

Converting Data Types Python Turtles

Textbook

Converting Data Types Python Turtles



There will be times when you want to make sure that your variable is a certain data type.

`"14"` is a **string**

`14` is an **integer**

`14.0` is a **float**

Problems with Math

If you wanted to do math with the string `"14"`, you would need to first change it to an integer.

```
1 candies = "14"
2 print(candies * 3)
```

This will print out `"141414"`. Why is this? It is duplicating the string of `"14"` three times. If we want to do math with a string, we need to change it to an integer.

Changing a variable type is done with [converting](#).

Converting to an Integer

Converting can be done while assigning a variable.

You can change the `"3"` from a string to an integer using the `int()` function. `int` is short for integer, so you are telling the string to turn into an integer.

```
1 donuts = "3"
2 donuts = int("3")
3 print(donuts)
```

This will change the string `"3"` to the integer `3`.

Let's do another example.

You can change the float `2.8` from a float to an integer using the `int()` function.

```
1 slices = 2.8
2 slices = int(2.8)
3 print(slices)
```

This will change the float `2.8` to the integer `2`. This is done by dropping the decimal and any numbers that follow it.

To be clear: when changing a float to an integer, it **DOES NOT ROUND DOWN**. It **drops the decimal**, which is not exactly the same thing.

Converting to a String

You can also change data into a string using the following function.

```
str()
```

`str` is short for string, so you are telling the data to become a string.

```
1 frogs = 20
2 frogs = str(20)
3 print(frogs)
```

Converting Inputs



Remember the lesson on inputs/outputs? This is very important. **Inputs are automatically accepted as a string.** Take this code for example:

```
candies = input("How far should the turtle move")
```

If the user answers with the number 50, the computer accepts it as a **string** with the number 50 in it. Like this: `"50"`.

This becomes very important when you need to use that number to do move your turtle. The following code will throw an error.

```
1 import turtle
2 turtle.getscreen()
3
4 move = input("How far should the turtle move?")
5
6 turtle.forward(move)
```

This won't work because the turtle needs to move a distance that has a number value. We are currently giving it a string value.

We will need to change your input into an [integer](#) before we can move the turtle.

```
1 import turtle
2 turtle.getscreen()
3
4 move = int(input("How far should the turtle move?"))
5
6 turtle.forward(move)
```

To be very clear: Inputs are automatically accepted as a [string](#)! To move the turtle with an integer input, the input will need to be converted into an integer.

Concatenating an Integer?

Concatenation can only be done with strings. So how do you put an integer into your sentence? You need to first convert your integer to a string, then you can concatenate them together.

The following code will throw an error because you cannot concatenate an integer into a string.

```
1 age = 12
2 print("You are " + age + " years old.")
```

This is because the computer doesn't know if you are trying to concatenate with that number or to do arithmetic with it! The "+" symbol is confusing to the computer.

To clarify what we want the computer to do, we convert our integer into a string when we concatenate it.

```
1 age = 12
2 print("You are " + str(age) + " years old.")
```

Debugging

Let's take a look at the error from the previous example. The console will show something like this message.

```
1 Traceback (most recent call last):
2
3   File "/home/main.py", line 5, in <module>
4
5     print("I am " + age + " years old.")
6
7 TypeError: can only concatenate str (not "int") to str
```

This message is telling us that there is an error with the data type. Let's take a closer look to see what this message means.

line 5 lets us know which line in the code is having a problem and shows the code in that line.

TypeError lets us know that we need to pay attention to the data types in the code.

can only concatenate str lets us know that we can only concatenate with strings.

This message has a lot of information we would need to find and fix the problem. To fix this code, we need to change the integer to a string to concatenate it.

Checkpoint

Converting Data Types

Practice converting between data types!

1. Include the necessary code to start up a python screen (import the library and generate a screen.)
2. Create a variable named `my_variable` and assign to to the string `"360"` . In the same line of code, convert the string of `"360"` to an integer by adding `int()` to your string declaration.
3. Print the variable named `my_variable`.
4. Create a variable named `my_variable2` and assign to to the integer `68` . In the same line of code, convert the integer `68` to a string using `str()` .
5. Print the variable named `my_variable2` .

Requirements:

- Include the necessary code to start up a python screen (import the library and generate a screen.)
- Create a variable named `my_variable` and assign to to the string `"360"` . In the same line of code, convert the string of `"360"` to an integer using `int()` .
- Print the variable named `my_variable` .
- Create a variable named `my_variable2` and assign to to the integer `68` . In the same line of code, convert the integer `68` to a string using `str()` .
- Print the variable named `my_variable2` .

Questions (10)

1. What is the purpose of converting data types in programming?

MULTIPLE CHOICE

Choose the correct answer:

- A. To make the code shorter.
- B. To ensure variables have a specific data type.
- C. To make the code more efficient.
- D. To make the code cleaner.

2. Why would you need to change a string to an integer before performing math operations?

MULTIPLE CHOICE

Choose the correct answer:

- A. Strings cannot be used in math operations.
- B. It makes the code more readable.
- C. It makes the code shorter.
- D. It makes the code more efficient.

MULTIPLE CHOICE

3. Which function is used to convert a string to an integer in Python?

Choose the correct answer:

- A. `str()`
- B. `float()`
- C. `int()`
- D. `convert()`

4. When converting a float to an integer in Python, what happens to the decimal part?

MULTIPLE CHOICE

Choose the correct answer:

- A. It is rounded down.
- B. It is rounded up.
- C. It is dropped.
- D. It is converted to a string.

MULTIPLE CHOICE

5. What function is used to convert data into a string in Python?

Choose the correct answer:

- A. `convert()`
- B. `str()`
- C. `string()`
- D. `text()`

6. What error might occur if you try to concatenate an integer directly into a string in Python?

MULTIPLE CHOICE

Choose the correct answer:

- A. `SyntaxError`
- B. `TypeError`
- C. `ValueError`
- D. `RuntimeError`

7. Why do we need to convert an integer to a string when using concatenation in Python?

MULTIPLE CHOICE

Choose the correct answer:

- A. More conversion makes a program run faster.
- B. To make the code longer.
- C. To make the code easier to read.
- D. Concatenation is only done with strings.

8. In Python, why is the input automatically accepted as a string?

MULTIPLE CHOICE

Choose the correct answer:

- A. It is a default behavior in Python.
- B. To simplify coding for beginners.
- C. To prevent numeric inputs.
- D. It is a bug in the programming language.

9. What information does the error message "can only concatenate str (not 'int') to str" provide?

MULTIPLE CHOICE

Choose the correct answer:

- A. The code is perfectly fine.
- B. The code is trying to do math with a string.
- C. The need to convert an integer to a string for concatenation.
- D. The need to avoid concatenation in Python.

10. Debug the following code:

DEBUG CODE

Code to Debug:

```
1 import turtle
2 turtle.getscreen()
3
4 move = int(input("How far should the turtle move?"))
5
6 turtle.forward(move)
```


Challenges (5)

1. Convert an Input to an Integer

Practice converting an input to an integer so you can do math with it.

1. Include the necessary code to start up a Python screen. (Import the library and generate a screen.)
2. Create a variable named `response` and assign it to an input that says `Enter a number 1-10`.
3. Create a variable named `total` and assign it to the variable named `response` plus 5.
4. Print the variable named `total`.

Run the above code. See how it will throw an error?

5. Now fix the code by converting the input to an integer by using `int()`. Right before the input statement, convert it to an integer using `int()`.

Requirements:

- Include the necessary code to start up a Python screen. (Import the library and generate a screen.)
- Create a variable named `response` and assign it to an input that says `Enter a number 1-10`.
- Create a variable named `total` and assign it to the variable named `response` plus 5.
- Print the variable named `total`. Try running the code and see what happens.
- Now fix the code by converting the input to an integer by using `int()`. Right before the input statement, convert it to an integer using `int()`.

2. Concatenate with an Integer

Practice converting an integer so it can be concatenated.

1. Include the necessary code to start up a python screen (import the library and generate a screen.)
2. Create a variable named `age` and assign it to the integer `13`.
3. Create a print statement. Inside the print statement concatenate the strings `I am` and `years old.` with the variable named `age` between them. So the program will print `I am 13 years old.` to the console.

Try running the code. See how it will throw an error? Let's fix it.

4. Inside the print statement, convert the variable named `age` to a string using `str()`.

Requirements:

- Include the necessary code to start up a python screen (import the library and generate a screen.)
- Create a variable named `age` and assign it to the integer `13`.
- Create a print statement. Inside the print statement concatenate the strings `I am` and `years old.` with the variable named `age` between them. So the program will print `I am 13 years old.` to the console.
- Inside the print statement, convert the variable named `age` to a string using `str()`.

3. How Far?

Ask the user how far they want the turtle to move.

1. Include the necessary code to start up a Python screen. (Import the library and generate a screen.)
2. Create a variable named `move` and assign it to an input that asks the user `How far should the turtle move?` .
3. Since we need that value to be used as an integer, on that same line of code, convert the input to an integer using `int()` .
4. Put the variable named `move` into the `turtle.forward()` command.

Requirements:

- Include the necessary code to start up a Python screen. (Import the library and generate a screen.)
- Create a variable named `move` and assign it to an input that asks the user `How far should the turtle move?` .
- Since we need that value to be used as an integer, on that same line of code, convert the input to an integer using `int()` .
- Put the variable named `move` into the `turtle.forward()` command.

4. Custom Turtle Movement

Create a program where the user determines what the turtle does!

1. Include the necessary code to start up a Python screen. (Import the library and generate a screen.)
2. Create a variable named `move` and assign it to an input that asks the user `How far should the turtle move?`
Convert the input to an integer.
3. Create a variable named `turn` and assign it to an input that asks the user `How much should the turtle turn?`
Convert the input to an integer.
4. Create a variable named `move2` and assign it to an input that asks the user `How far should the turtle move the second time?` Convert the input to an integer.
5. Put the variable named `move` into the `turtle.forward()` command.
6. Put the variable named `turn` into the `turtle.right()` command.
7. Put the variable named `move2` into a second `turtle.forward()` command.

Requirements:

- Include the necessary code to start up a Python screen. (Import the library and generate a screen.)
- Create a variable named `move` and assign it to an input that asks the user `How far should the turtle move?`
Convert the input to an integer.
- Create a variable named `turn` and assign it to an input that asks the user `How much should the turtle turn?`
Convert the input to an integer.
- Create a variable named `move2` and assign it to an input that asks the user `How far should the turtle move the second time?` Convert the input to an integer.
- Put the variable named `move` into the `turtle.forward()` command.
- Put the variable named `turn` into the `turtle.right()` command.
- Put the variable named `move2` into a second `turtle.forward()` command.

5. Custom Circle

Create a program where the user determines how big the turtle circle will be.

1. Include the necessary code to start up a Python screen. (Import the library and generate a screen.)
2. Create a variable named `radius` and assign it to an input that asks the user `How big should the circle be?`
Convert the input to an integer.
3. Put the variable named `radius` into the `turtle.circle()` command.

Requirements:

- Include the necessary code to start up a Python screen. (Import the library and generate a screen.)
- Create a variable named `radius` and assign it to an input that asks the user `How big should the circle be?`
Convert the input to an integer.
- Put the variable named `radius` into the `turtle.circle()` command.

Answer Keys & Solutions

Checkpoint Solutions

Converting Data Types

```
1 import turtle
2 turtle.getscreen()
3
4 my_variable = int("360")
5
6 print(my_variable)
7
8 my_variable2 = str(68)
9
10 print(my_variable2)
```

Questions

1. What is the purpose of converting data types in programming?

MULTIPLE CHOICE

Correct Answer:

- A. To make the code shorter. ✗ Incorrect
- B. To ensure variables have a specific data type. ✓ Correct
- C. To make the code more efficient. ✗ Incorrect
- D. To make the code cleaner. ✗ Incorrect

Explanation:

The data type will determine if a program runs correctly or not.

2. Why would you need to change a string to an integer before performing math operations?

MULTIPLE CHOICE

Correct Answer:

- A. Strings cannot be used in math operations. ✓ Correct
- B. It makes the code more readable. ✗ Incorrect

C. It makes the code shorter.

✗ Incorrect

D. It makes the code more efficient.

✗ Incorrect

Explanation:

Math is done with integers and floats.

3. Which function is used to convert a string to an integer in Python?

MULTIPLE CHOICE

Correct Answer:

A. `str()`

✗ Incorrect

B. `float()`

✗ Incorrect

C. `int()`

✓ Correct

D. `convert()`

✗ Incorrect

Explanation:

It's short for integer

4. When converting a float to an integer in Python, what happens to the decimal part?

MULTIPLE CHOICE

Correct Answer:

A. It is rounded down.

✗ Incorrect

B. It is rounded up.

✗ Incorrect

C. It is dropped.

✓ Correct

D. It is converted to a string.

✗ Incorrect

Explanation:

When converting a float to an integer in Python, what happens to the decimal part?

5. What function is used to convert data into a string in Python?

MULTIPLE CHOICE

Correct Answer:

- A. `convert()` ✗ Incorrect
- B. `str()` ✓ Correct
- C. `string()` ✗ Incorrect
- D. `text()` ✗ Incorrect

Explanation:

It's short for string.

6. What error might occur if you try to concatenate an integer directly into a string in Python?

MULTIPLE CHOICE

Correct Answer:

- A. `SyntaxError` ✗ Incorrect
- B. `TypeError` ✓ Correct
- C. `ValueError` ✗ Incorrect
- D. `RuntimeError` ✗ Incorrect

Explanation:

It's an error with the data type

7. Why do we need to convert an integer to a string when using concatenation in Python?

MULTIPLE CHOICE

Correct Answer:

- A. More conversion makes a program run faster. ✗ Incorrect
- B. To make the code longer. ✗ Incorrect
- C. To make the code easier to read. ✗ Incorrect

D. Concatenation is only done with strings.

✓ Correct

Explanation:

You cannot concatenate an integer

8. In Python, why is the input automatically accepted as a string?

MULTIPLE CHOICE

Correct Answer:

A. It is a default behavior in Python.

✓ Correct

B. To simplify coding for beginners.

✗ Incorrect

C. To prevent numeric inputs.

✗ Incorrect

D. It is a bug in the programming language.

✗ Incorrect

Explanation:

It's simply a rule of Python code

9. What information does the error message "can only concatenate str (not 'int') to str" provide?

MULTIPLE CHOICE

Correct Answer:

A. The code is perfectly fine.

✗ Incorrect

B. The code is trying to do math with a string.

✗ Incorrect

C. The need to convert an integer to a string for concatenation.

✓ Correct

D. The need to avoid concatenation in Python.

✗ Incorrect

Explanation:

The words "can only concatenate str" are a clue.

10. Debug the following code:

DEBUG CODE

Incorrect Code:

```
1 import turtle
2 turtle.getscreen()
3
4 move = int(input("How far should the turtle move?"))
5
6 turtle.forward(move)
```

Correct Solution:

```
1 import turtle
2 turtle.getscreen()
3
4 move = int(input("How far should the turtle move?"))
5
6 turtle.forward(move)
```

Explanation:

This code is missing a parenthesis

Challenges

1. Convert an Input to an Integer

Solution:

```
1 import turtle
2 turtle.getscreen()
3
4 response = int(input("Enter a number 1-10"))
5
6 total = response + 5
7
8 print(total)
```

2. Concatenate with an Integer

Solution:

```
1 import turtle
2 turtle.getscreen()
3
4 age = 13
5 print("I am " + str(age) + " years old.")
```

3. How Far?

Solution:

```
1 import turtle
2 turtle.getscreen()
```



```
3  
4 move = int(input("How far should the turtle move?"))  
5  
6 turtle.forward(move)
```

4. Custom Turtle Movement

Solution:

```
1 import turtle  
2 turtle.getscreen()  
3  
4 move = int(input("How far should the turtle move?"))  
5  
6 turn = int(input("How much should the turtle turn?"))  
7  
8 move2 = int(input("How far should the turtle move the second time?"))  
9  
10 turtle.forward(move)  
11 turtle.right(turn)  
12 turtle.forward(move2)
```

5. Custom Circle

Solution:

```
1 import turtle  
2 turtle.getscreen()  
3  
4 radius = int(input("How big should the circle be?"))  
5  
6 turtle.circle(radius)
```