CS 1112: Introduction To Programming

Match-Case statement;

Mutability in Python

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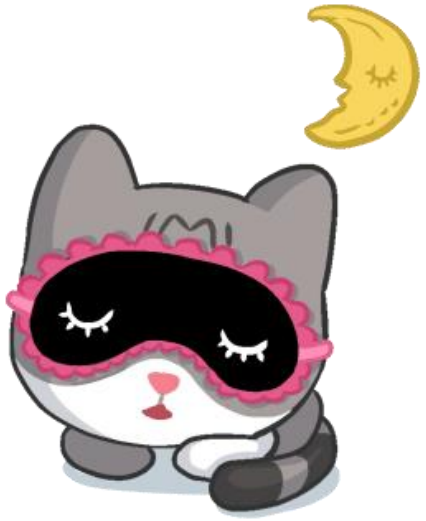
Friendly Reminders

- Your ***safety*** and ***comfort*** is important!
  - If you choose to wear a mask you are welcome to do so
  - *We will interpret wearing a mask as being **considerate and caring** of others in the classroom (not that you are sick), and realize that some may choose to mask to **remain distanced***
- Be an ***active*** participant in your learning!
  You're welcome and ***encouraged*** to ask questions during class!
- If you feel ***unwell***, or think you are, please stay home
  - *We will work with you!*
  - Get some rest ☺
  - View the recorded lectures – *please allow 24-48 hours to post*
  - *Contact us!*



Announcements

- **PA02** is out and is due by 11:00pm on Wednesday (***2/14***)!
  - Submit on Gradescope: your .py file and a reflection file (PDF).
  - *Not sure how to create/submit a **PDF**? No problem! Ask one of the TAs for help!*
- **Quiz 2** has been graded. Scores can be seen on Sherlock (and Canvas).
- **Quiz 3** will be released this afternoon and is due by 11:00pm on Monday (***2/12***)!
  - No late quizzes accepted
  - No make-up quizzes allowed
  - If you believe your computer is glitching, it's a good idea to copy down your answers to each of the questions in a word document. In the event something happens, you can send me your solutions.
  - *Note: in general, will **cannot and will not** accept quiz solutions via **email**. We will only accept them in the case where your quiz may have glitched and we no longer have your submitted answers.*
  - **Take quiz on:** Sherlock.cs.virginia.edu

Review Solution

conditionals.ica.py

See how we can write a gpa_calc function *(challenge portion of the activity)*

Match-Case statement

Alternative to **if-elif-else** statement

Match-Case statement

- In short, we pass a **parameter** then try to check in which **case** the parameter is satisfied
  - If we find a **match**, we will do something, and if there is no match at all we will do something else
- Initialized with the `match` keyword
  - Creating a block and taking a parameter *(here the variable name is also parameter)*
- Cases are established with the `case` keyword
  - There are several cases followed by a *pattern*
  - In each case the *pattern* tries to match the parameter
- The "_" is the wildcard character which is run when nothing is matched

```
parameter = "SomeValue"

match parameter:
    case "first":
        # do something (first)
        print("first")
    case "second":
        # do something (second)
        print("second")
    case "third":
        # do something (third)
        print("third")
        # do more stuff
        # ...
    case "n":
        # do something (n)
        print("n")
    case _:
        # nothing else matched, do this now
        print("Nothing else matched!")
```

Examples

Note: “ | ” means “**or**”

```
character = 'M'

match character:
    case 'A' | 'Z':
        print("character is A or Z")
    case 'B' | 'D':
        print("character is B or D")
    case 'C' | 'M':
        print("character is C or M")
```

```
character = 'V'

match character:
    case 'A' | 'Z':
        print("character is A or Z")
    case 'B' | 'D':
        print("character is B or D")
    case 'C' | 'M':
        print("character is C or M")
    case _:
        print("Unknown character given")
```

More Examples (complex ones)

```python
def alarm(item):
    match item:
        case ['evening', action]:
            print(f'You almost finished the day! Now {action}!')
        case [time, action]:
            print(f'Good {time}! It is time to {action}!')
        case _:
            print('The time is invalid.')
```

```python
alarm(['evening', 'play video games'])
```

```
You almost finished the day! Now play video games!
```

```python
alarm(['evening', 'work'])
```

```
You almost finished the day! Now work!
```

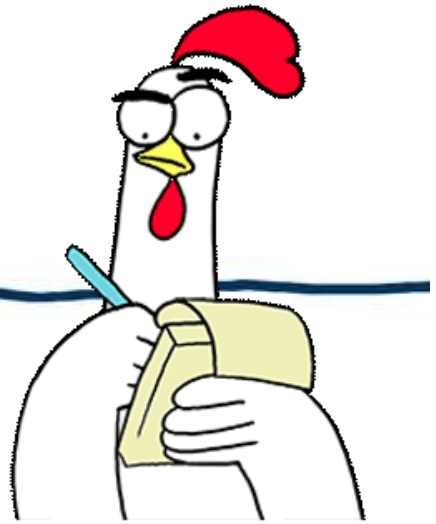
```python
def alarm(item):
    match item:
        case ['evening', action] if action not in ['work', 'study']:
            print(f'You almost finished the day! Now {action}!')
        case ['evening', _]:
            print('Come on, you deserve some rest!')
        case [time, action]:
            print(f'Good {time}! It is time to {action}!')
        case _:
            print('The time is invalid.')
```

```python
alarm(['evening', 'study'])
```

```
Come on, you deserve some rest!
```

Resource: medium – towardsdatascience

More on Match-Case statements



- Snippet taken from geeksforgeeks

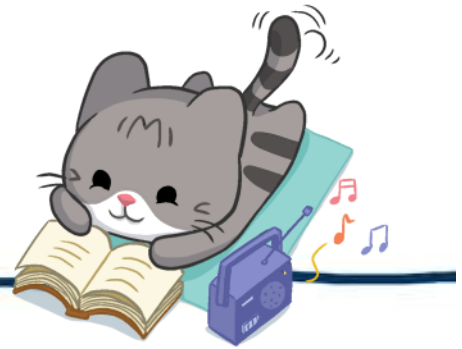
Q: How does the match-case statement differ from if-elif-else statements?

A: The match-case statement is a more powerful and expressive construct compared to if-elif-else statements. While if-elif-else statements rely on boolean expressions, match-case statements can match patterns based on the structure and value of the data. Match-case statements provide a more structured and readable way to handle multiple conditions and perform different actions based on those conditions.

Q: What are the benefits of using the match-case statement?

A: The match-case statement offers several benefits, including:

- Conciseness: Match-case statements allow you to express complex branching logic in a concise and readable manner.
- Readability: Pattern matching makes the code more readable and self-explanatory, as it closely resembles the problem domain.
- Safety: Match-case statements provide exhaustive pattern matching, ensuring that all possible cases are handled.



Python Demonstration

Let's jump on PyCharm!

`match_case.py`

Mutability

Mutability

- In Python, as in some other languages, data structures are either ***mutable*** or ***immutable***.
  - Mutable: the values of the structure *can* be changed
  - Immutable: the values of the structure *cannot* be changed (the opposite)

- Learning which structures are which is vital for writing good code and selecting appropriate data structures to use. Additionally, you can be mindful of how to use immutable data types.

- A **list** is a *data structure* that is mutable
- The **string** *data type* is immutable

Mutability (think "mutate" … changeable)

- A collection is **mutable** if I can **reassign** a value at an index **without** creating a new copy of the collection.
- A collection is **immutable** if it **can not** be **changed** without creating a brand new copy of the collection.

- A **list** is a *data structure* that is mutable
- The **string** *data type* is immutable

Properties of some collections

Type	Stores	Syntax	Mutable?
Range	ints	`range(3,7)`	no
String	characters	`"Hello", "abc 123"`	no
List	anything	`[1,2,3,6,"hello"]`	yes
Tuple	anything	`(1,2,3,6,"hello")`	no
Dictionary	key:value pairs	`{17:"hi", 29:"bye"}`	yes
Set	anything	`{1,2,6,"hi"}`	yes

Mutability as it relates to memory

- We can change a value stored in a *variable* that is of an **immutable** type
  - However, that new "value" is stored in a **new memory location**.
- We can get a variables memory location using `hex(id(var_name))`
- Example:

```
my_str = "Hello World"
print(my_str, "\ttype:", type(my_str), "\tstored at:", hex(id(my_str)))
my_str = my_str.upper()
print(my_str, "\ttype:", type(my_str), "\tstored at:", hex(id(my_str)))
```

- <u>Prints</u>: (notice the *address has changed*)

```
Hello World     type: <class 'str'>     stored at: 0x1eb39bf2530
HELLO WORLD     type: <class 'str'>     stored at: 0x1eb39bf5330
```

Mutability as it relates to memory

The same is *not* true for **lists**:

If we change the first element of ***my_list*** *to a 9…*

```
my_list = [8, 6, 7, 5, 3, 0, 9]
print(my_list, "\ttype:", type(my_list), "\tstored at:", hex(id(my_list)))
my_list[0] = 9
print(my_list, "\ttype:", type(my_list), "\tstored at:", hex(id(my_list)))
```

Prints:

(the address is **still the same**!)

```
[8, 6, 7, 5, 3, 0, 9]   type: <class 'list'>    stored at: 0x1eb39bf2c88
[9, 6, 7, 5, 3, 0, 9]   type: <class 'list'>    stored at: 0x1eb39bf2c88
```

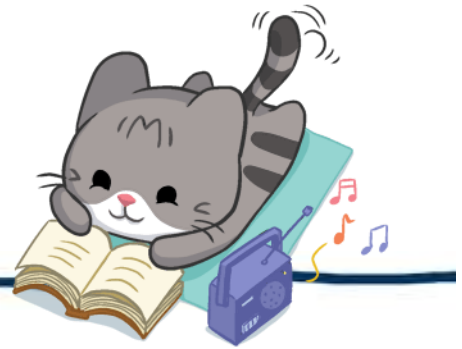
Let's look at the **string** data type

- In Python, **strings are immutable**
- That is, they *cannot* be mutated or changed

- You can swap out a whole string for another (this is OK). You can assign strings to variables, and reassign new strings to the same variable, but individual ***characters*** within a string ***cannot*** be reassigned.
- Example:

```
1  greeting = "hi there!"
2  greeting[0] = "H"
3  print(greeting)
```

```
Error: Line 2
TypeError: 'str' does not support item assignment on line 2
```



Python Demonstration

Let's jump on PyCharm!

`mutability_examples.py`

`mutability_exercise.py`

Reminder: CS Laptop Loaner Program

- This course requires students to have a **laptop**
- I realize that not everybody might have one (nor necessarily need one for their desired major / path…)
- If you do not have a laptop for any reason… ***not to worry!***
- The CS department's Systems staff has a notebook / laptop loaner program and will be able to loan you a notebook / laptop computer for the duration of the semester if you don't have one or if you cannot afford one.
  - Also available if your laptop is broken and under repair, we can arrange for you to receive a loaner laptop for a week or two until your own laptop is fixed

Interested? Link: https://www.cs.virginia.edu/wiki/doku.php?id=cs_laptop_loaner

I am happy to be your sponsor. Please let me know.