

# Exemplar\_\_Create more functions

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## 1 Exemplar: Create more functions

### 1.1 Introduction

Built-in functions are functions that exist within Python and can be called directly. They help analysts efficiently complete tasks. Python also supports user-defined functions. These are functions that analysts write for their specific needs.

For example, patterns in login attempts could reveal suspicious activity. Python functions can help analysts work efficiently with lists of login attempts. Both built-in functions and user-defined functions in Python can help security analysts analyze login attempts.

In this lab, you'll use built-in functions to work with a list of failed login attempts per month to prepare it for further analysis, and you'll define a function that compares the user's login attempts for the current day to their average number of login attempts.

Tips for completing this lab

As you navigate this lab, keep the following tips in mind:

- **### YOUR CODE HERE ###** indicates where you should write code. Be sure to replace this with your own code before running the code cell.
- Feel free to open the hints for additional guidance as you work on each task.
- To enter your answer to a question, double-click the markdown cell to edit. Be sure to replace the “[Double-click to enter your responses here.]” with your own answer.
- You can save your work manually by clicking File and then Save in the menu bar at the top of the notebook.
- You can download your work locally by clicking File and then Download and then specifying your preferred file format in the menu bar at the top of the notebook.

### 1.2 Scenario

In your work as a security analyst, you're responsible for working with a list that contains the number of failed attempts that occurred each month. You'll identify any patterns that might indicate malicious activity. You're also responsible for defining a function that compares the logins for the current day to an average and improving it by adding a **return** statement.

### 1.3 Task 1

In your work as an analyst, imagine that you're provided a list of the number of failed login attempts per month, as follows:

119, 101, 99, 91, 92, 105, 108, 85, 88, 90, 264, and 223.

This list is organized in chronological order of months (January, February, March, April, May, June, July, August, September, October, November, and December).

This list is stored in a variable named `failed_login_list`.

In this task, use a built-in Python function to order the list. You'll pass the call to the function that sorts the list directly into the `print()` function. This will allow you to display and examine the result.

Be sure to replace each `### YOUR CODE HERE ###` with your own code before you run the following cell.

```
[1]: # Assign `failed_login_list` to the list of the number of failed login attempts
      ↪ per month

failed_login_list = [119, 101, 99, 91, 92, 105, 108, 85, 88, 90, 264, 223]

# Sort `failed_login_list` in ascending numerical order and display the result
print(sorted(failed_login_list))
```

```
[85, 88, 90, 91, 92, 99, 101, 105, 108, 119, 223, 264]
```

Hint 1

To order the `failed_login_list` in ascending numerical order, use the `sorted()` function.

This is a built-in Python function that takes in a list, sorts its components, and returns the result.

Hint 2

To order the `failed_login_list` in ascending numerical order, call the `sorted()` function and pass in `failed_login_list`.

To display the result, make sure to place the call to `sorted()` inside the `print()` statement.

**Question 1** What do you observe from the output above? Do you notice any outlying numbers that indicate an increase in the failed number of login attempts?

The output above shows that the function call to `sorted()` sorted the `failed_login_list` in ascending numerical order. The outputted list starts with the lowest number of failed login attempts and ends with the highest number of failed login attempts. The last two numbers in the sorted list (223 and 264) seem to be outlying numbers, indicating an increase in the number of failed login attempts.

## 1.4 Task 2

Now, you'll want to isolate the highest number of failed login attempts so you can later investigate information about the month when that highest value occurred.

You'll use the function that returns the largest numeric element from a list. Then, you'll pass this function into the `print()` function to display the result. This will allow you to determine which month to investigate further.

Be sure to replace each `### YOUR CODE HERE ###` with your own code before you run the following cell.

```
[2]: # Assign `failed_login_list` to the list of the number of failed login attempts
      ↪ per month

failed_login_list = [119, 101, 99, 91, 92, 105, 108, 85, 88, 90, 264, 223]

# Determine the highest number of failed login attempts from
      ↪ `failed_login_list` and display the result

print(max(failed_login_list))
```

264

Hint 1

To determine the highest number of failed login attempts from `failed_login_list`, use the `max()` function.

This is a built-in Python function that takes in a sequence, identifies the maximum value from the sequence and returns the result.

Hint 2

To determine the highest number of failed login attempts from `failed_login_list`, call the `max()` function and pass in `failed_login_list`.

To display the result, make sure to place the call to `max()` inside the `print()` statement.

### Question 2 What do you observe from the output above?

The output above shows that the function call to `max()` isolated the highest number from the `failed_login_list`. The highest number of failed login attempts was 264.

## 1.5 Task 3

In your work as an analyst, you'll first define a function that displays a message about how many login attempts a user has made that day.

In this task, define a function named `analyze_logins()` that takes in two parameters, `username` and `current_day_logins`. Every time this function is called, it should display a message about the number of login attempts the user has made that day.

Be sure to replace each `### YOUR CODE HERE ###` with your own code before you run the following cell. Note that the code cell will contain only a function definition, so running it will not produce an output.

```
[3]: # Define a function named `analyze_logins()` that takes in two parameters,
      ↪ `username` and `current_day_logins`

def analyze_logins(username, current_day_logins):

    # Display a message about how many login attempts the user has made that day

    print("Current day login total for", username, "is", current_day_logins)
```

Hint 1

To write a function header in Python, start with the `def` keyword, followed by the function name and then parantheses.

Hint 2

In Python, to define a function that takes in parameters, place the names of the parameters inside of the parantheses at the function header, and use a `,` between each parameter and the next.

Hint 3

To define a function named `analyze_logins()` that takes in two parameters, `username` and `current_day_logins`, start with the `def` keyword, followed by `analyze_logins()`, and write `username, current_day_logins` inside the parantheses. Be sure to write this code before the `::`.

## 1.6 Task 4

Now that you've defined the `analyze_logins()` function, call it to test out how it behaves.

Call `analyze_logins()` with the arguments "ejones" and 9.

Be sure to replace each `### YOUR CODE HERE ###` with your own code before you run the following cell.

```
[4]: # Define a function named `analyze_logins()` that takes in two parameters,
      ↪ `username` and `current_day_logins`

def analyze_logins(username, current_day_logins):

    # Display a message about how many login attempts the user has made that day

    print("Current day login total for", username, "is", current_day_logins)

    # Call `analyze_logins()`
```

```
analyze_logins("ejones", 9)
```

Current day login total for ejones is 9

Hint 1

To call the `analyze_logins()` function after it's defined, write `analyze_logins()`. Then make sure to place the arguments "ejones" and 9 inside the parantheses.

Hint 2

The function call should be written as `analyze_logins("ejones", 9)`.

**Question 3** What does this function display? Would the output vary for different users?

This function displays the message "Current day login total for ejones is 9" when the arguments are "ejones" and 9. The function is defined in a way that's specific to the user, so it would produce a different output for a different user.

## 1.7 Task 5

Now, you'll need to expand this function so that it also provides the average number of login attempts made by the user on that day. Doing this will require incorporating a third parameter into the function definition.

In this task, add a parameter called `average_day_logins`. The code will use this parameter to display an additional message. The additional message will convey the average login attempts made by the user on that day. Then, call the function with the same first and second arguments as used in Task 4 and a third argument of 3.

Be sure to replace each `### YOUR CODE HERE ###` with your own code before you run the following cell.

```
[1]: # Define a function named `analyze_logins()` that takes in three parameters,
    ↪ `username`, `current_day_logins`, and `average_day_logins`

def analyze_logins(username, current_day_logins, average_day_logins):

    # Display a message about how many login attempts the user has made that day

    print("Current day login total for", username, "is", current_day_logins)

    # Display a message about average number of login attempts the user has
    ↪ made that day

    print("Average logins per day for", username, "is", average_day_logins)

# Call `analyze_logins()`
```

```
analyze_logins("ejones", 9, 3)
```

Current day login total for ejones is 9

Average logins per day for ejones is 3

Hint 1

In Python, to define a function that takes in parameters, place the names of the parameter inside the parantheses at the function header, with a , between each parameter and the next.

Hint 2

You need to define a function named `analyze_logins()` that takes in three parameters, `username`, `current_day_logins`, and `average_day_logins`. So you'll need to write `username`, `current_day_logins`, `average_day_logins` inside the parantheses.

Hint 3

To call the `analyze_logins()` function after it's defined, write `analyze_logins()`. Then make sure to place the arguments "ejones", 9, and 3 inside the parantheses.

## 1.8 Task 6

In this task, you'll further expand the function. Include a calculation to get the ratio of the logins made on the current day to the logins made on an average day. Store this in a new variable named `login_ratio`. The function displays an additional message that uses this variable.

Note that if `average_day_logins` is equal to 0, then dividing `current_day_logins` by `average_day_logins` will cause an error. Due to the error, Python will display the following message: `ZeroDivisionError: division by zero`. For this activity, assume that all users will have logged in at least once before. This means that their `average_day_logins` will be greater than 0, and the function will not involve dividing by zero.

After defining the function, call the function with the same arguments that you used in the previous task.

Be sure to replace each `### YOUR CODE HERE ###` with your own code before you run the following cell.

```
[6]: # Define a function named `analyze_logins()` that takes in three parameters,
    ↪ `username`, `current_day_logins`, and `average_day_logins`

def analyze_logins(username, current_day_logins, average_day_logins):

    # Display a message about how many login attempts the user has made that day

    print("Current day login total for", username, "is", current_day_logins)

    # Display a message about average number of login attempts the user has
    ↪ made that day
```

```

print("Average logins per day for", username, "is", average_day_logins)

# Calculate the ratio of the logins made on the current day to the logins
→made on an average day, storing in a variable named `login_ratio`

login_ratio = current_day_logins / average_day_logins

# Display a message about the ratio

print(username, "logged in", login_ratio, "times as much as they do on an
→average day.")

# Call `analyze_logins()`
analyze_logins("ejones", 9, 3)

```

Current day login total for ejones is 9  
Average logins per day for ejones is 3  
ejones logged in 3.0 times as much as they do on an average day.

Hint 1

To calculate the ratio of the logins made on the current day to the logins made on an average day, divide `current_day_logins` by `average_day_logins`. Make sure to write this calculation to the right of the `=`, so the result will be stored in the variable `login_ratio`.

Hint 2

Call the updated `analyze_logins()` function and pass in "ejones", 9, and 3 as the three arguments, in that order.

**Question 4** What does this version of the `analyze_logins()` function display? Would the output vary for different users?

This version of the `analyze_logins()` function displays a user's current day login total, average logins per day, and ratio of current day login total to average logins per day. It produces a distinct output for each distinct username that it takes in.

## 1.9 Task 7

You'll continue working with the `analyze_logins()` function and add a return statement to it. Return statements allow you to send information back to the function call.

In this task, use the `return` keyword to output the `login_ratio` from the function, so that it can be used later in your work.

You'll call the function with the same arguments used in the previous task and store the output from the function call in a variable named `login_analysis`. You'll then use a `print()` statement to display the saved information.

Be sure to replace each `### YOUR CODE HERE ###` with your own code before you run the following cell.

```
[7]: # Define a function named `analyze_logins()` that takes in three parameters,
      ↪ `username`, `current_day_logins`, and `average_day_logins`

def analyze_logins(username, current_day_logins, average_day_logins):

    # Display a message about how many login attempts the user has made that day

    print("Current day login total for", username, "is", current_day_logins)

    # Display a message about average number of login attempts the user has
    ↪made that day

    print("Average logins per day for", username, "is", average_day_logins)

    # Calculate the ratio of the logins made on the current day to the logins
    ↪made on an average day, storing in a variable named `login_ratio`

    login_ratio = current_day_logins / average_day_logins

    # Return the ratio

    return login_ratio

# Call `analyze_logins()` and store the output in a variable named
    ↪`login_analysis`

login_analysis = analyze_logins("ejones", 9, 3)

# Display a message about the `login_analysis`

print("ejones", "logged in", login_analysis, "times as much as they do on an
    ↪average day.")
```

```
Current day login total for ejones is 9
Average logins per day for ejones is 3
ejones logged in 3.0 times as much as they do on an average day.
```

Hint 1

When defining the `analyze_logins()` function this time, place the `return` keyword in front of the output that you want the function to return.

Hint 2

When defining the `analyze_logins()` function this time, write `return` in front of `login_ratio`. (Do not place parentheses after the `return` keyword. It is not a function.)



**Question 5** How does this version of the `analyze_logins()` function compare to the previous versions?

This version of the `analyze_logins()` function involves a `return` statement instead of a `print()` statement, which allows you to store the output from the function call in a variable for later usage.

### 1.10 Task 8

In this task, you'll use the value of `login_analysis` in a conditional statement. When the value of `login_analysis` is greater than or equal to 3, then the login activity will require further investigation, and an alert will be displayed. Incorporate this condition to complete the conditional statement in the code.

Be sure to replace each `### YOUR CODE HERE ###` with your own code before you run the following cell.

```
[8]: # Define a function named `analyze_logins()` that takes in three parameters,
      ↪ `username`, `current_day_logins`, and `average_day_logins`

def analyze_logins(username, current_day_logins, average_day_logins):

    # Display a message about how many login attempts the user has made that day

    print("Current day login total for", username, "is", current_day_logins)

    # Display a message about average number of login attempts the user has
    ↪ made that day

    print("Average logins per day for", username, "is", average_day_logins)

    # Calculate the ratio of the logins made on the current day to the logins
    ↪ made on an average day, storing in a variable named `login_ratio`

    login_ratio = current_day_logins / average_day_logins

    # Return the ratio

    return login_ratio

# Call `analyze_logins()` and store the output in a variable named
    ↪ `login_analysis`

login_analysis = analyze_logins("ejones", 9, 3)

# Conditional statement that displays an alert about the login activity if it's
    ↪ more than normal

if login_analysis >= 3:
```

```
print("Alert! This account has more login activity than normal.")
```

Current day login total for ejones is 9  
Average logins per day for ejones is 3  
Alert! This account has more login activity than normal.

Hint 1

To calculate the ratio of the logins made on the current day to the logins made on an average day, divide `current_day_logins` by `average_day_logins`.

Assign a variable named `login_ratio` to the result of this calculation, using the `=` assignment operator.

Hint 2

To assign a variable named `login_ratio` to the result of the calculation, use the `=` assignment operator. Write `login_ratio` to the left of `=`, and place the calculation to the right of `=`.

Hint 3

Call the updated `analyze_logins()` function and pass in "ejones", 9, and 3 as the three arguments, in that order.

## 1.11 Conclusion

**What are your key takeaways from this lab?**

- There are a variety of ways a function can be written.
  - It can be written to display information to the screen, or return information that can then be saved in a variable.
  - Also it can be written to take in any number of parameters, use the parameters to execute a series of tasks, and then return a result.
- The `sorted()` function in Python is a built-in function that helps you sort the components of a list.
  - For example, when you call `sorted()` with a list of numbers, it returns the list with the elements in numerical order.
- The `max()` function in Python is a built-in function that helps you identify the element with the maximum value in a list.
  - For example, when you call `max()` with a list of numbers, it returns the largest number in the list.
- The `print()` function in Python is a built-in function that helps display information. It can also be used to directly display the output from another function call.
  - To display the output from another function call, make sure to place it inside a `print()` statement.