CS 1112: Introduction To Programming

Strings II

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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***
- Remember to always be **kind**, **respectful**, **supportive**, **compassionate** and **mindful of others**! ☺
- 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
  - *Contact us!* *We will work with you!*
  - Get some rest ☺
  - View the recorded lectures – *please allow 24-48 hours to post*

Announcements

- **PA04** is due by 11:00pm on Wednesday (***March 19 ~ After Spring Break***)!
  - Submit on Gradescope: your **.py** file, and a **PDF** of your reflection
  - Please be mindful about submitting the right kind of files (.py file and .pdf file) as well as submitting the .py file that is named correctly (see assignment document for full details)
  - A note about submitting on Gradescope: you can submit an **UNLIMITED** number of times prior to the deadline. Look at the score you got, if you have some points taken off, that's ok, go back and fix your code and resubmit! Do this as often as you like BEFORE the assignment deadline. You cannot resubmit after the deadline.
  - ***REMEMBER ALSO***: You have a grace period of 24 hours to submit your PAs!
- **Quiz 5** will come out this week (probably 3/5) and due Monday (***March 17 ~ After Spring Break***)

Exam 1

- **Exam 1** is ***being graded***!
- Results will be on both Sherlock and Canvas grades
- Most students including our TAs have many midterms this week before the break
- **So, Exam 1 grades will be returned after the break, so grading is done accurately and not rushed**

Reminder: Python Strings: Basics

- Strings as collections:
  - Collection of characters
  - **Order** matters
  - Repetition (of characters) is ok
  - Each character is assigned a particular index, starting at index zero (0)

hello
0 1 2 3 4

0	1	2	3	4	5	6
A	S	T	R	I	N	G

-7	-6	-5	-4	-3	-2	-1
A	S	T	R	I	N	G

```
X = "hello"
X[i] gives the ith
character in the
string (starts at 0)

X[0] = first character
     = "h"
```

Reminder: Indexing details

- (Using the example, s = ‘wilson’)
- Start counting at 0 (**positive** indices)
  - `s[0]` is ‘w’
    - Read as “s sub 0” or “s of 0”
    - “*The zeroth character of s*”
  - `s[1]` is ‘i’
  - `s[2]` is ‘l’
  - (Indices are always **integers**, if you tried `s[1.0]` it will give you an error)
- `len(s)` gives the number of things in the collection
  - `len(s)` is 6
- Use **negative** indices to count from the ***end***.
  - `s[-1]` is ‘n’
  - `s[-2]` is ‘o’

Wilson the Volleyball
From the movie **Cast Away** (2000)

Reminder: More on String Indexing

- Consider the string "Bananas"

Positive Index	0	1	2	3	4	5	6
Letter	**B**	**A**	**N**	**A**	**N**	**A**	**S**
Negative Index	-7	-6	-5	-4	-3	-2	-1

- The table shows the positive and negative index of each letter

- The **largest** positive index of a string is the length of the string **minus 1**
  - Example, in the above, the largest index of the string is **6**
- The **smallest** index is the negative value of the length
  - Example, in the above, the smallest index is **-7**

Python Demonstration

Let's jump on PyCharm!

Solution to: `strings_ica1.py`

Let's review the solution to the last in-class "lab" activity.

Slicing

- **Indexing** is how to get one thing out of a collection
- **Slicing** is how to get a chunk out of a collection (multiple contiguous items)
  - Give it a **start** index and an **end** index
  - Evaluates to a new collection from **start** (*inclusive*) to **end** (*exclusive*)
  - If S is a string, here's the syntax:

```
S[start:stop:step]
```

Start position *End position* *The increment*

  - This returns the portion of the string from index **start** to index **stop**, at a step size **step**.
  - **Fun trick** with slicing: **Reversing a string**: `my_string[: : -1]` # full index range, backwards!

Examples and images from *learnbyexample*

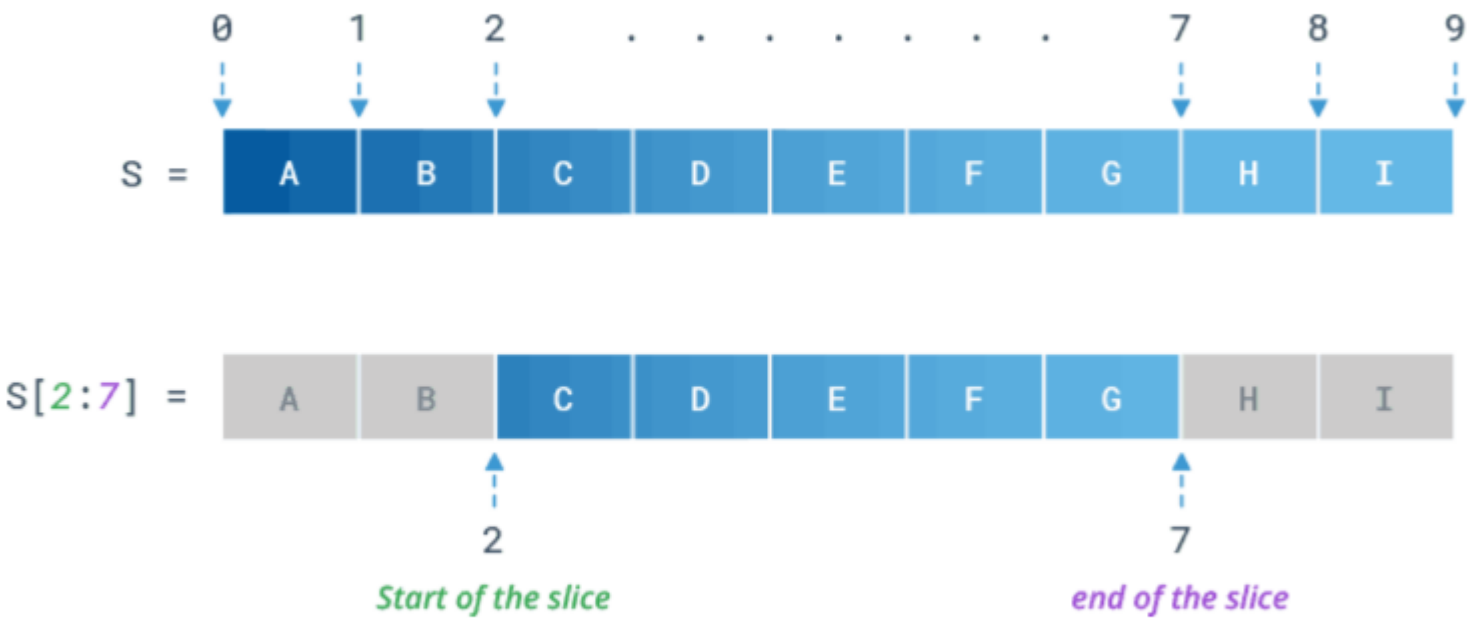
String/List slicing [::] method

- `str1[start:stop]` # from **start** (incl.) to **stop** (excl.) (through stop-1)
- `str1[start:]` # from **start** (incl.) through the **end** of the collection
- `str1[:stop]` # from the **beginning** through to **stop** (excl.) (through stop-1)
- `str1[:]` # a **copy** of the whole array
- `str1[start:stop:step]` # from **start** (incl.) to **stop** (excl.) (through stop-1), keeping every $step^{th}$ item

Slicing a String:

```
s[2:7]  # CDEFG
```

```
s = 'ABCDEFGHI'
print(s[2:7])   #  CDEFG
```

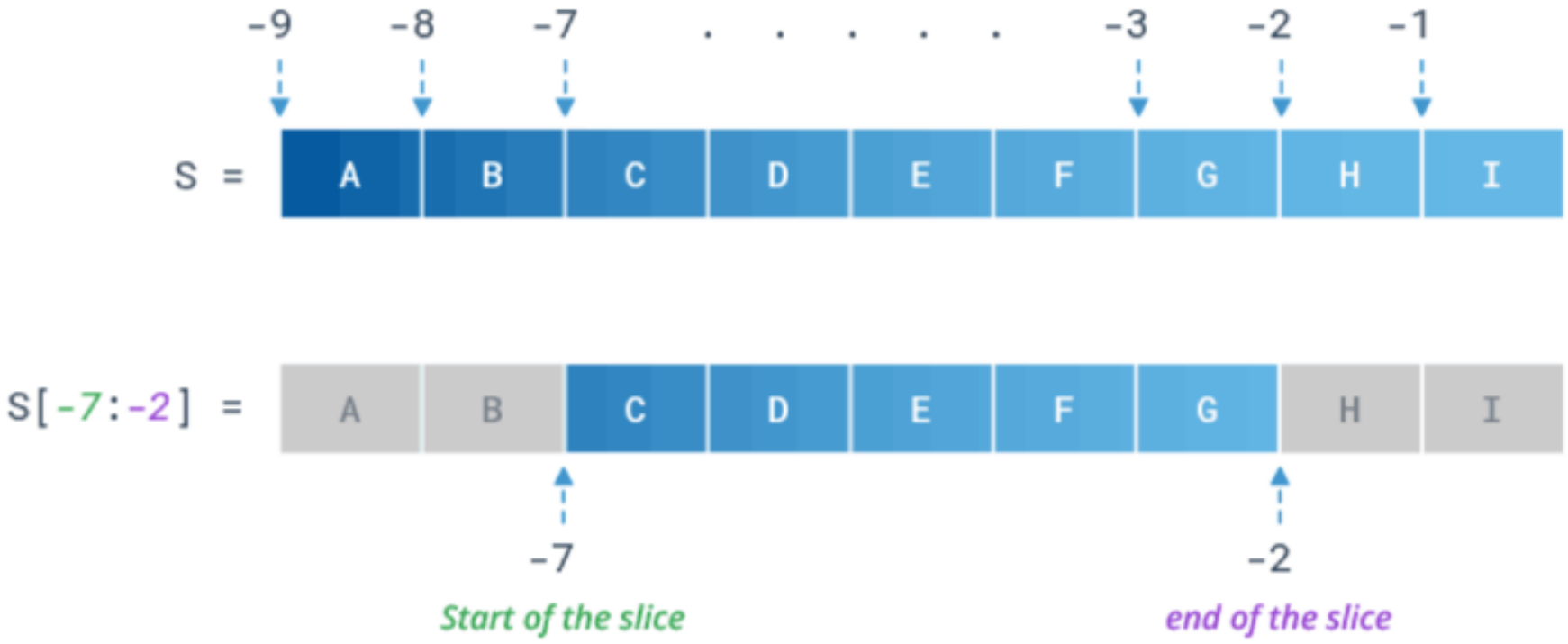


Note that the item at index 7 `'H'` is not included.

Examples and images from *learnbyexample*

Slice with Negative Indices

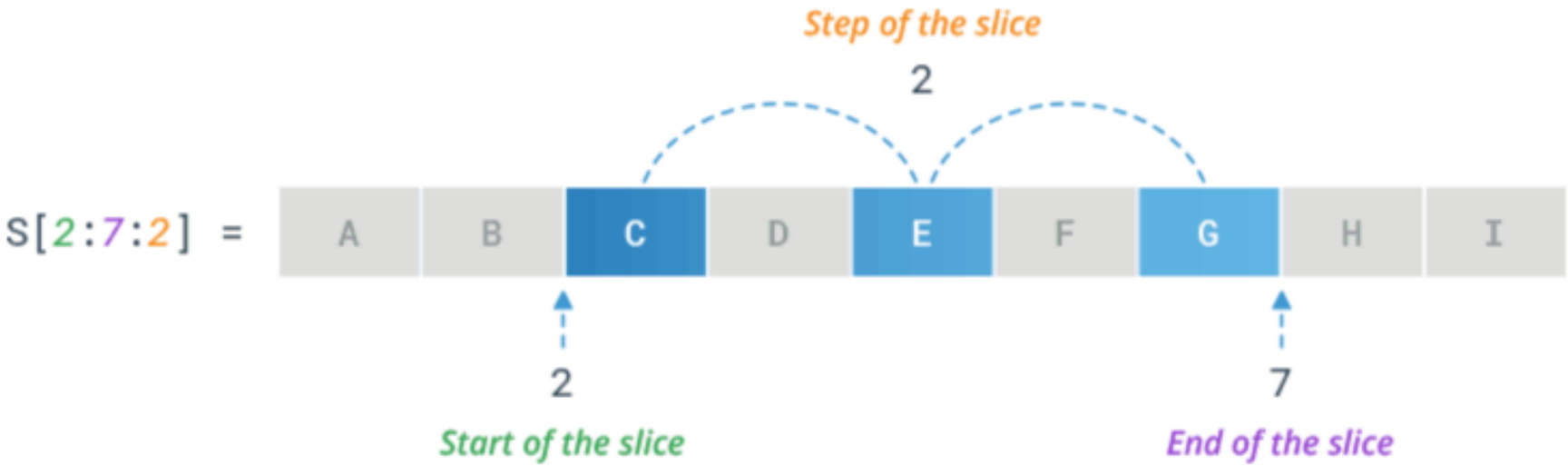
```
s[-7:-2]  # CDEFG
```



Examples and images from *learnbyexample*

Specify Step of the Slicing

```
s[2:7:2]  # CEG
```




```
# Return every 2nd item between position 2 to 7
S = 'A B C D E F G H I'
print(S[2:7:2]) #  C E G
```

```
# Returns every 2nd item between position 6 to 1 in reverse order
S = 'A B C D E F G H I'
print(S[6:1:-2])    #  G E C
```

Examples and images from *learnbyexample*

Slice at the Beginning and End

- **Omitting** the start index starts the slice from the index 0.
  - Meaning, `S[:stop]` is *equivalent* to `S[0:stop]`

```
# Slice first three characters from the string
S = 'ABCDEFGHI'
print(S[:3])    # ABC
```

- Whereas, **omitting** the stop index extends the slice to the end of the string.
  - Meaning, `S[start:]` is *equivalent* to `S[start:len(S)]`

```
# Slice last three characters from the string
S = 'ABCDEFGHI'
print(S[6:])    # GHI
```

Examples and images from *learnbyexample*

Slicing – Example 1

- Consider the string "Oranges"

Positive Index	0	1	2	3	4	5	6
Letter	**O**	**R**	**A**	**N**	**G**	**E**	**S**
Negative Index	-7	-6	-5	-4	-3	-2	-1

- This table shows the positive and negative index references of each letter
- Example: `str[1:-2:2]`
- Start = 1; Stop = -2; Step = 2

Slicing – Example 1

- Consider the string "Oranges"

Positive Index	0	1	2	3	4	5	6
Letter	**O**	**R**	**A**	**N**	**G**	**E**	**S**
Negative Index	-7	-6	-5	-4	-3	-2	-1

- This table shows the positive and negative index references of each letter
- Example: `str[1:-2:2]`
- Start = 1; Stop = -2; Step = 2
- Solution: `r`
  - We start at index 1

Slicing – Example 1

- Consider the string "Oranges"

Positive Index	0	1	2	3	4	5	6
Letter	**O**	**R**	**A**	**N**	**G**	**E**	**S**
Negative Index	-7	-6	-5	-4	-3	-2	-1

- This table shows the positive and negative index references of each letter
- Example: `str[1:-2:2]`
- Start = 1; Stop = -2; Step = 2
- Solution: `rn`
  - We move by 2 (step is 2)

Slicing – Example 1

- Consider the string "Oranges"

Positive Index	0	1	2	3	4	5	6
Letter	**O**	**R**	**A**	**N**	**G**	**E**	**S**
Negative Index	-7	-6	-5	-4	-3	-2	-1

- This table shows the positive and negative index references of each letter
- Example: `str[1:-2:2]`
- Start = 1; Stop = -2; Step = 2
- Solution: `rn`
  - We move by 2 (step is 2), and then **stop** (we exclude the -2 index)

What is printed?

my_string = **"I love pizza"**

print(my_string**[2:-1:3]**)

What is printed?

my_string = **"I love pizza"**

print(my_string**[2:-1:3]**)

lei

What is printed?

my_string = **"I love pizza"**

print(my_string**[4:]**)

What is printed?

my_string = **"I love pizza"**

print(my_string**[4:]**)

ve pizza

What is printed?

my_string = **"I love pizza"**

print(my_string**[2:6]**)

What is printed?

my_string = **"I love pizza"**

print(my_string**[2:6]**)

love

Slicing – Example 2

- Consider the string “I love pizza”

Positive Index	0	1	2	3	4	5	6	7	8	9	10	11
Letter	**“I”**	**“ ”**	**“l”**	**“o”**	**“v”**	**“e”**	**“ ”**	**“p”**	**“i”**	**“z”**	**“z”**	**“a”**
Negative Index	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1

- Example: `str[2:-1:3]`
- Start = 1; Stop = -1; Step = 3

Slicing – Example 2

- Consider the string "I love pizza"

Positive Index	0	1	2	3	4	5	6	7	8	9	10	11
Letter	**"I"**	**" "**	**"l"**	**"o"**	**"v"**	**"e"**	**" "**	**"p"**	**"i"**	**"z"**	**"z"**	**"a"**
Negative Index	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1

- Example: `str[2:-1:3]`
- Start = 1; Stop = -1; Step = 3
- Solution: `l`
  - We start at index 2

Slicing – Example 2

- Consider the string "I love pizza"

Positive Index	0	1	2	3	4	5	6	7	8	9	10	11
Letter	**"I"**	**" "**	**"l"**	**"o"**	**"v"**	**"e"**	**" "**	**"p"**	**"i"**	**"z"**	**"z"**	**"a"**
Negative Index	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1

- Example: `str[2:-1:3]`
- Start = 1; Stop = -1; Step = 3
- Solution: `lei`
  - We move by 3 (step is 3)

Slicing – Example 2

- Consider the string "I love pizza"

Positive Index	0	1	2	3	4	5	6	7	8	9	10	11
Letter	**"I"**	**" "**	**"l"**	**"o"**	**"v"**	**"e"**	**" "**	**"p"**	**"i"**	**"z"**	**"z"**	**"a"**
Negative Index	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1

out of bounds

- Example: `str[2:-1:3]`
- Start = 1; Stop = -1; Step = 3
- Solution: `lei`
  - We move by 3 (step is 3)

Slicing – Example 3 (with negative step)

- Consider the string "Oranges"

Positive Index	0	1	2	3	4	5	6
Letter	**O**	**R**	**A**	**N**	**G**	**E**	**S**
Negative Index	-7	-6	-5	-4	-3	-2	-1

- Example: `str[-2:1:-2]`
- Start = -2; Stop = 1; Step = -2

Slicing – Example 3 (with negative step)

- Consider the string "Oranges"

Positive Index	0	1	2	3	4	5	6
Letter	**O**	**R**	**A**	**N**	**G**	**E**	**S**
Negative Index	-7	-6	-5	-4	-3	-2	-1

- Example: `str[-2:1:-2]`
- Start = -2; Stop = 1; Step = -2
- Solution: `e`
  - We start at index -2

Slicing – Example 3 (with negative step)

- Consider the string "Oranges"

Positive Index	0	1	2	3	4	5	6
Letter	**O**	**R**	**A**	**N**	**G**	**E**	**S**
Negative Index	-7	-6	-5	-4	-3	-2	-1

- Example: `str[-2:1:-2]`
- Start = -2; Stop = 1; Step = -2
- Solution: `en`
  - We move back 2 (step is -2)

Slicing – Example 3 (with negative step)

- Consider the string "Oranges"

Positive Index	0	1	2	3	4	5	6
Letter	**O**	**R**	**A**	**N**	**G**	**E**	**S**
Negative Index	-7	-6	-5	-4	-3	-2	-1

- Example: `str[-2:1:-2]`
- Start = -2; Stop = 1; Step = -2
- Solution: `en`
  - We move by 2 (step is 2), and then **stop** (exclusive)

Slicing – Example 4

- Consider the string "Oranges"

Positive Index	0	1	2	3	4	5	6
Letter	**O**	**R**	**A**	**N**	**G**	**E**	**S**
Negative Index	-7	-6	-5	-4	-3	-2	-1

- Example: `str[1:-2:2]` vs. `str[-2:1:-2]`
- Solution: `rn` vs. `en`

Slicing – Example 5

- Example of str[start:end:step]

- my_str = “Python”
- print(my_str[1:5:2])

- Output: yh

Slicing – Example 6

- Example of str[start:end:step]

- my_str = “GEEKSFORGEEKS”
- print(my_str[-1:-12:-2])

- Output: ???

Example used with thanks to geeksforgeeks

Slicing – Example 6

- Example of str[start:end:step]

-12 -1

- my_str = “GEEKSFORGEEKS”
- print(my_str[-1:-12:-2])

- Output: SEGOSE

Example used with thanks to geeksforgeeks

Slicing – Example 7
Printing a String in Reverse Order

- Example of str[start:end:step]

- my_str = “University of Virginia”
- print(my_str[::-1]) # Remember, this reverses the string!

- Output: ainigriV fo ytisrevinU

Quick & Fun Survey Questions

Get to know your peers! ☺

Books or Movies or Both?

Python Demonstration

Let's jump on PyCharm!

`strings.py` – More string slicing examples!

In-Class "lab" Activity!

Activity for Today!

- In pairs or groups up to three work on the following activity.
- **string_ica2.py**
- *Practice writing solutions that require string methods and string slicing*

Remember to check-in with a TA before leaving class today!

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.