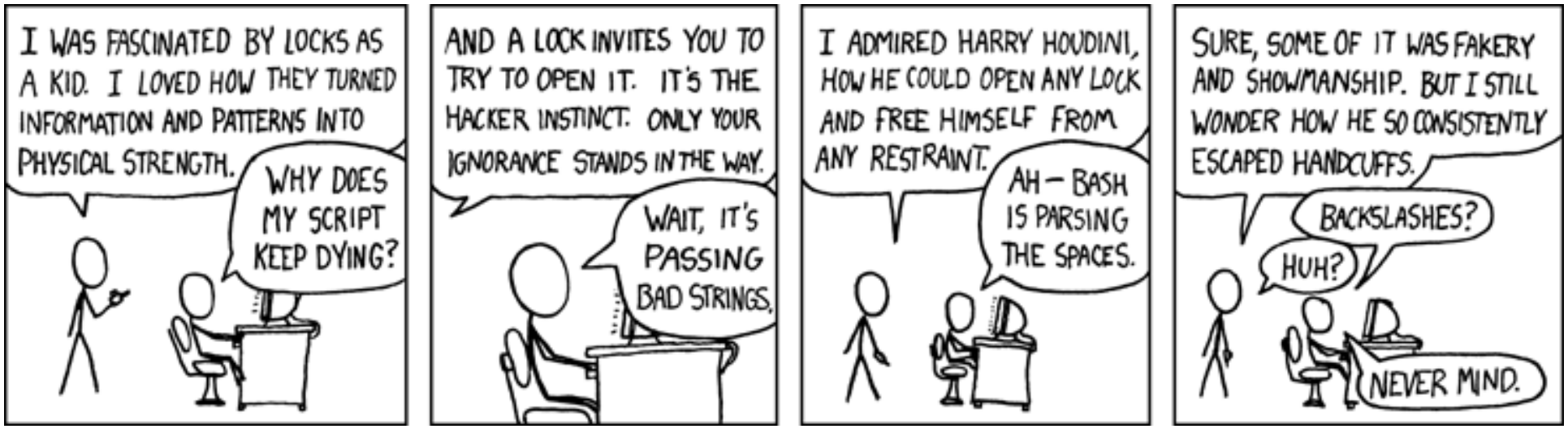
CSc 110, Spring 2017

Lecture 10: Strings

Adapted from slides by Marty Stepp and Stuart Reges



Cumulative sum answer - Review

```
# This program enhances our Receipt program using a cumulative sum.
def main():
    subtotal = meals()
    results(subtotal)

# Prompts for number of people and returns total meal subtotal.
def meals():
    people = float(input("How many people ate? "))
    subtotal = 0.0;              # cumulative sum

    for i in range(1, people + 1):
        person_cost = float(input("Person #" + str(i) +
                          ": How much did your dinner cost? "))
        subtotal = subtotal + person_cost;  # add to sum
    return subtotal
...
```

Cumulative answer, cont'd.

```
# Calculates total owed, assuming 8% tax and 15% tip
def results(subtotal):
    tax = subtotal * .08
    tip = subtotal * .15
    total = subtotal + tax + tip

    print("Subtotal: $" + str(subtotal))
    print("Tax: $" + str(tax))
    print("Tip: $" + str(tip))
    print("Total: $" + str(total))
```

Strings

- **string**: a sequence of characters

  name = **"text"**
  name = **expression**

  - Examples:

```
name = "Daffy Duck"
x = 3
y = 5
point = "(" + str(x) + ", " + str(y) + ")"
```

Indexes

- Characters of a string are numbered with 0-based *indexes*:

```
name = "Ultimate"
```

index	0	1	2	3	4	5	6	7
	-8	-7	-6	-5	-4	-3	-2	-1
character	U	l	t	i	m	a	t	e

  - First character's index : 0
  - Last character's index : 1 less than the string's length

Indexes

- You can access a character with **string**`[`**index**`]`:

```
name = "Merlin"
print(name[0])
```

Output: `M`

`name[0]` produces a string of length 1

Subscripting

- Syntax:

  `part = string[start:stop]`

  produces a substring of **string**, including **start**, excluding **stop**

- Example:

```
s = "Merlin"
mid = [1:3]      # characters from position 1 (included)
                 # to position 3 (excluded)
```

- `mid` is the following string:

  `"er"`

Subscripting

- If you want to start at the beginning you can leave off the start position

```
s = "Merlin"
mid = [:3]      # characters from the beginning to position 2
```

Produces the string

```
"Mer"
```

- If you want to stop at the end you can leave off the stop position

```
mid = [1:]      # characters from position 1 to the end
```

Produces the string

```
"erlin"
```

Built-in `String` function - length

- Syntax:

```
length = len(string)
```

- Example:

```
s = "Merlin"
count = len(s)     # 6
```

Note: Not all "functions" defined for strings are built-in

`String` methods

- Some functions are associated with a specific data type, but are not part of the built-in set of functions
- Such functions are called methods
- Special syntax is used to call methods (dot notation)

```
s = "Merlin"
s.lower()     # merlin
```

`String` methods

Method name	Description
`find(`**`str`**`)`	index where the start of the given string appears in this string (-1 if not found)
`substring(`**`index1`**`, `**`index2`**`)` or `substring(`**`index1`**`)`	the characters in this string from *index1* (inclusive) to *index2* (exclusive); if *index2* is omitted, grabs till end of string
`lower()`	a new string with all lowercase letters
`upper()`	a new string with all uppercase letters

- These methods are called using the dot notation shown below:

```
starz = "Biles & Manuel"
print(starz.lower())              # biles & manuel
print(starz.find("Manuel"))       # 8
```

`String` method examples

```
# index      012345678901
s1 = "Oliver Twist"
s2 = "Merlin The Cat"

print(s1.find("r"))       # 5
print(s2.lower())         # "merlin the cat"
```

- Given the following string:

```
# index  012345678901234567890123
book =  "Building Python Programs"
```

  - How would you extract the word `"Python"` ?

Modifying strings

- String methods like `lowercase` build and return a new string, rather than modifying the current string.

```
s = "Aceyalone"
s.upper()
print(s)    # Aceyalone
```

- To modify a variable's value, you must reassign it:

```
s = "Aceyalone"
s = s.upper()
print(s)    # ACEYALONE
```

Looping through a string

- You can use a `for` loop and indexes to print each character in a string:

```
major = "CSc";
for letter in range(0, len(major)):
    print(major[letter:letter + 1])
```

- You can also use a `for` loop to print or examine each character without range:

```
major = "CSc";
for letter in major:
    print(letter)
```

Output:

```
C
S
c
```

ALLISON
LLISON
LISON
ISON
SON
ON
N
A
AL
ALL
ALLI
ALLIS
ALLISO
ALLISON
OBOURN
BOURN
OURN
URN
RN
N
O
OB
OBO
OBOU
OBOUR
OBOURN

Name border

- Prompt the user for full name
- Draw out the pattern to the left
- This should be resizable. Size 1 is shown and size 2 would have the first name twice followed by last name twice

Strings question

- Write a program that reads two people's first names and suggests a name for their child

Example Output:

```
Parent 1 first name? Danielle
Parent 2 first name? John
Child Gender? f
Suggested baby name: JODANI

Parent 1 first name? Danielle
Parent 2 first name? John
Child Gender? Male
Suggested baby name: DANIJO
```

String methods that produce True or False

Operation	Description
`startswith(`**`str`**`)`	whether one contains other's characters at start
`endswith(`**`str`**`)`	whether one contains other's characters at end

```
name = "Voldermort"
if(name.startswith("Vol")):
    print("He who must not be named")
```

- The `in` operator can be used to test if a string contains another string.

  example: `"er" in name` **`# true`**

`Strings` and `ints`

- All characters are assigned numbers internally by the computer, called *ASCII* values.

  - Examples:
    `'A'` is 65, `'B'` is 66, `' '` is 32
    `'a'` is 97, `'b'` is 98, `'*'` is 42

  - We can get the ASCII value of a `String` of length 1 using `ord(str)`
    `ord('a')` is 97

  - The function `chr(n)` returns the character represented by the ASCII value n
    `chr(66)` is 'B'

  - This is useful because you can do the following:
    `chr(ord('a' + 2))` is `'c'`

`String` question

- A *Caesar cipher* is a simple encryption where a message is encoded by shifting each letter by a given amount.
  - e.g. with a shift of 3, A → D, H → K, X → A, and Z → C

- Write a program that reads a message from the user and performs a Caesar cipher on its letters:

```
Your secret message: Brad thinks Angelina is cute
Your secret key: 3
The encoded message: eudg wklqnv dqjholqd lv fxwh
```

Strings answer

```
# This program reads a message and a secret key from the user and
# encrypts the message using a Caesar cipher, shifting each letter.
def main():
    message = input("Your secret message: ")
    message = message.lower()
    key = int(input("Your secret key: "))
    encode(message, key)

# This method encodes the given text string using a Caesar
# cipher, shifting each letter by the given number of places.
def encode(text, shift):
    print("The encoded message: ")
    for letter in text:
        # shift only letters (leave other characters alone)
        if (letter >= 'a' and letter <= 'z'):
            letter = chr(ord(letter) + shift)
            # may need to wrap around
            if (letter > 'z'):
                letter = chr(ord(letter) - 26)
            elif (letter < 'a'):
                letter = chr(ord(letter) + 26)
        print(letter, end='')
    print()
```