

# Stats 21: Homework 1

## Jack Conner

Acknowledgements: several of these problems are copied from or modified from Think Python by Allen Downey.

I've started the homework file for you. You'll need to fill in the rest with your answers. My encouragement is to use the keyboard shortcuts as much as possible and use the mouse as little as possible while working the Jupyter Notebook.

After you complete the homework with your answers, go to the menu and choose **Kernel > Restart & Run All**. Review the document to **make sure all requested output is visible**. You will not get credit for problems where the requested output is not visible, even if the function you coded is correct.

When you are satisfied with the output, choose File > Download As ... > PDF or HTML. If you choose to save as HTML, you'll then need to "Print as PDF". Submit the PDF to Gradescope.

Submit this ipynb file, complete with your answers and output to Canvas / Bruin Learn.

Again, you must make sure all requested output is visible to receive full credit.

## Task 1

Create an account on GitHub.

Change your profile picture. Ideally, use photo of yourself that would be appropriate for a resume. If you are not comfortable with the idea of using a photo of yourself, use any other image that is suitable for a workplace environment.

Follow the instructions provided in class to fork the class repository to your GitHub.

Create another repository with at least two text files in it on GitHub (other than the forked class notes repository). Make at least two additional commits to the repository and push them to GitHub.

Provide a link to both repositories here.

You will also need to submit the link to your own repository (not the forked one) to Canvas / Bruin Learn.

## Your Answer:

- Link to your forked repository: <https://github.com/jack-conner/2024-sp-stats21>
- Link to your own repository: [https://github.com/jack-conner/my\\_stats\\_21](https://github.com/jack-conner/my_stats_21)

## Problem 2

An important part of programming is learning to interpret error messages and understanding what correction needs to be made.

Read and familiarize yourself with the following error messages.

Explain the error. Then duplicate each cell and correct the error. The first problem has been done for you as an example.

```
In [1]:
# A
print("Hello World")

Cell In[1], line 2
    print("Hello World")
    ^
SyntaxError: incomplete input
```

Answer: The `print()` function is missing the closing parenthesis. This results in an unexpected EOF error.

```
In [2]:
# corrected:
print("Hello World")

Hello World
```

```
In [3]:
# B
print("Hello")
    print("Goodbye")

Cell In[3], line 3
    print("Goodbye")
    ^
IndentationError: unexpected indent
```

Answer: The second `print()` function is indented, which is syntax used for loops and if-else statements. Since the first line is not one of these loops/statements and doesn't end in a colon, it results in an `IndentationError` for an unexpected indent.

```
In [4]:
# corrected
print("Hello")
print("Goodbye")

Hello
Goodbye
```

```
In [5]:
# C
x = 10
if x > 8
    print("x is greater than 8")

Cell In[5], line 3
    if x > 8
    ^
SyntaxError: expected ':'
```

Answer: A colon is needed to indicate the start of an if-statement clause. Since this is missing here, it throws an error, as the compiler doesn't know immediately that if `x > 8` is an if statement without this colon.

```
In [6]:
# corrected
x = 10
if x > 8:
    print("x is greater than 8")

x is greater than 8
```

```
In [7]:
# D
if x = 10:
    print("x is equal to 10")

Cell In[7], line 2
    if x = 10:
    ^
SyntaxError: invalid syntax. Maybe you meant '==' or '!=' instead of '='
```

Answer: In Python, a single equal sign is used for assignment, so the statement `x = 10` assigns `x` the value of 10 rather than forming the mathematical statement `x == 10`; Python uses two equal signs to stand in for equality, so, to fix this, we just add a second equal sign to turn it into an inequality statement (?)

```
In [8]:
# corrected
if x == 10:
    print("x is equal to 10")

x is equal to 10
```

```
In [9]:
# E
x = 5
if x == 5:
    print("x is five")

Cell In[9], line 4
    print("x is five")
    ^
IndentationError: expected an indented block after 'if' statement on line 3
```

Answer: Here, we get another indentation error, except for this time, it is because the clause we want attached to the if statement is not indented. We want to print "x is five" if `x == 5`, but, since this isn't indented, Python doesn't recognize it as code to execute for the if statement, and throws an error because it expects to see an indent after the start of an if statement.

```
In [10]:
# E
x = 5
if x == 5:
    print("x is five")

x is five
```

```
In [11]:
# F
l = [1, 2, 50, 10]
l = sort(l)

-----
NameError                                Traceback (most recent call last)
Cell In[11], line 3
      1 # F
      2 l = [1, 2, 50, 10]
----> 3 l = sort(l)

NameError: name 'sort' is not defined
```

Answer: This code chunk incorrectly uses "sort" instead of the actual function call, "sorted". `sort` is not a function, and not a defined variable, giving us the error of 'sort' not being defined.

```
In [12]:
# F
l = [1, 2, 50, 10]
l = sorted(l)
```

## Problem 3

Use Python as a calculator. Enter the appropriate calculation in a cell and be sure the output value is visible.

A. How many seconds are there in 42 minutes 42 seconds?

```
In [13]:
time = 42 * 60 + 42
print(time)

2562
```

B. There are 1.61 kilometers in a mile. How many miles are there in 10 kilometers?

```
In [14]:
km_to_mile = 1 / 1.61
tenk = 10 * km_to_mile
print(tenk)

6.211180124223602
```

C. If you run a 10 kilometer race in 42 minutes 42 seconds, what is your average 1-mile pace (time to complete 1 mile in minutes and seconds)? What is your average speed in miles per hour?

```
In [15]:
time_sec = time / tenk
time_min = time_sec / 60
leftover = time_min % 1
minutes = time_min - leftover
seconds = round(leftover * 60)
print("Your average mile pace is " + str(int(minutes)) + " minutes and "
      + str(int(seconds)) + " seconds")
mph = round(3600 / time_sec, 2)
print("Your average speed is " + str(mph) + " miles per hour")

Your average mile pace is 6 minutes and 52 seconds
Your average speed is 8.73 miles per hour
```

## Problem 4

Write functions for the following problems.

A. The volume of a sphere with radius `r` is

$$V = \frac{4}{3}\pi r^3$$

Write a function `sphere_volume(r)` that will accept a radius as an argument and return the volume.

- Use the function to find the volume of a sphere with radius 5.
- Use the function to find the volume of a sphere with radius 15.

```
In [16]:
import math
def sphere_volume(r):
    return((4/3) * math.pi * (r ** 3))
print(sphere_volume(5))
print(sphere_volume(15))

523.5987755982989
14137.166941154068
```

B. Suppose the cover price of a book is \$24.95, but bookstores get a 40% discount. Shipping costs \$3 for the first copy and 75 cents for each additional copy.

Write a function `wholesale_cost(books)` that accepts an argument for the number of books and will return the total cost of the books plus shipping.

- Use the function to find the total wholesale cost for 60 copies.
- Use the function to find the total wholesale cost for 10 copies.

```
In [17]:
def wholesale_cost(books):
    book_cost = 24.95 * 0.6
    return((3 + 0.75 * books) * book_cost)
print(wholesale_cost(60))
print(wholesale_cost(10))

718.56
157.185
```

C. A person runs several miles. The first and last miles are run at an 'easy' pace. Other than the first and last miles, the other miles are at a faster pace.

Write a function `run_time(miles, warm_pace, fast_pace)` to calculate the time the runner will take. The function accepts three input arguments: how many miles the runner travels (minimum value is 2), the warm-up and cool-down pace, and the fast pace. The function will print the time in the format minutes:seconds, and will return a tuple of values: (minutes, seconds)

Use the function to find the time to run a total of 5 miles. The warm-up pace is 8:15 per mile. The speed pace is 7:12 per mile.

Call the function using: `run_time(miles = 5, warm_pace = 495, fast_pace = 432)`

```
In [18]:
def run_time(miles, warm_pace, fast_pace):
    if(miles < 2):
        return("Miles argument must be at least 2")
    warm_cool_time = warm_pace * 2
    fast_time = fast_pace * (miles - 2)
    total_time = warm_cool_time + fast_time
    min = total_time // 60
    sec = total_time - (min * 60)
    print(f"{ min }:{ sec }")
    return((min, sec))
run_time(miles = 5, warm_pace = 495, fast_pace = 432)

38:6
Out[18]:
(38, 6)
```

Another important skill is to be able to read documentation.

Read the documentation for the function `str.split()` at <https://docs.python.org/3/library/stdtypes.html#str.split>

Adjust the function so that the call can be made with minutes and seconds:

```
run_time(miles = 5, warm_pace = "8:15", fast_pace = "7:12")
```

```
In [19]:
def run_time(miles, warm_pace, fast_pace):
    if(miles < 2):
        return("Miles argument must be at least 2")
    warm_cool_min = int(warm_pace.split(sep = ':')[0])
    warm_cool_sec = int(warm_pace.split(sep = ':')[1])
    fast_min = int(fast_pace.split(sep = ':')[0])
    fast_sec = int(fast_pace.split(sep = ':')[1])
    min = (warm_cool_min * 2) + (fast_min * (miles - 2))
    sec = (warm_cool_sec * 2) + (fast_sec * (miles - 2))
    if(sec >= 60):
        min = min + (sec // 60)
        sec = sec % 60
    print(f"{ min }:{ sec }")
    return((min, sec))
run_time(miles = 5, warm_pace = "8:15", fast_pace = "7:12")

38:6
Out[19]:
(38, 6)
```

## Problem 5

Use `import math` to gain access to the math library.

Create a function `polar(real, imaginary)` that will return the polar coordinates of a complex number.

The input arguments are the real and imaginary components of a complex number. The function will return a tuple of values: the value of the radius `r` and the angle `theta`.

For a refresher, see: <https://ptolemy.berkeley.edu/eecs20/sidebars/complex/polar.html>

Show the results for the following complex numbers:

- $1 + i$
- $-2 - 3i$
- $4 + 2i$

```
In [20]:
import math
def polar(real, imaginary):
    r = math.sqrt((real ** 2) + (imaginary ** 2))
    theta = math.atan(imaginary / real)
    return(r, theta)
print(polar(1, 1))
print(polar(-2, -3))
print(polar(4, 2))

(1.4142135623730951, 0.7853981633974483)
(3.605551275463989, 0.982793723247329)
(4.47213595499958, 0.46364760900080615)
```

## Problem 6

Define a function called `insert_into(listname, index, iterable)`. It will accept three arguments, a currently existing list, an index, and another list/tuple that will be inserted at the index position.

Python's built-in function, `list.insert()` can only insert one object.

```
In [21]:
# write your code here
def insert_into(listname, index, iterable):
    iterable.reverse()
    for n in iterable:
        listname.insert(index, n)
    return(listname)
```

```
In [22]:
# do not modify. We will check this result for grading
l = [0, 'a', 'b', 'c', 4, 5, 6]
i = ['hello', 'there']
insert_into(l, 3, i)

Out[22]:
[0, 'a', 'b', 'hello', 'there', 'c', 4, 5, 6]
```

## Problem 7

Define a function called `first_equals_last(listname)`

It will accept a list as an argument. It will return `True` if the first and last elements are equal and the if the list has a length greater than 1. It will return `False` for all other cases.

```
In [23]:
# write your function here
def first_equals_last(listname):
    first = listname[0]
    last = listname[len(listname) - 1]
    if(len(listname) == 1 or first == last):
        return(True)
    return(False)
```

```
In [24]:
# do not modify. We will check this result for grading
a = [1,2,3]
first_equals_last(a)

Out[24]:
False
```

```
In [25]:
# do not modify. We will check this result for grading
b = ['hello', 'goodbye', 'hello']
first_equals_last(b)

Out[25]:
True
```

```
In [26]:
# do not modify. We will check this result for grading
c = [1,2,3,'1']
first_equals_last(c)

Out[26]:
False
```

```
In [27]:
# do not modify. We will check this result for grading
d = [[1,2],[3,2],[1,2]]
first_equals_last(d)

Out[27]:
True
```