

CS 146 Fall 2025 – Quiz 8 “Cheat Sheet”

Numeric Operators

+, -, /, *, **: Addition, subtraction, division, multiplication, power

//: Floor division: Round division result down to nearest whole number

%: Modulo: Evaluate to remainder of division

Comparison Operators

==, !=: Equals, not equals

>, >=, <, <=: Greater than, greater than or equals, less than, less than or equals

Boolean Operators

not op, op1 and op2, op1 or op2: Logical NOT of op, AND of op1 and op2, OR of op1 and op2

Indexing Operator

seq[idx]: Item of seq at index idx

seq[start:stop[:step]]: Subsequence of seq from inclusive start to exclusive stop by step

Precedence:

parentheses > indexing > ** > negate > *,/,//,% > +,- > comparisons > not > and > or

Range

range(stop): Equivalent to range(0, stop, 1)

range(start, stop[, step]): Create sequence of integers from inclusive **start** to exclusive **stop** by **step**

Input

- Reading input from the user
input(message): Displays message to the user and returns what the user typed as a string
- Reading from a file with a for loop
with open(filename, "r") as file:
 for line in file:
 # do something with line (a string)

Built-in functions

abs(a): Return absolute value of number a

Strings

- The following functions are built-in
len(string): Returns the number of characters in the string
int(string), float(string): Converts numeric string to int or float
str(object): Converts object, e.g. int or float to a string
sorted(string): Returns the characters of the string as a list in sorted order
- String object methods
count(some_string): Return number of occurrences of **some_string** in the string
index(some_string): Returns the index of the first occurrence of **some_string** or error if it does not occur
upper(), lower(), capitalize(): Returns a new upper or lower-cased, or 1st letter upper-cased string
find(some_string): Returns the first index that **some_string** occurs at in the string or -1 if not found
find(some_string, index): Same as above, but starts searching at index
replace(old, new): Return a copy of the string with all occurrences of old substituted with new
startswith(prefix): Returns **True** if the string starts with prefix, False otherwise
endswith(suffix): Returns **True** if the string ends with suffix, False otherwise
strip(): Returns a copy of the string with only the leading and trailing whitespace removed
split(): Return a list of the words in the string using whitespace as the delimiter
isalpha(): Return **True** if all characters in string are alphabetical and the string has at least one character

- String operators
 - string1 + string2**: Returns a new string that is the concatenation of string1 and string2
 - string * int**: Returns a new string that is string repeated int times
 - substr in string**: Returns True if substr is a substring of string, False otherwise

Lists

- Creating new lists
 - []** creates empty list
 - [object1, object2, ...]** creates list containing objects
 - list(iterable)** creates a list from any iterable object (e.g., range, string)
- The following functions are built-in
 - len(list)**: Returns the number of elements in list
 - sum(list), min(list), max(list)**: Returns the sum, min, or max of elements in list
 - sorted(list)**: Returns a new copy of the list in sorted order
- List object methods
 - count(item)**: Returns the number of occurrence of item in the list
 - index(item)**: Returns the index of the first occurrence of item in the list or error if it does not occur
 - append(x)**: Adds x to the end of the list
 - extend(other_list)**: Adds all elements of other_list to the end of the list
 - index(item)**: Returns the index of the first occurrence of item in the list or error if it does not occur
 - insert(index, x)**: Insert x before index in the list
 - pop()**: Removes the item at the end of the list and returns it
 - pop(index)**: Removes item at index from the list and returns it
 - remove(value)**: Remove first occurrence of value from list
 - reverse()**: Reverses the elements in the list in place
 - sort()**: sorts the elements in the list in place
- List operators
 - list1 + list2**: Returns a new list that contains the elements of list1 followed by the elements of list2
 - list * int**: Returns a new list that contains the items in list repeated int times
 - item in list**: Returns True if item is an element of list, False otherwise

Sets

- Creating new sets
 - set()** creates empty set
 - {elt1, elt2, ...}** creates a new set with the given elements
 - set(iterable)** creates a set from any iterable object (e.g., string, list)
- The following functions are built-in and answer questions about sets
 - len(set)**: Returns the number of elements in the set
- Set object methods
 - add(elt)**: Adds elt to the set
 - clear()**: Removes all elements from the set
 - pop()**: Removes an arbitrary element from the set and returns it
 - remove(elt)**: Removes elt from the set
 - union(set2)**: Returns new set with union of itself and set2
 - update(set2)**: Update itself with union of itself and set2
- Set operators
 - elt in set**: Returns True if elt is an element of set, False otherwise
 - set1 < set2**: Returns True if set1 is a proper subset of set2 (every element of set1 is in set2 and set1 != set2)
 - set1 | set2**: Returns union of the two sets (new set with elements from both set)

set1 & set2: Returns intersection of the two sets (new set with only elements common to both sets)
set1 - set2: Returns set difference (new set with elements set1 not in set2)
set1 ^ set2: Returns set symmetric difference (new set with elements in set1 or set2 but not both)

Dictionaries

- Creating new dictionaries
`{}` creates empty dictionary
`{key1:value1, key2:value2, ...}` creates a new dictionary with key-value pairs
- The following functions are built-in and answer questions about dictionaries
len(dict): Returns the number of entries (key-value pairs) in the dictionary
- Dictionary object methods
clear(): Removes all entries from the dictionary
keys(): Returns an iterable object of all the keys in the dictionary
values(): Returns an iterable object of all the values in the dictionary
items(): Returns an iterable object of all (key, value) tuples in the dictionary
get(key[, item]): Returns value associated with **key** if in dictionary, **item** otherwise. **item** defaults to None.
- Dictionary operators
item in dict: Returns True if **item** is in the keys of **dict**, False otherwise

Tuples

- Creating new tuples
`()` creates empty tuple
`(object1, object2, ...)` creates tuple containing objects
- The following functions are built-in and answer questions about tuples
len(tuple): Returns the number of elements in the tuple
- Tuple operators
item in tuple: Returns True if **item** is contained in **tuple**, False otherwise
tuple1 + tuple2: Returns a new tuple that is the concatenation of **tuple1** and **tuple2**

Classes

- Define a class **DerivedClass** that inherits/derives from **BaseClass**

```
class DerivedClass(BaseClass):  
    def __init__(self, x):  
        # Initialize instance variables, e.g.  
        self.x_coord = x  
  
    def a_method(self, y):  
        # ...
```
- Create an instance of a class: **DerivedClass(4)**
- **print** uses the **__str__** method
- Operators **+**, **-**, *****, **/** map to methods **__add__**, **__sub__**, **__mul__**, **__truediv__**
- Operators **==**, **!=**, **<**, **<=**, **>**, **>=** map to methods **__eq__**, **__ne__**, **__lt__**, **__le__**, **__gt__**, **__ge__**

Modules

- **turtle** module
forward(dist), backward(dist): Move the turtle forward/backward by the length **dist**. Doesn't change heading.
right(angle) left(angle): Turn the turtle right/left by **angle** (in degrees)
goto(x, y): Move turtle to position **x**, **y**
setheading(angle): Set the turtles heading to **angle**
circle(radius): Draw a circle with specified **radius**; the center is **radius** above the starting position

dot(size): Draw a filled circle with diameter `size` centered on current position of the turtle

penup(): Pull the pen up – no drawing when moving

pendown(): Put the pen down – drawing when moving

fillcolor(color): Change the fill color to `color`, where `color` is a string

begin_fill(), end_fill(): Start and end filling shapes with fill color

- **random** module

randint(a, b): Return a random integer `N` such that $a \leq N \leq b$

uniform(a, b): Return a random floating point number `N` such that $a \leq N \leq b$

- **math** module

sqrt(num): Return the square root of `num`

pow(x, y): Return `x` to the power of `y` (i.e. `x ** y`)