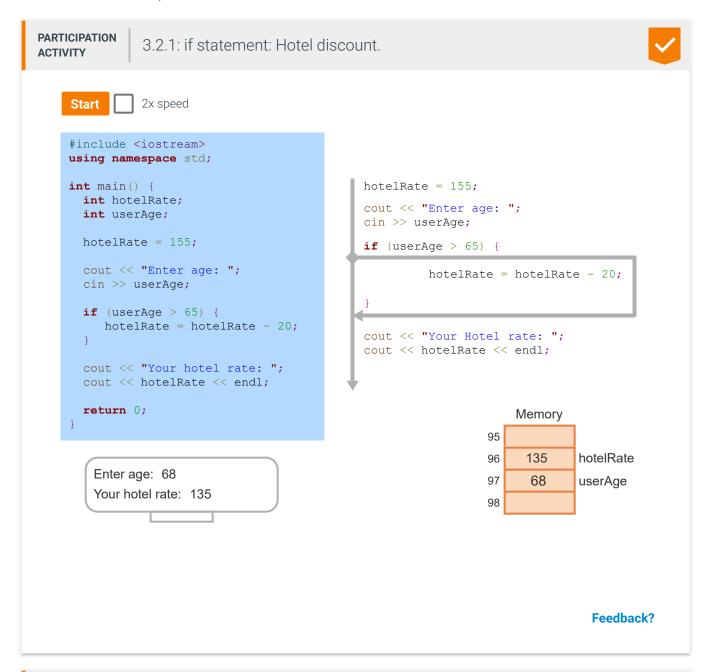
3.2 If-else

If statements

An **if** statement executes a group of statements if an expression is true. Braces surround the if branch's statements. **Braces** {}, sometimes redundantly called curly braces, represent a grouping, such as a grouping of statements. Note: {} are braces, [] are brackets.

<u>Good practice</u> is to indent a branch's statements, using a consistent number of spaces. This material indents 3 spaces.





If-else statement

An **if-else** statement executes one group of statements when an expression is true, and another group of statements when the expression is false.

```
Construct 3.2.1: If-else statement.

// Statements that execute before the branches

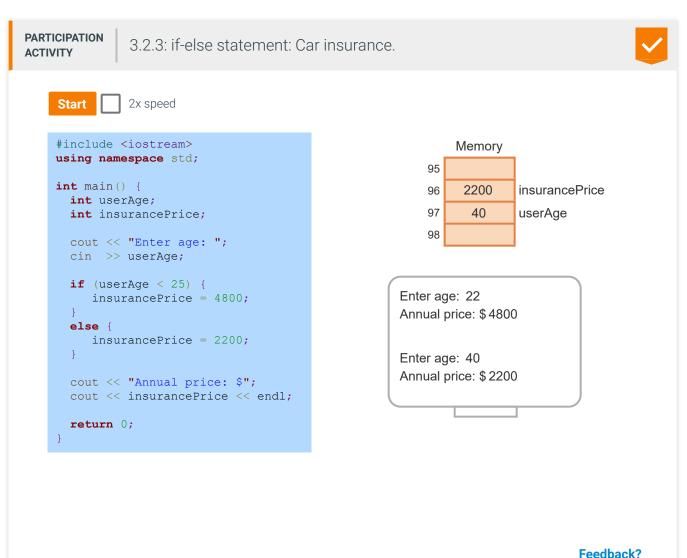
if (expression) {
    // Statements that execute when expression is true (first branch)
}

else {
    // Statements that execute when expression is false (second branch)
}

// Statements that execute after the branches

Feedback?
```

In the example below, if a user inputs an age less than 25, the statement insurancePrice = 4800 executes. Otherwise, insurancePrice = 2200 executes.



Car insurance prices

(Car insurance prices for drivers under 25 are higher because 1 in 6 such drivers are involved in an accident each year, vs. 1 in 15 for older drivers. Source: www.census.gov, 2009).

PARTICIPATION ACTIVITY

3.2.4: If-else statements.



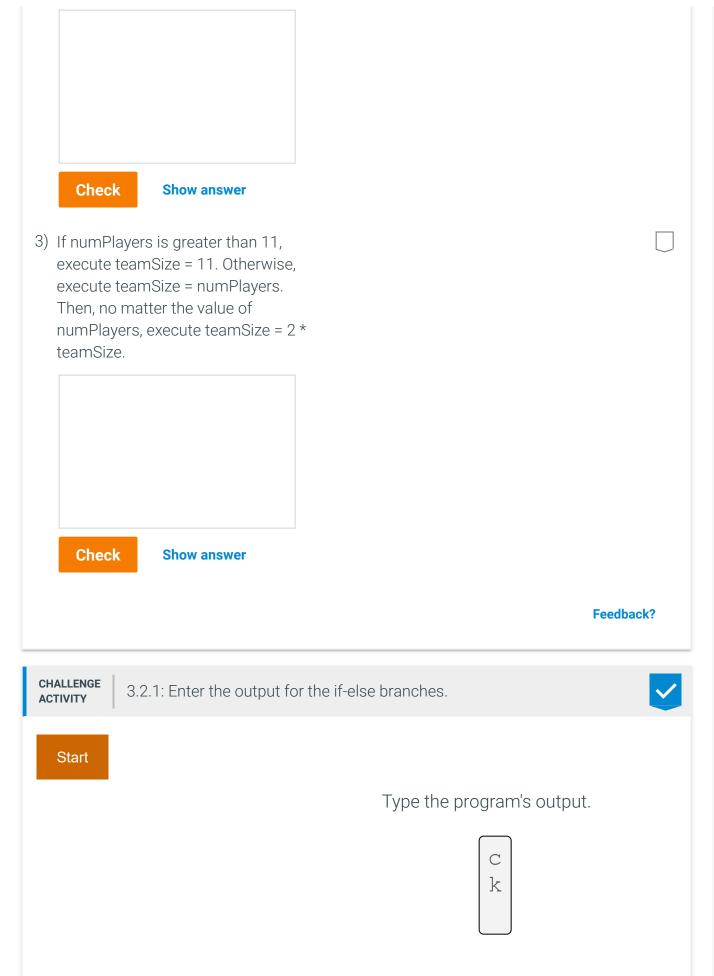
1) What is the final value of numltems?



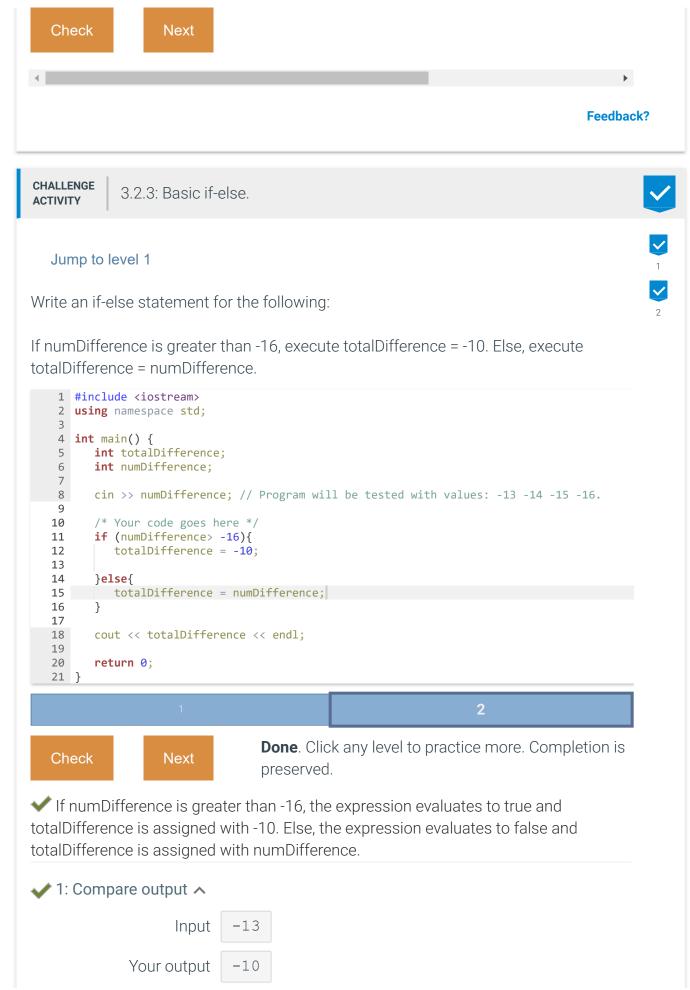
```
bonusVal = 5;
    if (bonusVal < 12) {</pre>
       numItems = 100;
    else {
       numItems = 200;
      Check
                    Show answer
2) What is the final value of numltems?
    bonusVal = 12;
    if (bonusVal < 12) {</pre>
       numItems = 100;
    else {
       numItems = 200;
      Check
                    Show answer
3) What is the final value of numltems?
    bonusVal = 15;
    numItems = 44;
    if (bonusVal < 12) {</pre>
       numItems = numItems + 3;
    else {
       numItems = numItems + 6;
    numItems = numItems + 1;
      Check
                    Show answer
4) What is the final value of bonus Val?
    bonusVal = 11;
    if (bonusVal < 12) {</pre>
       bonusVal = bonusVal + 2;
    else {
       bonusVal = bonusVal + 10;
      Check
                    Show answer
```

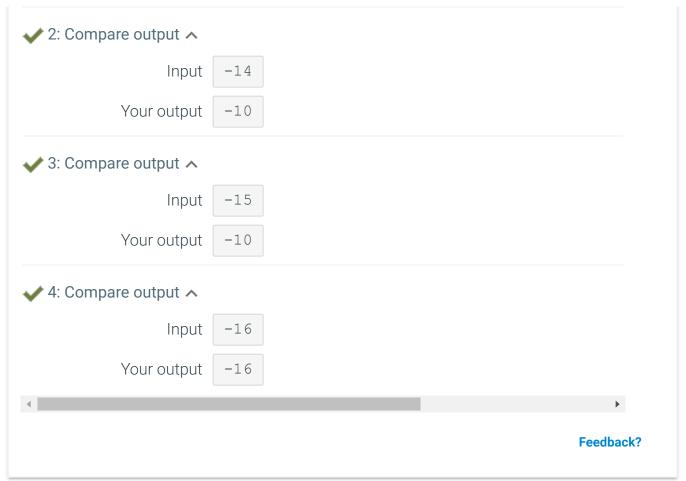
5) What is the final value of bonus Val?

```
bonusVal = 11;
    if (bonusVal < 12) {</pre>
       bonusVal = bonusVal + 2;
       bonusVal = 3 * bonusVal;
    else {
       bonusVal = bonusVal + 10;
      Check
                   Show answer
                                                                                  Feedback?
PARTICIPATION
                3.2.5: Writing an if-else statement.
ACTIVITY
Translate each description to an if-else statement as directly as possible. Use { }. (Not
checked, but please indent a branch's statements some consistent number of spaces,
such as 3 spaces).
1) If userAge is greater than 62, assign
   itemDiscount with 15. Else, assign
   itemDiscount with 0.
      Check
                  Show answer
2) If numPeople is greater than 10,
   execute groupSize = 2 * groupSize.
   Otherwise, execute groupSize = 3 *
   groupSize and numPeople =
   numPeople - 1.
```



```
#include <iostream>
                                    using namespace std;
                                    int main() {
                                       int numApples;
                                       numApples = 5;
                                       if (numApples < 7) {</pre>
                                          cout << "c" << endl;</pre>
                                       else {
                                          cout << "e" << endl;
                                       cout << "k" << endl;</pre>
                                       return 0;
   Check
                                                                                     Feedback?
CHALLENGE
             3.2.2: Basic if-else expression.
ACTIVITY
   Start
Write an expression that will cause the following code to print "greater than 20" if the
value of userAge is greater than 20.
    1 #include <iostream>
    2 using namespace std;
    3
    4 int main() {
    5
         int userAge;
    6
    7
         cin >> userAge; // Program will be tested with values: 19, 20, 21, 22.
    8
         if (/* Your code goes here */) {
    9
   10
         cout << "greater than 20" << endl;</pre>
   11
         else {
   12
         cout << "20 or less" << endl;
   13
   14
   15
   16
         return 0;
   17 }
```





Multi-branch if-else statements

An If-else statement can be extended to have three (or more) branches. Each branch's expression is checked in sequence. As soon as one branch's expression is found to be true, that branch's statement execute (and no subsequent branch is considered). If no expression is true, the else branch executes.

Construct 3.2.2: Multi-branch if-else statement. Only 1 branch will execute.

```
if (expression1) {
    // Statements that execute when expression1 is true
    // (first branch)
}
else if (expression2) {
    // Statements that execute when expression1 is false and expression2 is true
    // (second branch)
}
else {
    // Statements that execute when expression1 is false and expression2 is false
    // (third branch)
}
```

i country.

The **equality operator ==** evaluates to true if the left side and right side are equal. Ex: If numYears holds the value 10, then the expression **numYears** == **10** evaluates to true.

Note that the equality operator is ==, not =.

Figure 3.2.1: Multi-branch if-else example: Anniversaries.

```
#include <iostream>
using namespace std;
int main() {
   int numYears;
   cout << "Enter number years married: ";</pre>
   cin >> numYears;
   if (numYears == 1) {
      cout << "Your first year -- great!" << endl;</pre>
   else if (numYears == 10) {
      cout << "A whole decade -- impressive." << endl;</pre>
   else if (numYears == 25) {
      cout << "Your silver anniversary -- enjoy." << endl;</pre>
   else if (numYears == 50) {
      cout << "Your golden anniversary -- amazing." << endl;</pre>
   else {
      cout << "Nothing special." << endl;</pre>
   return 0;
```

```
Enter number years married: 10
A whole decade -- impressive.
...
Enter number years married: 25
Your silver anniversary -- enjoy.
...
Enter number years married: 30
Nothing special.
...
Enter number years married: 1
Your first year -- great!
```

Feedback?

PARTICIPATION ACTIVITY

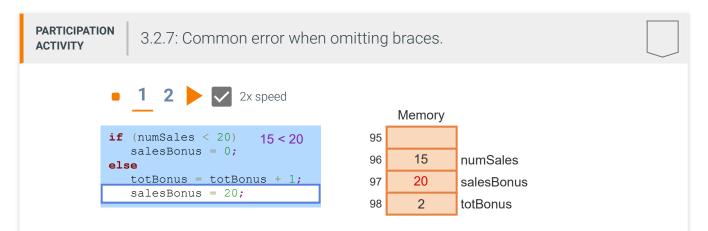
3.2.6: Multi-branch if-else statements.

What is the final value of employeeBonus for each given value of numSales?

```
if (numSales == 0) {
   employeeBonus = 0;
else if (numSales == 1) {
   employeeBonus = 2;
else if (numSales == 2) {
   employeeBonus = 5;
else {
   employeeBonus = 10;
1) numSales is 2
      Check
                  Show answer
2) numSales is 0
      Check
                  Show answer
3) numSales is 7
      Check
                  Show answer
                                                                                  Feedback?
```

Common errors

When a branch has a single statement, the braces are optional, but good practice always uses the braces. Always using braces even when a branch only has one statement prevents the common error of mistakenly thinking a statement is part of a branch.



Braces aren't used, so the else branch's only statement is totBonus = totBonus + 1. But, salesBonus = 20; should also be part of the else branch.

Feedback?

PARTICIPATION 3.2.8: Braces are important. ACTIVITY Omitting braces is a common source of errors. What is the final value of numltems? 1) numItems = 0;bonusVal = 19; if (bonusVal > 10) numItems = bonusVal; numItems = numItems + 1; Check **Show answer** 2) numItems = 0; bonusVal = 5; if (bonusVal > 10) // Need to update bonusVal numItems = bonusVal; numItems = numItems + 1; Check **Show answer** 3) numItems = 0; bonusVal = 5; if (bonusVal > 10) // Update bonusVal bonusVal = bonusVal - 1; numItems = bonusVal; numItems = numItems + 1;

Check

Show answer

Feedback?

CHALLENGE ACTIVITY

3.2.4: If-else statement: Fix errors.



Re-type the code and fix any errors. The code should convert non-positive numbers to 1.

```
if (userNum > 0)
    cout << "Positive." << endl;
else
    cout << "Not positive, converting to 1." << endl;
    userNum = 1;

cout << "Final: " << userNum << endl;</pre>
```

```
1 #include <iostream>
2 using namespace std;
4 int main() {
      int userNum;
6
7
      cin >> userNum;
 8
      /* Your solution goes here */
9
      if (userNum > 0)
10
          cout << "Positive." << endl;</pre>
11
12
          cout << "Not positive, converting to 1." << endl;</pre>
13
14
          userNum = 1;
15
16
17 cout << "Final: " << userNum << endl;</pre>
18
19
      return 0;
20 }
```

Run

✓ All tests passed

✓ Testing with userNum = -5.

```
Your output Not positive, converting to 1. Final: 1
```

✓ Testing with userNum = 99.

Your output Positive. Final: 99

