3.1 If-else branches (general)

Branch concept

People familiar with restaurants may be familiar with steering people to different-sized tables based on group size.

PARTICIPATION ACTIVITY 3.1.1: Branching concept.

1 2 3 2x speed

The host mentally executes the algorithm: If party of 1, seat at counter; Else If party of 2, seat at small table; Else seat at large table.

Feedback?

PARTICIPATION ACTIVITY 3.1.2: Branch concept.

Consider the example above.

1) A party of 1 is sat at _____.

- the counter
- a small table

Correct

The host's algorithm starts with: If party of 1, seat at counter.

2) A party of 2 is sat at _____.

- the counter

Correct

- a small table

The host's algorithm is: If not a party of 1, but a party of 2, seat at a small table.

3) A party of 5 is sat ____ .

- at a large table
- nowhere

Correct

In the host's algorithm, if not a party of 1, and not a party of 2, then seat at a large table. Thus, any party that is not of size 1 or 2 gets a large table, so parties of 3, 4, 5, 6, etc. (The algorithm doesn't do anything special for very large parties).

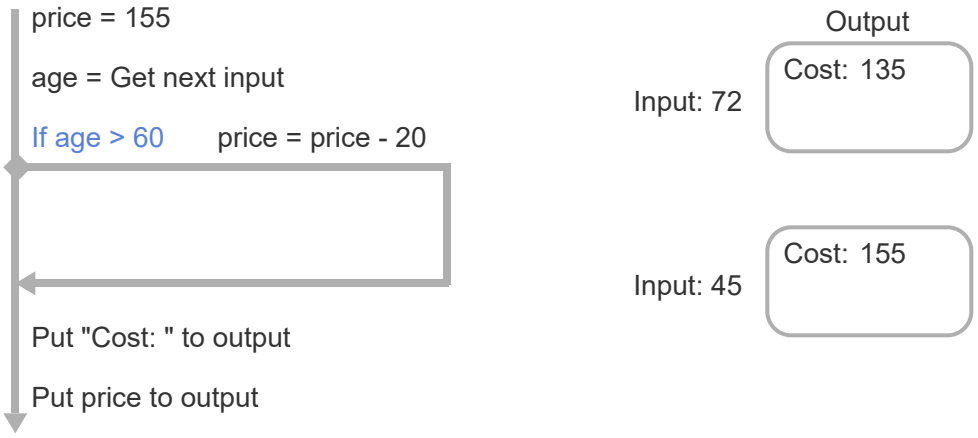
Feedback?

Branch basics (If)

A ***branch*** is a program path taken only if an expression's value is true. Ex: A hotel may discount a price only for people over age 60.

PARTICIPATION ACTIVITY 3.1.3: A simple branch: Hotel discount.

1 2 3 2x speed



But, if the input age were 45, then age > 60 is false. The branch is not taken, so the output is 155.

Feedback?

Such a branch is commonly known as an ***If*** branch: A branch taken only if an expression is true.

PARTICIPATION ACTIVITY 3.1.4: Branches.

Consider the example above.

1) If the input is 25, the output is Cost: _____ .

- 135
- 155 (selected)

Correct

Initially, price = 155 executes. Next, the age is assigned with the input 25. Next, because 25 > 60 is false, the branch is not taken, so the output statements execute, thus outputting 155.

2) If the input is 80, the output is Cost: _____ .

- 135 (selected)
- 155

Correct

Initially, price = 155 executes. Next, the age is assigned with the input 80. Next, because 80 > 60 is true, the branch is taken, and price = price - 20 executes, making price 135. Next, the output statements execute, thus outputting 135.

3) If the input is 60, will the branch be taken?

- Yes
- No (selected)

Correct

The expression will be 60 > 60, which is false (60 equals 60, but 60 is not greater than 60). Thus, the branch will not execute, and price will remain 155.

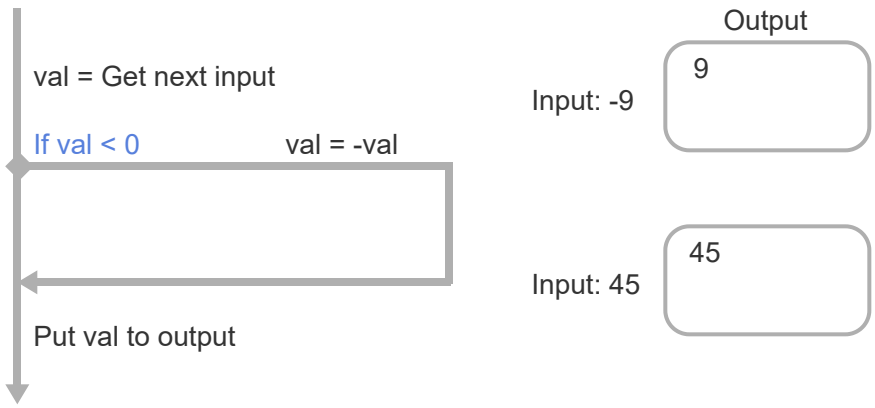
Feedback?

If branch example: Absolute value

The following shows how an if branch can be used to compute an absolute value of a number.

PARTICIPATION ACTIVITY 3.1.5: Example if branch: Computing absolute value.

1 2 3 2x speed



But, if the input val were 45, then val < 0 is false.

The branch is not taken, so the output is 45.

Feedback?

PARTICIPATION ACTIVITY 3.1.6: Example if branch: Absolute value.

Consider the example above.

1) If the input is -6, does the branch execute?
   - (•) Yes
   - ( ) No

Correct

-6 < 0 is true, so the branch executes. val = -val executes, assigning val with -(-6) or 6, which is then output.

2) If the input is 0, does the branch execute?
   - ( ) Yes
   - (•) No

Correct

0 < 0 is false, so the branch does not execute.

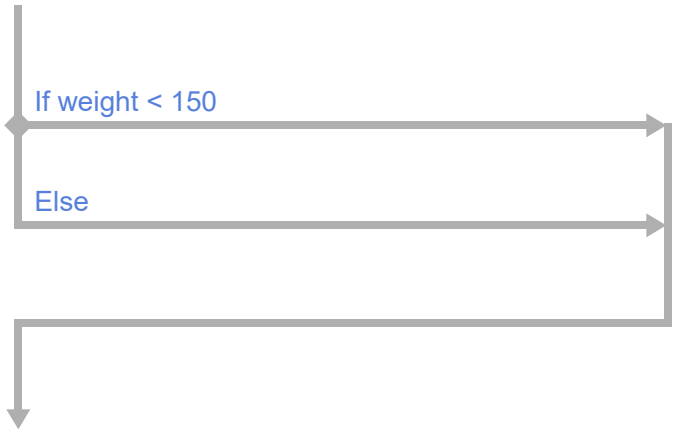
Feedback?

If-else branches

An ***if-else*** structure has two branches: The first branch is taken if an expression is true, else the other branch is taken.

PARTICIPATION ACTIVITY 3.1.7: If-else branches.

1 2 3 4 ▶ ☑ 2x speed



An if-else has two branches.
The if branch is taken if the expression is true. Otherwise, the else branch is taken.

Feedback?

PARTICIPATION ACTIVITY 3.1.8: If-else branches.

Consider the example above.

1) What is output when the input is 90?
   - (•) Can ride. Done.
   - ( ) Can't ride. Done.

Correct
90 < 150 is true, so the if branch is taken, which outputs "Can ride." Finally, "Done." is output.

2) What is output when the input is 200?
   - ( ) Can ride. Done.
   - (•) Can't ride. Done.

Correct
200 < 150 is false, so the else branch is taken, which outputs "Can't ride." Finally, "Done." is output.

3) What is output when the input is exactly 150?
   - ( ) Can ride. Done. Can't ride. Done.
   - ( ) Can ride. Can't ride. Done.
   - (•) Can't ride. Done.

Correct
150 < 150 is false, so the else branch executes.

4) What input value causes both the if branch to execute (outputting "Can ride") and the else branch to execute (outputting "Can't ride")?
   - ( ) 149
   - ( ) 150
   - ( ) 151
   - (•) No such value

Correct
No value can cause both branches to execute. Either the expression is true (so the if branch executes), or false (so the else branch executes).

5) What value causes "Done." to NOT be output?
   - ( )

Correct

130
160
No such value.

The if branch and the else branch join and lead to the statement that follows the if-else, which outputs "Done." Any value will cause either the if branch or the else branch to execute, either of which is followed by outputting "Done."

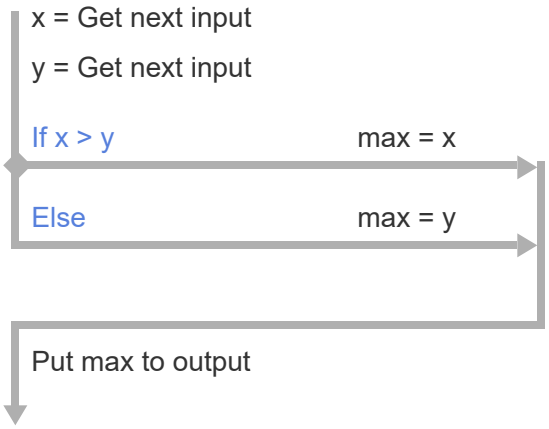
Feedback?

If-else example: Max

The following example shows how an if-else can be used to get the maximum of two values.

PARTICIPATION ACTIVITY 3.1.9: If-else example: Max.

1 2 3 2x speed



This program should output the maximum of two input values.

Feedback?

PARTICIPATION ACTIVITY 3.1.10: If-else example: Max.

Consider the example above.

1) When the input is -3 0, which branch executes?
   - If
   - Else

Correct

-3 > 0 is false, so the else branch executes, assigning max with 0.

2) When the input is 99 98, which branch executes?

- (●) If
- ( ) Else

Correct

99 > 98 is true, so the if branch executes, assigning max with 99.

3) The if branch assigns max = x. The else branch assigns max = ?

- ( ) x
- (●) y

Correct

If x > y, the if branch assigns max = x. Otherwise, the else branch assigns max = y.

4) If the inputs are 5 5, does max get assigned with x or y?

- ( ) x
- (●) y

Correct

Because 5 > 5 is false, the else branch executes, thus assigning max = y. However, note that when x and y are equal, the code could have been written to assign max = x, as in: If x ≥ y.

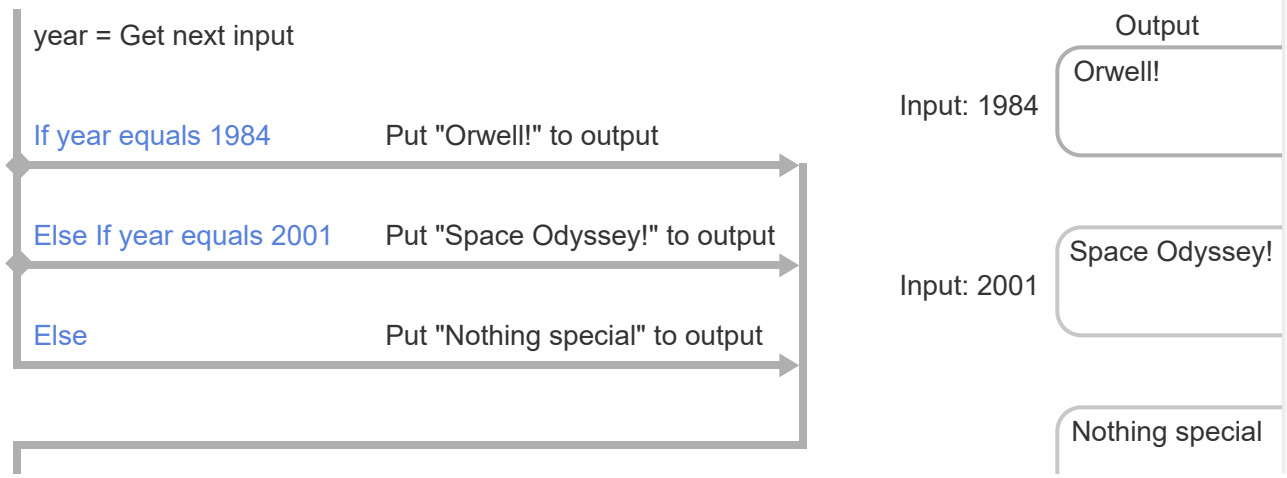
Feedback?

If-elseif-else branches

Commonly a programmer wishes to take one of multiple (three or more) branches. An if-else can be extended to an if-elseif-else structure. Each branch's expression is checked in sequence; as soon as one branch's expression is found to be true, that branch is taken. If no expression is found true, execution will reach the else branch, which then executes.

PARTICIPATION ACTIVITY 3.1.11: If-elseif-else branch.

1 2 3 4 2x speed



(more statements)

Input: 1997

If year equals anything else, like 1997, the if branch is not taken, and else-if branch is not taken, so t branch is taken. "Nothing special" is output.

Feedback?

Note: The else part is optional. If omitted, then if none of the previous expressions are true, no branch executes.

PARTICIPATION ACTIVITY 3.1.12: If-elseif-else.

Consider the if-elseif-else structure below:

```
If x equals -1
     Put "Disagrees" to output

Else If x equals 0
     Put "Neutral" to output

Else If x equals 1
     Put "Agrees" to output

Else
     Put "Invalid entry" to output
```

1) If x is 1, what is output?

- Disagrees
- Neutral
- Agrees
- Invalid entry

Correct

When executing, the program first checks if x equals -1, which is false. So the program next checks if x equals 0, which is false. So the program next checks if x equals 1, which is true, so the branch is taken.

2) If x is -2, what is output?

- Disagrees
- Invalid entry
- (Nothing is output)

Correct

x equals -1 is false, so the first branch is skipped. x equals 0 is false, so the second branch is skipped. x equals 1 is false, so the third branch is skipped. Thus, the else branch is reached, which executes regardless of x's value.

3) Could the programmer have written the three branches in the order x equals 1, x equals 0, and

Correct

For those particular expressions, the order doesn't matter; only one branch can have a true expression, so that one branch whose expression is true will execute, or the else branch will execute.

x equals -1, and achieved the same results?

- No
- Yes

4) In the code above, suppose a programmer, after the third branch (x equals 1), inserts a new branch: Else If x equals -1 ... When might that new branch execute?

- When x is -1
- When x is 1
- Never

Correct

That branch could never execute, because if x is -1, the first branch will execute, and the latter branches will not be considered. The programmer is making a logic error by inserting such a branch.

5) In the code above, suppose a programmer removed the Else part entirely. If x is 2, which is correct?

- The last branch, meaning the Else If x equals 1 branch, will execute.
- No branch will execute.
- The program is not legal.

Correct

A branch only executes if the branch's expression is reached and is true. Each expression is reached, but none is true, so none will execute. Execution will simply proceed to the next statement following the if-elseif structure.

Feedback?