

Structures: Strings

**CPSC 231: Introduction to Computer Science for Computer Science
Majors I
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Jonathan Hudson, Ph.D.
Instructor
Department of Computer Science
University of Calgary

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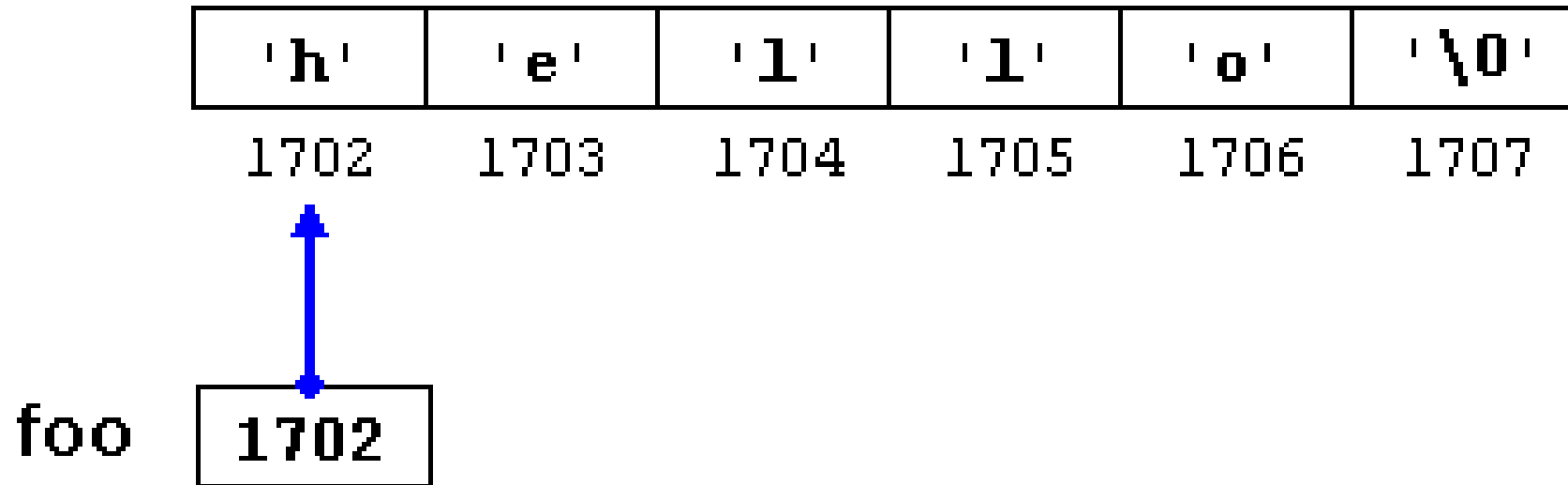
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Strings

- Strings are basically wrappers of an immutable tuple of character symbols
- In non-Python Strings are just a type of list
- Ex.
`foo = "hello"`



String creation

Strings

- Strings are immutable. Meaning, their values cannot change after it has been created.
- Ex.

```
greeting = "Hello, world!"  
greeting[0] = 'J' # ERROR!  
print(greeting)
```

↓
Do this instead

```
greeting = "Hello, world!"  
newGreeting = 'J' + greeting[1:]  
print(newGreeting)  
print(greeting)
```



Jello, world!
Hello, world!

Creating String Variables

- **Form:** `var = ""`
 - The string object must be enclosed with either a single quote (') or double quote (").
 - Single quote and double quote are interchangeable: "Hello World!" == 'Hello World!'
- If your string object contains single quotes, then enclose it with double quotes, or vice versa:

```
myStr1 = "Jonathan's lecture ROCKS!"
```

```
myStr2 = 'The students agreed: "Yes, it does!"'
```

Creating String Variables

- Use triple single quote (""") or double quote ("""") to create a string that spans multiple lines.

```
myStr3 = '''hello  
        my name is Jonathan'''
```

Accessing characters

Accessing Single String Characters

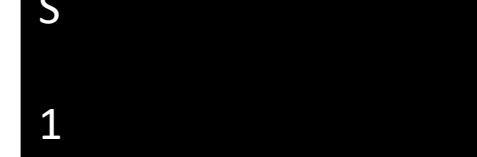
- Using **indexing operator** you can access a single character from a string.
- Python uses square brackets to enclose the index

```
Course = "CPSC 231"  
m = Course[2]  
print(m)
```

Index

```
lastchar = Course[-1]  
print(lastchar)
```

0	1	2	3	4	5	6	7
C	P	S	C		2	3	1
-8	-7	-6	-5	-4	-3	-2	-1



```
S  
1
```


Escaping

Escaping Characters

- `\\` → Backslash (keeps `\`)
 - `\'` → Single quote (keeps `'`)
 - `\"` → Double quote (keeps `"`)
 - `\n` → Newline, end of line
 - `\t` → Horizontal tab
 - ...
-
- When Python sees the backslash (`\`), it treats the following character as a part of string

Escaping Characters

- Sometimes, you need to include special characters in your string, such as backslash (\), single quote, double quote, newline (\n), tab (\t), etc.
- Ex. I want to print the string *She said, "It's a beautiful morning!"* and a newline afterwards.

```
>>>print("She said, "It's a beautiful morning! "\n")  
SyntaxError: invalid character in identifier
```

- backslash \ is used to indicate that the character is part of the string and to indicate the special character *newline* (\n)

```
>>>print("She said, \"It's a beautiful morning!\"\n")  
She said, "It's a beautiful morning!"
```

Concatenation

String Concatenation

- Combine two or more strings together
- Example appending the last name “**Smith**” to the first name “**John**”

```
print('John', 'Smith')  
print('John'+ 'Smith')
```



What is the difference between these calls?

```
>>> print('John', 'Smith')  
John Smith  
>>> print('John'+ 'Smith')  
JohnSmith
```

Formatting

String Formatting – Old-old-school way

- This original way of formatting strings:

```
>>>name = input("What is your name hooman?")
```

```
Jonathan
```

```
>>>print("Hello %s!" % (name))
```

%s a place holder of string type

% marks the start of the format specifier

```
'Hello Jonathan!'
```

String Formatting – Old-school way

- This next way of formatting strings:

```
>>>name = input("What is your name hooman?")
```

```
Jonathan
```

```
>>>print("Hello {}".format(name))
```

{} is a placeholder

Format function takes arguments that are each variable to fill into each placeholder

```
'Hello Jonathan!'
```


String Formatting – New-school way

- This new way of formatting strings:

```
>>>name = input("What is your name hooman?")
```

```
Jonathan
```

```
>>>print(f"Hello {name}")
```

f-string

Variable name filled into {}

```
'Hello Jonathan!'
```

String Formatting – Float Formatting

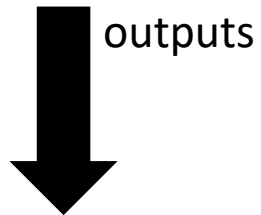
- You can format floats to have specific width (padding) and precision.

width is 10

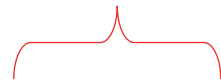
precision is 3

```
someValue = 12.12345
```

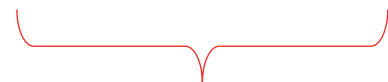
```
print("someValue = %10.3f" % (someValue))
```



Precision = 3



```
someValue = 12.123
```



width = 10

Operations

String Operations - Illegal

```
message - 1  
"Hello" / 123  
"15" + 2
```

**Most
simple
expressions
illegal**

String Operations - Concatenation

```
message - 1  
"Hello" / 123  
"15" + 2
```

**Most
simple
expressions
illegal**

```
fruit = "banana"  
bakedGood = " nut bread"  
print(fruit + bakedGood)
```

**Legal
concatentation**

String Operations

```
message - 1  
"Hello" / 123  
"15" + 2
```

↘ Illegal

```
fruit = "banana"  
bakedGood = " nut bread"  
print(fruit + bakedGood)
```

↙ concatenation

```
print("Go" * 6)
```

GoGoGoGoGoGo

```
name = "Dinos"  
print(name * 3)
```

DinosDinosDinos

```
print(name + "Go" * 3)
```

DinosGoGoGo

```
print((name + "Go") * 3)
```

DinosGoDinosGoDinosGo



Methods

String Methods

- NOTE: A method is a function that is associated with a specific object/class.

```
ss = "Hello, World"  
print(ss.upper())  
  
print(ss.lower())
```



```
HELLO, WORLD  
  
hello, world
```

- Other functions include:
 - capitalize, join, strip, count, center, replace, ljust, rjust, find, rfind, ...
 - For more details, refer to: <https://docs.python.org/3/library/stdtypes.html>

String Methods - *count()*, *strip()*, and *replace()* Examples

```
ss = "    Hello, World    "
```

```
els = ss.count("l")
```

```
print(els)
```

```
print("***" + ss.strip() + "***")
```

```
print("***" + ss.lstrip() + "***")
```

```
print("***" + ss.rstrip() + "***")
```

```
news = ss.replace("o", "***")
```

```
print(news)
```

Outputs

```
3
***Hello, World***
***Hello, World    ***
***    Hello, World***
    Hell***, W***rld
```

Slicing

String Methods - The Slice Operator

- A substring of a string is called a **slice**.

```
singers = "Peter, Paul, and Mary"  
print(singers[0:5])  
print(singers[7:11])  
print(singers[17:21])
```



```
Peter  
Paul  
Mary
```

- The slice operator [n:m] returns the part of the string from the n'th character to the m'th character.
- Including the first but excluding the last.

String Methods - The Slice Operator

n and m are optional, their default values are 0 and len(str)-1, respectively

```
name = "CPSC 231"
```

```
print(name[:])
```

```
print(name[3:])
```

```
print(name[:6])
```



```
CPSC 231
C 231
CPSC 2
```

If n or m have values larger than the length of the string, no error is returned

```
name = "CPSC 231"
```

```
print(name[100:200])
```

```
print(name[:200])
```

```
print(name[100:])
```



```
' '
```

```
'CPSC 231'
```

```
' '
```

String Methods - The Slice Operator

```
name = "CPSC 231"  
print(name[-1:])  
print(name[: -1])  
print(name[-8: -1])
```



```
1  
CPSC 23  
CPSC 23
```

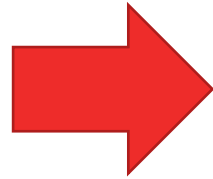
n and m can be negative values

split()

String Methods - *split()*

- The `split()` function takes a string argument (delimiter) returns a list of words of the original string split on this delimiter.

```
a = "this is a string"  
a = a.split(" ")  
print(a)
```




```
['this', 'is', 'a', 'string']
```

len()

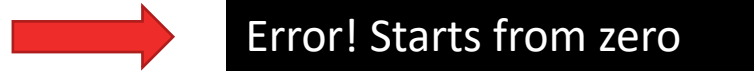
The *len()* function

`len(str)` returns the number of characters in a given string.

```
fruit = "Banana"  
print(len(fruit))
```

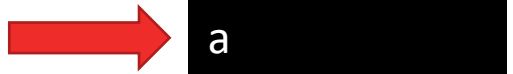


```
fruit = "Banana"  
sz = len(fruit)  
last = fruit[sz] # ERROR!  
print(last)
```



Error! Starts from zero

```
fruit = "Banana"  
sz = len(fruit)  
last = fruit[sz-1]  
print(last)
```



a

Examples

Example

```
def replaceSpaces(text, replacement) :  
    result = ""  
    for ch in text :  
        if (ch == ' ') :  
            result = result + replacement  
        else :  
            result = result + ch  
    return result
```

```
print(replaceSpaces("ab ra cad abra", "*"))
```



ab*ra*cad*abra

```
def countFor1(theString, theChar) :
    counter = 0
    for ch in theString:
        if (ch == theChar) :
            counter += 1
    return counter

def countFor2(theString, theChar) :
    counter = 0
    for index in range(len(theString)):
        if (theString[index] == theChar) :
            counter += 1
    return counter

def countWhile(theString, theChar) :
    counter = 0
    index = 0
    while index < len(theString) :
        if (theString[index] == theChar) :
            counter += 1
        index += 1
    return counter

print(countFor1("abracadara", "a"))
print(countFor2("abracadara", "a"))
print(countWhile("abracadara", "a"))
```



5
5
5

Onward to ... file and exceptions.

Jonathan Hudson
jwhudson@ucalgary.ca
<https://pages.cpsc.ucalgary.ca/~hudsonj/>

