REPORT JULY 22

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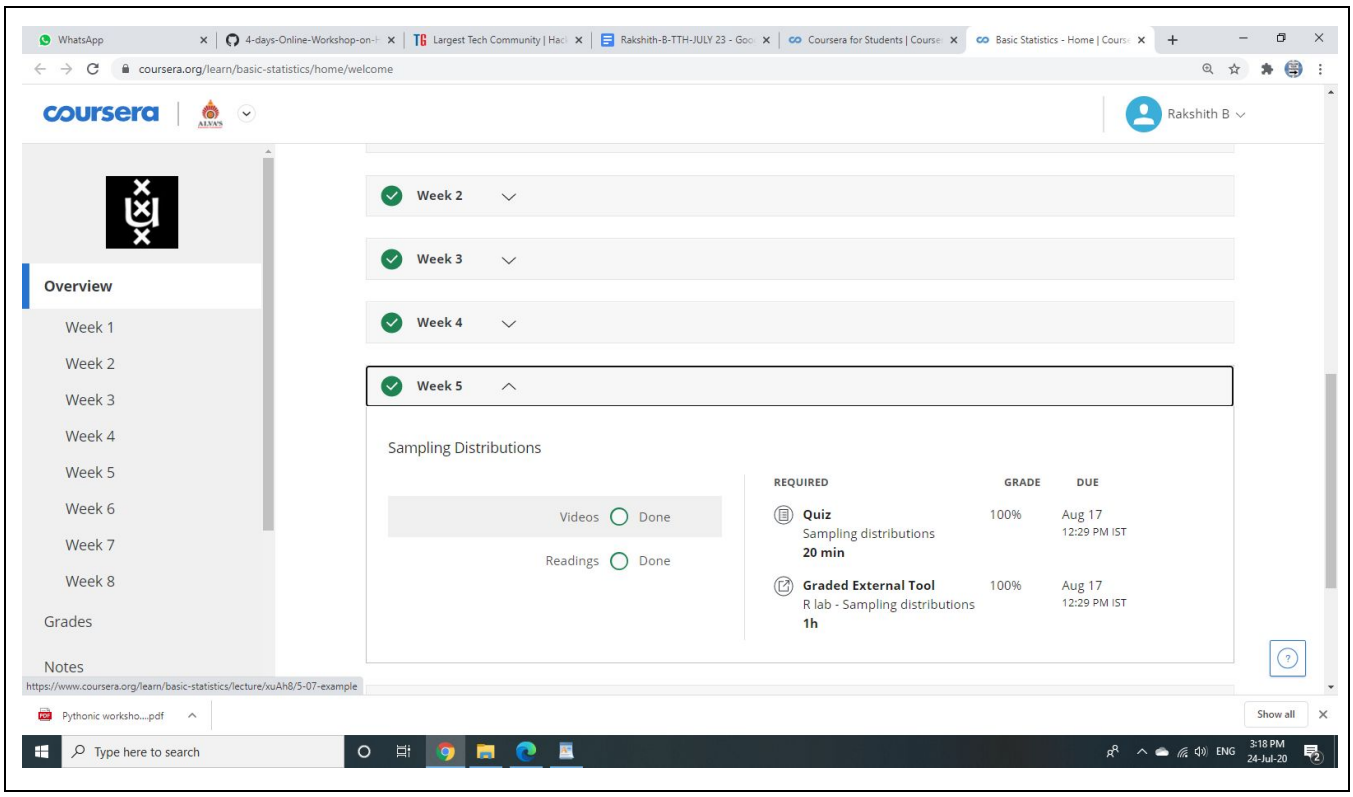
Course:	Coursera	USN:	4AL16EC409
Topic:	Basic statistics	Semester & Section:	6th SEM B
Github Repository:	Rakshith-B		

Image of the Session



The reason that we have a bad head for randomness is that our brain tends to measure randomness in the effort it takes to memorize a pattern.

And it turns out that memorizing frequently changing short sequences is harder than longer sequences.

Given this state of affairs it's really important to learn about formal ways for quantifying randomness, reasoning about it and generating realistic random patterns. It will help to avoid mistakes, predict more accurate and be more efficient when you try to make sense of the world around you. Let me summarize what I hope you understood from this video.

Randomness is not an intrinsic property of a phenomenon. It also depends amongst others of prior knowledge, observation method, and a scale at which the phenomenon is considered.

While there are many words to express aspects of randomness, humans are not very good in assessing it quantitatively. We suffer from apophenia, the over interpretation of what are purely random patterns and are also bad in constructing randomness.Also the scale of your search matters. While you may not be very certain about finding another shell within a few minutes at a short stretch of beach, the chance to find one when you take a bit more time and cover a larger stretch of beach will increase.

But in spite of many words, our ability to memorize in our daily experience with randomness, we are not very good at assessing it quantitatively at all.

On one hand, we see all sorts of patterns in what is really random data. There's a word for it, apophenia.

And on the other hand, we are unable to make up random data ourselves.

An example of a failed attempt to create random data is this fabricated map of random shell locations which turn out to be spaced too regular.

This is how a realistic random point pattern looks like with much more clusters.

Another example of over interpreting randomness is the so called gambler's fallacy, the false idea that a random phenomenon can be predicted from a series of preceding random phenomena.Before we can understand probability we first have to understand another concept: **randomness**. The first video explains this concept. It also shows that even though randomness is everywhere around us, humans are nonetheless bad in assessing it.

Once we understand randomness we can define **probability** as a way to **quantify randomness**. The second video explains how this quantification can be accomplished by experiments which record the **relative frequency** that certain **events** of interest occur. It follows that probabilities are always **larger or equal to zero** and **smaller or equal to one**; and also that the **sum of the probabilities for all possible events equals one**. Due to the very nature of random events, the experiments may have to continue for a while before the relative frequencies represent the probabilities accurately, but the law of large numbers dictates that it will do so eventually.

Recognizing and understanding randomness as well as the ability to reason about it are important skills, not only to apply statistical analysis but also to make sense of things happening around us every day. Here, I will explain that humans are pathologically bad at dealing with randomness. I will use an example along the way.

Imagine you're on a beach watching the waves roll in.

And then your attention is caught by a beautiful shell which is distinctive in shape and larger than it's neighboring shells. So you start to search for another one. This will be an unpredictable enterprise. The shells may be distributed at random at this huge beach. Hence, the time it will take you to find another will be uncertain. You may not be able to find a similar at all.

The more you think about it, the more you'll realize that randomness is pervasive in everyday life. It is therefore not surprising that we have a rich vocabulary to communicate it,

with terms like uncertainty, chance, risk and likelihood.

Also, degrees of variability and uncertainty can expressed quite subtly. Consider for example this sequence. Rarely. Seldom. Sometimes. Common. Frequent. Often.

Importantly, whether something is random is not just a property of that phenomenon, but very much also a consequence of our knowledge about it.

If you'd have been at this beach before, you might have spotted this special shell previously, so that this may change your search strategy and increase your chance of finding more of them.

And who doesn't recognize this. If you have thrown a six four times in a row with a die, it feels as if it's going to be very unlikely to throw a six again the fifth time.

Yet, the probability of this outcome was and continues to be one sixth.

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Writing Pythonic Code

Example #1

```
x=[1, 2, 3, 4, 5, 6]

result = []

for idx in range(len(x)):

        result.append(x[idx] * 2)

print(result)
```

Output: [2, 4, 6, 8, 10, 12]

Consider the above code, where you're trying to multiply some elements, "x" by 2.

So, what we did here was, we created an empty list to store the results. We would then append the solution of the computation into the result. The result now contains a function which is 2 multiplied by each of the elements.

Now, if you were to write the same code in a Pythonic way, you might want to simply use list comprehensions.

Here's how:

```
x=[1, 2, 3, 4, 5, 6]
print([(element * 2) for element in x])
```

only 2 line! it is pythonic

Example #2

```
x=[1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
result = []
for idx in range(len(x)):
        if x[idx] % 2 == 0:
                result.append(x[idx] * 2)
        else:
                result.append(x[idx])
print(result|)
```

We've actually created an if else statement to solve this problem, but there is a simpler way of doing things the Pythonic way. The Pythonic way is to combine for and if using list comprehension

```
x=[1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
[(element * 2 if element % 2 == 0 else element) for element in x]
```

Output: [1, 4, 3, 8, 5, 12, 7, 16, 9, 20]

Example #3 filtering only even numbers

```
x=[1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
```

```
result = []

for idx in range(len(x)):

        if x[idx] % 2 == 0

print(result|)
```

We've actually created an if else statement to solve this problem, but there is a simpler way of doing things the Pythonic way.

```
x=[1, 2, 3, 4, 5, 6, 7, 8, 9, 10]

[element * 2 for element in x if element % 2 == 0]
```

- How to Write Beautiful Python Code With PEP 8

PEP stands for Python Enhancement Proposal, and there are several of them. A PEP is a document that describes new features proposed for Python and documents aspects of Python, like design and style, for the community.

- Naming Conventions

When you write Python code, you have to name a lot of things: variables, functions, classes, packages, and so on. Choosing sensible names will save you time and energy later. You'll be able to figure out, from the name, what a certain variable, function, or class represents. You'll also avoid using inappropriate names that might result in errors that are difficult to debug.

Never use l, O, or I single letter names as these can be mistaken for 1 and 0, depending on typeface:

```
O = 2  # This may look like you're trying to reassign 2 to zero
```

- Naming Styles

- How to Choose Names?

Choosing names for your variables, functions, classes, and so forth can be challenging. You should put a fair amount of thought into your naming choices when writing code as it will make your code more readable. The best way to name your objects in Python is to use descriptive names to make it clear what the object represents.

When naming variables, you may be tempted to choose simple, single-letter lowercase names, like x. But, unless you're using x as the argument of a mathematical function, it's not clear what x represents. Imagine you are storing a person's name as a string, and you want to use string slicing to format their name differently. You could end up with something like this:

```
# Not recommended
```

```
x = 'John Smith'
y, z = x.split()
print(z, y, sep=', ')
'Smith, John'
```

This will work, but you'll have to keep track of what x, y, and z represent. It may also be confusing for collaborators. A much clearer choice of names would be something like this:

```
name = 'John Smith'
first_name, last_name = name.split()
 print(last_name, first_name, sep=', ')
'Smith, John'
```

Similarly, to reduce the amount of typing you do, it can be tempting to use abbreviations when choosing names. In the example below, I have defined a function db() that takes a single argument x and doubles it:

```
# Not recommended
def db(x):
   return x * 2
```

At first glance, this could seem like a sensible choice. db() could easily be an abbreviation for double. But imagine coming back to this code in a few days. You may have forgotten what you were trying to achieve with this function, and that would make guessing how you abbreviated it difficult.

The following example is much clearer. If you come back to this code a couple of days after writing it, you'll still be able to read and understand the purpose of this function:

```
# Recommended
def multiply_by_two(x):
```

```
    return x * 2
```

The same philosophy applies to all other data types and objects in Python. Always try to use the most concise but descriptive names possible.

- Code Layout
- Blank Lines

Vertical whitespace, or blank lines, can greatly improve the readability of your code. Code that's bunched up together can be overwhelming and hard to read. Similarly, too many blank lines in your code makes it look very sparse, and the reader might need to scroll more than necessary. Below are three key guidelines on how to use vertical whitespace.

Surround top-level functions and classes with two blank lines. Top-level functions and classes should be fairly self-contained and handle separate functionality. It makes sense to put extra vertical space around them, so that it's clear they are separate:

```
class MyFirstClass:
    pass


class MySecondClass:
    pass


def top_level_function():
    return None
```

Surround method definitions inside classes with a single blank line. Inside a class, functions are all related to one another. It's good practice to leave only a single line between them:

```
class MyClass:
    def first_method(self):
        return None
```

```
    def second_method(self):
        return None
```

Use blank lines sparingly inside functions to show clear steps. Sometimes, a complicated function has to complete several steps before the return statement. To help the reader understand the logic inside the function, it can be helpful to leave a blank line between each step.

In the example below, there is a function to calculate the variance of a list. This is two-step problem, so I have indicated each step by leaving a blank line between them. There is also a blank line before the return statement. This helps the reader clearly see what's returned:

```
def calculate_variance(number_list):
    sum_list = 0
    for number in number_list:
        sum_list = sum_list + number
    mean = sum_list / len(number_list)

    sum_squares = 0
    for number in number_list:
        sum_squares = sum_squares + number**2
    mean_squares = sum_squares / len(number_list)

    return mean_squares - mean**2
```

- Maximum Line Length and Line Breaking

PEP 8 suggests lines should be limited to 79 characters. This is because it allows you to have multiple files open next to one another, while also avoiding line wrapping.

Of course, keeping statements to 79 characters or less is not always possible. PEP 8 outlines ways to allow statements to run over several lines.

Python will assume line continuation if code is contained within parentheses, brackets, or braces:

```
def function(arg_one, arg_two,
```

```
        arg_three, arg_four):
    return arg_one
```

If it is impossible to use implied continuation, then you can use backslashes to break lines instead:

```
from mypkg import example1, \
    example2, example3
```

However, if you can use implied continuation, then you should do so.

If line breaking needs to occur around binary operators, like + and *, it should occur before the operator. This rule stems from mathematics. Mathematicians agree that breaking before binary operators improves readability. Compare the following two examples.

Below is an example of breaking before a binary operator:

```
# Recommended
total = (first_variable
        + second_variable
        - third_variable)

# Not Recommended
total = (first_variable +
        second_variable -
        third_variable)
```

- Indentation

Indentation, or leading whitespace, is extremely important in Python. The indentation level of lines of code in Python determines how statements are grouped together.

Consider the following example:

```
if x > 5:
    print('x is larger than 5')
```

The indented print statement lets Python know that it should only be executed if the if statement returns True. The same indentation applies to tell Python what code to execute when a function is called or what code belongs to a given class.

The key indentation rules laid out by PEP 8 are the following:

- Use 4 consecutive spaces to indicate indentation.
- Prefer spaces over tabs.

```
# Not Recommended
var = function(arg_one, arg_two,
   arg_three, arg_four)


# Not Recommended
def function(
   arg_one, arg_two,
   arg_three, arg_four):
   return arg_one


# Recommended
def function(
      arg_one, arg_two,
      arg_three, arg_four):
   return arg_one
```

- Where to Put the Closing Brace?

Line up the closing brace with the first character of the line that starts the construct:

```
list_of_numbers = [
```

```
    1, 2, 3,
    4, 5, 6,
    7, 8, 9
]
```

- Whitespace in Expressions and Statements

Whitespace can be very helpful in expressions and statements when used properly. If there is not enough whitespace, then code can be difficult to read, as it's all bunched together. If there's too much whitespace, then it can be difficult to visually combine related terms in a statement.

- Whitespace Around Binary Operators

Surround the following binary operators with a single space on either side:

- Assignment operators (=, +=,-=, and so forth)
- Comparisons (==, !=, >, <. >=, <=) and (is, is not, in, not in)
- Booleans (and, not, or)

Note: When = is used to assign a default value to a function argument, do not surround it with spaces.

```
# Recommended
def function(default_parameter=5):
    # ...


# Not recommended
def function(default_parameter = 5):
    # ...
```

When there's more than one operator in a statement, adding a single space before and after each operator can look confusing. Instead, it is better to only add whitespace around the operators with the lowest priority, especially when performing mathematical manipulation. Here are a couple examples:

```
# Recommended
y = x**2 + 5
```

```
z = (x+y) * (x-y)


# Not Recommended
y = x ** 2 + 5
z = (x + y) * (x - y)


# Not recommended
if x > 5 and x % 2 == 0:
    print('x is larger than 5 and divisible by 2!')


# Recommended
if x>5 and x%2==0:
    print('x is larger than 5 and divisible by 2!')


# Definitely do not do this!
if x >5 and x% 2== 0:
    print('x is larger than 5 and divisible by 2!')
```

Don’t use if x: when you mean if x is not None: Sometimes, you may have a function with arguments that are None by default. A common mistake when checking if such an argument,arg, has been given a different value is to use the following:

```
# Not Recommended
if arg:
    # Do something with arg...


# Recommended
if arg is not None:
    # Do something with arg...
```

The mistake being made here is assuming that not None and truthy are equivalent. You could have set arg = []. As we saw above, empty lists are evaluated as false in Python. So, even though the argument arghas been assigned, the condition is not met, and so the code in the body of the if statement will not be executed.

Use .startswith() and.endswith()instead of slicing.If you were trying to check if a string word was prefixed, or suffixed, with the word cat, it might seem sensible to use list slicing. However, list slicing is prone to error, and you have to hardcode the number of characters in the prefix or suffix. It is also not clear to someone less familiar with Python list slicing what you are trying to achieve:

```
# Not recommended
if word[:3] == 'cat':
   print('The word starts with "cat"')

# Recommended
if word.startswith('cat'):
   print('The word starts with "cat"')
```

```
# Not recommended
if file_name[-3:] == 'jpg':
   print('The file is a JPEG')

# Recommended
if file_name.endswith('jpg'):
   print('The file is a JPEG')
```