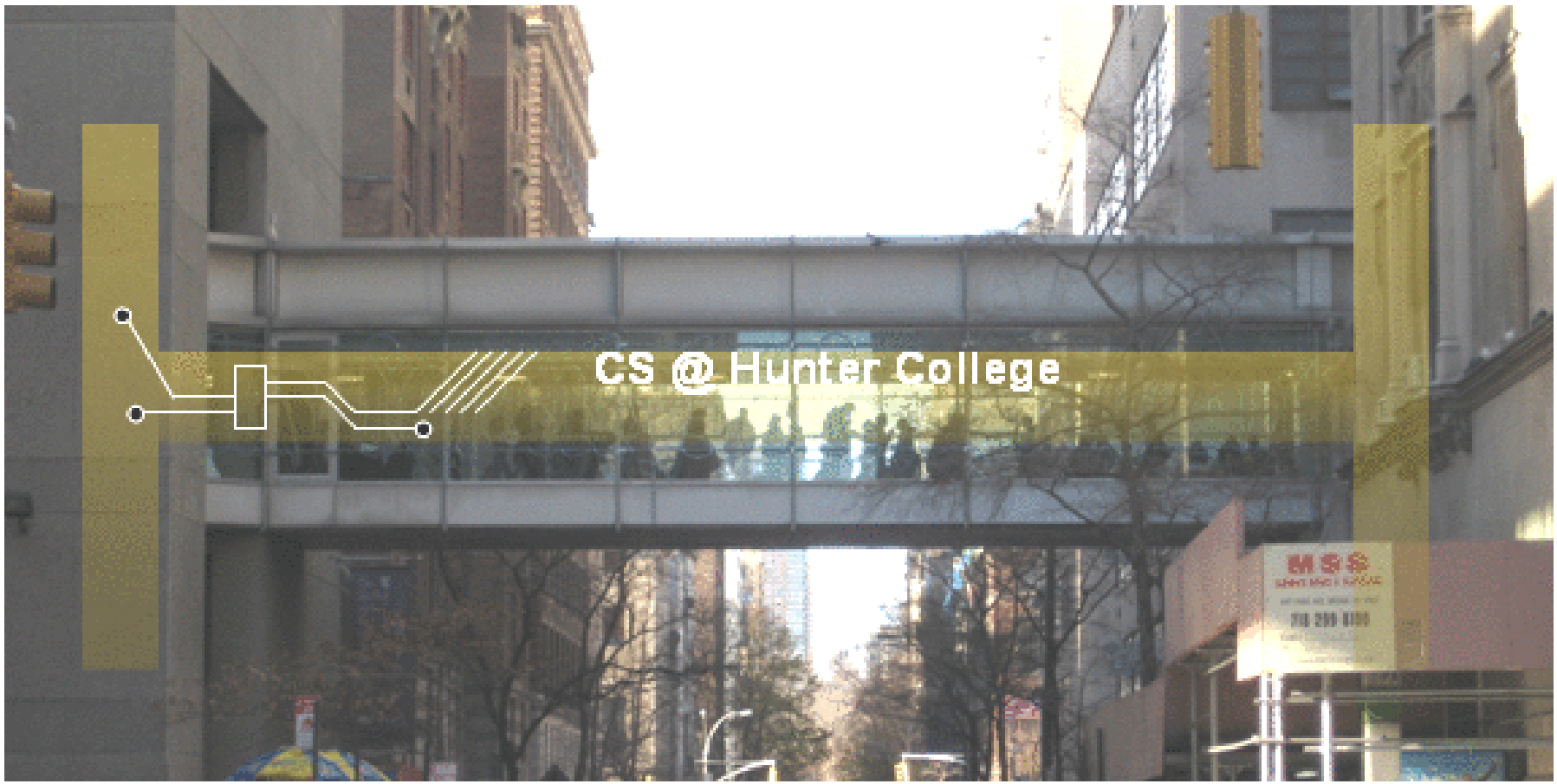
CSci 127: Introduction to Computer Science



hunter.cuny.edu/csci

Review of Lecture 1: range function

- Simplest version of range function is `range(n)`, where n is a positive integer. Function `range(n)` returns a list of integers ranging (see how the name is coming from?) from 0 to n-1, a total of n integer. For example, `range(5)` returns a list [0, 1, 2, 3, 4], while `range(-1)` returns an empty list.
- Usage: range(n) is part of for statement to repeat something for n times.
- Common mistake 1: use floating point number as parameters for range function. For example, range(1.2) is wrong.
- Common mistake 2: use square brackets [and] instead of parentheses (and) after range function. Note that range is a function name, it is followed by a pair of matched parentheses that enclose parameters for range function. For example, range[2] is wrong while range(2) is correct.

Review of Lecture 1: turtle graphics

- Imagine a turtle has a pen, when it moves some distance, say, 100 pixels, a distance unit in digital world, a line is drawn on the screen.
- Then the turtle turn left 120 degrees.
- Repeat the above two steps for 3 times.

```
1  import turtle
2
3  t = turtle.Turtle()
4
5  t.fd(100) # same as t.forward(100), ie, t moves forward 100 pixels
6  t.left(120) # t turns left 90 degrees
7
8  t.fd(100)
9  t.left(120)
10
11 t.fd(100)
12 t.left(120)
```

Review of Lecture 1: use turtle to draw a triangle

- After turning 120 degrees for three times, the turtle turns around in a circle and comes back to its start point.
- Use for-statement and range function to rewrite the above program.

```
1 import turtle
2
3 t = turtle.Turtle()
4
5 for i in range(3):
6     t.fd(100) #same as t.forward(100)
7     t.left(120)
```

For more commands, read turtle documentation

Draw a polygon with $n >= 3$ sides using turtle

Pseudocode (not actual code) work with any language with turtle library. Also called algorithm, consisting of step to step instructions.

```
import turtle library

instantiate a turtle object called t

initialize n to be an integer at least 3
Repeat the following for n times
(1) t moves forward t fixed number of distance
(2) t turns left 360 / n degrees
```

Explanation: every time a turtle turns 360 / n, after n rounds, move back to the start point.

Programming Environment

- Best choice: use command line and vi / Emac editors. Avoid using IDE (Integrated development environment).
- Second choice: Install Python and IDLE, an IDE for Python.
- Last choice (not encouraged): use online editor.
  - onlinegdb for non-turtle-graphics programs
  - trinket for turtle graphics programs.
- In windows, install WSL (Windows Subsystem for Linux) for command line testing.
- Lab 1001 G has Linux laptops, borrow one from TAs. Need department's permission to borrow overnight.
- You can borrow a Lenovo laptop free for a semester from the 2nd floor of library (at Audio/Video department, need an additional photo ID besides school's ID.

Today's Topics

- For-loops
- `range()`
- Variables
- Characters
- Strings

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- **For-loops**
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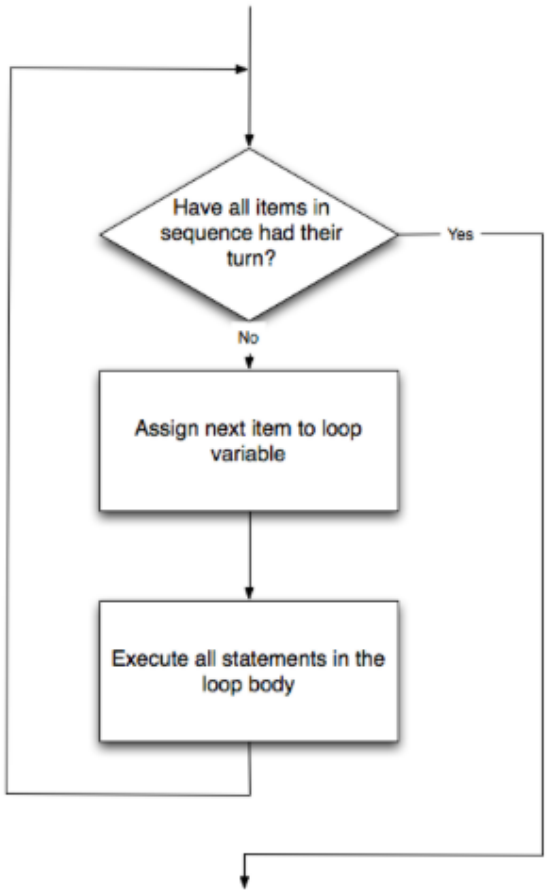
Group Work: predict what will be printed

```
1  for i in range(4):
2      print('The world turned upside down')
3  for j in [0,1,2,3,4,5]:
4      print(j)
5  for count in range(6):
6      print(count)
7  for color in ['red', 'green', 'blue']:
8      print(color)
9  for i in range(2):
10     for j in range(2):
11         print('Look around,')
12     print('How lucky we are to be alive!')
```

link to program

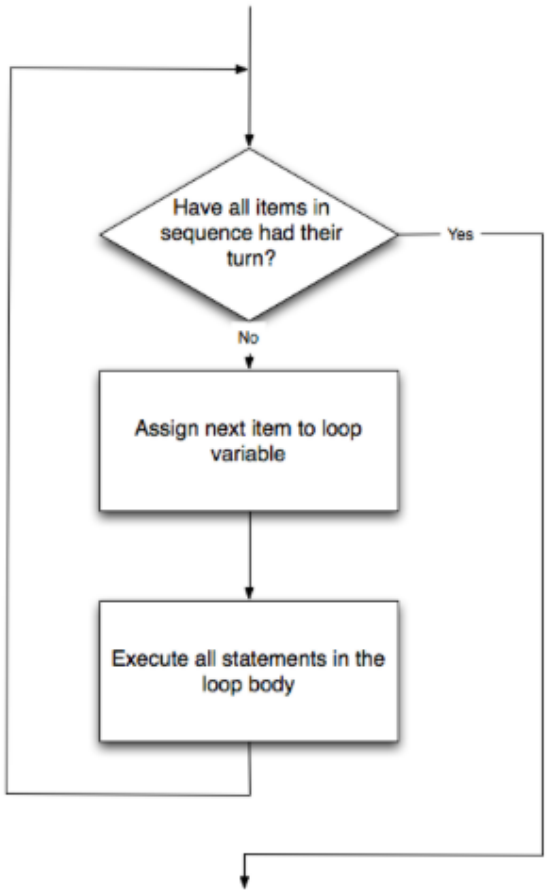
for-loop



How to Think Like CS, §4.5

```
for  i in list:
     statement1
     statement2
     statement3
```

for-loop



How to Think Like CS, §4.5

```
for  i in list:
     statement1
     statement2
     statement3
```

where `list` is a list of items:

- stated explicitly (e.g. [1,2,3]) or
- generated by a function, e.g. `range()`.

Today's Topics

- For-loops
- **range()**
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More on `range()`: predict what will be printed

```
1  for num in [2,4,6,8,10]:
2      print(num)
3
4  sum = 0
5  for x in range(0,12,2):
6      print(x)
7      sum = sum + x
8
9  print(sum)
10
11 for c in "ABCD":
12     print(c)
```

link to range demo

`range()`

Simplest version:

- `range(stop)`

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- Produces a list: [0,1,2,3,...,stop-1]

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- For example, if you want the the list [0,1,2,3,...,100], you would write:

range()

Simplest version:

- `range(stop)`
- Produces a list: [0,1,2,3,...,stop-1]
- For example, if you want the the list [0,1,2,3,...,100], you would write:

```
range(101)
```

range()

What if you wanted to start somewhere else:

`range()`

What if you wanted to start somewhere else:

- `range(start, stop)`

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  [start,start+1,...,stop-1]

`range()`

What if you wanted to start somewhere else:

- `range(start, stop)`
- Produces a list:
  [start,start+1,...,stop-1]
- For example, if you want the the list
  [10,11,...,20]
  you would write:

range()

What if you wanted to start somewhere else:

- `range(start, stop)`
- Produces a list:
  [start,start+1,...,stop-1]
- For example, if you want the the list
  [10,11,...,20]
  you would write:

```
range(10,21)
```

range()

What if you wanted to count by twos, or some other number:

range()

What if you wanted to count by twos, or some other number:

- `range(start, stop, step)`

range()

What if you wanted to count by twos, or some other number:

- `range(start, stop, step)`
- Produces a list: [start,start+step,start+2*step...,last] (where last is the largest start+k*step less than stop)

range()

What if you wanted to count by twos, or some other number:

- `range(start, stop, step)`
- Produces a list:
  [start,start+step,start+2*step...,last]
  (where last is the largest start+k*step less than stop)
- For example, if you want the the list
  [5,10,...,50]
  you would write:

range()

What if you wanted to count by twos, or some other number:

- `range(start, stop, step)`
- Produces a list:
  [start,start+step,start+2*step...,last]
  (where last is the largest start+k*step less than stop)
- For example, if you want the the list [5,10,...,50]
  you would write:

  ```
  range(5,51,5)
  ```

In summary: range()

The three versions:

In summary: range()

The three versions:

- `range(stop)`

In summary: range()

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- `range(stop)`
- `range(start, stop)`

In summary: range()

The three versions:

- `range(stop)`
- `range(start, stop)`
- `range(start, stop, step)`

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Variables

- A **variable** is a reserved memory location for storing a value.

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- Different kinds, or **types**, of values need different amounts of space:
  - **int**: integer or whole numbers
  - **float**: floating point or real numbers
  - **string**: sequence of characters

Variables

- A **variable** is a reserved memory location for storing a value.
- Different kinds, or **types**, of values need different amounts of space:
  - **int**: integer or whole numbers
  - **float**: floating point or real numbers
  - **string**: sequence of characters
  - **list**: a sequence of items
    e.g. `[3, 1, 4, 5, 9]` or `['violet','purple','indigo']`
  - **class variables**: for complex objects, like turtles.
- In Python (unlike other languages) you don't need to specify the type; it is deduced by its value.

Variable Names

- There's some rules about valid names for variables.
- Can use the underscore ('_'), upper and lower case letters.
- Can also use numbers, just can't start a name with a number.
- Can't use symbols (like '+' or '*') since used for arithmetic.
- Can't use some words that Python has reserved for itself (e.g. `for`).
  (List of reserved words in *Think CS*, §2.5.)

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Standardized Code for Characters

American Standard Code for Information Interchange (ASCII), 1960.

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ASCII TABLE

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2	2	[START OF TEXT]	34	22	"	66	42	B	98	62	b
3	3	[END OF TEXT]	35	23	#	67	43	C	99	63	c
4	4	[END OF TRANSMISSION]	36	24	$	68	44	D	100	64	d
5	5	[ENQUIRY]	37	25	%	69	45	E	101	65	e
6	6	[ACKNOWLEDGE]	38	26	&	70	46	F	102	66	f
7	7	[BELL]	39	27	'	71	47	G	103	67	g
8	8	[BACKSPACE]	40	28	(	72	48	H	104	68	h
9	9	[HORIZONTAL TAB]	41	29	)	73	49	I	105	69	i
10	A	[LINE FEED]	42	2A	*	74	4A	J	106	6A	j
11	B	[VERTICAL TAB]	43	2B	+	75	4B	K	107	6B	k
12	C	[FORM FEED]	44	2C	,	76	4C	L	108	6C	l
13	D	[CARRIAGE RETURN]	45	2D	-	77	4D	M	109	6D	m
14	E	[SHIFT OUT]	46	2E	.	78	4E	N	110	6E	n
15	F	[SHIFT IN]	47	2F	/	79	4F	O	111	6F	o
16	10	[DATA LINK ESCAPE]	48	30	0	80	50	P	112	70	p
17	11	[DEVICE CONTROL 1]	49	31	1	81	51	Q	113	71	q
18	12	[DEVICE CONTROL 2]	50	32	2	82	52	R	114	72	r
19	13	[DEVICE CONTROL 3]	51	33	3	83	53	S	115	73	s
20	14	[DEVICE CONTROL 4]	52	34	4	84	54	T	116	74	t
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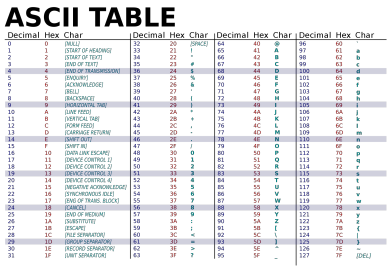
(wiki)

Converting from Character to Code:

(There is a link to the ASCII table on the course webpage, under 'Useful Links'.)



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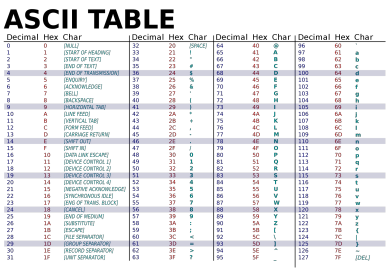

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- `ord(c)`: returns Unicode (ASCII) of the character.

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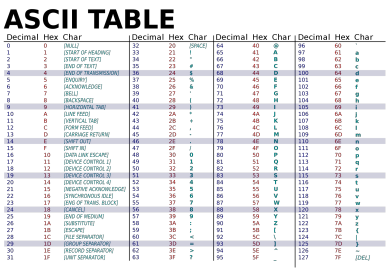

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- `ord(c)`: returns Unicode (ASCII) of the character.
- Example: `ord('a')` returns 97.

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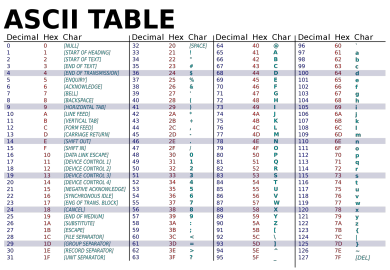
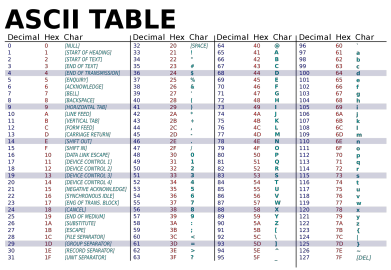


- `ord(c)`: returns Unicode (ASCII) of the character.
- Example: `ord('a')` returns 97.
- `chr(x)`: returns the character whose Unicode is x.

Converting from Character to Code:

(There is a link to the ASCII table on the course webpage, under 'Useful Links'.)



Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char
0	0	[NULL]	32	20	[SPACE]	64	40	@	96	60	`
1	1	[START OF HEADING]	33	21	!	65	41	A	97	61	a
2	2	[START OF TEXT]	34	22	"	66	42	B	98	62	b
3	3	[END OF TEXT]	35	23	#	67	43	C	99	63	c
4	4	[END OF TRANSMISSION]	36	24	$	68	44	D	100	64	d
5	5	[ENQUIRY]	37	25	%	69	45	E	101	65	e
6	6	[ACKNOWLEDGE]	38	26	&	70	46	F	102	66	f
7	7	[BELL]	39	27	'	71	47	G	103	67	g
8	8	[BACKSPACE]	40	28	(	72	48	H	104	68	h
9	9	[HORIZONTAL TAB]	41	29	)	73	49	I	105	69	i
10	A	[LINE FEED]	42	2A	*	74	4A	J	106	6A	j
11	B	[VERTICAL TAB]	43	2B	+	75	4B	K	107	6B	k
12	C	[FORM FEED]	44	2C	,	76	4C	L	108	6C	l
13	D	[CARRIAGE RETURN]	45	2D	-	77	4D	M	109	6D	m
14	E	[SHIFT OUT]	46	2E	.	78	4E	N	110	6E	n
15	F	[SHIFT IN]	47	2F	/	79	4F	O	111	6F	o
16	10	[DATA LINK ESCAPE]	48	30	0	80	50	P	112	70	p
17	11	[DEVICE CONTROL 1]	49	31	1	81	51	Q	113	71	q
18	12	[DEVICE CONTROL 2]	50	32	2	82	52	R	114	72	r
19	13	[DEVICE CONTROL 3]	51	33	3	83	53	S	115	73	s
20	14	[DEVICE CONTROL 4]	52	34	4	84	54	T	116	74	t
21	15	[NEGATIVE ACKNOWLEDGE]	53	35	5	85	55	U	117	75	u
22	16	[SYNCHRONOUS IDLE]	54	36	6	86	56	V	118	76	v
23	17	[END OF TRANS. BLOCK]	55	37	7	87	57	W	119	77	w
24	18	[CANCEL]	56	38	8	88	58	X	120	78	x
25	19	[END OF MEDIUM]	57	39	9	89	59	Y	121	79	y
26	1A	[SUBSTITUTE]	58	3A	:	90	5A	Z	122	7A	z
27	1B	[ESCAPE]	59	3B	;	91	5B	[	123	7B	{
28	1C	[FILE SEPARATOR]	60	3C	<	92	5C	\	124	7C	|
29	1D	[GROUP SEPARATOR]	61	3D	=	93	5D	]	125	7D	}
30	1E	[RECORD SEPARATOR]	62	3E	>	94	5E	^	126	7E	~
31	1F	[UNIT SEPARATOR]	63	3F	?	95	5F	_	127	7F	[DEL]

- `ord(c)`: returns Unicode (ASCII) of the character.
- Example: `ord('a')` returns 97.
- `chr(x)`: returns the character whose Unicode is x.
- Example: `chr(97)` returns 'a'.

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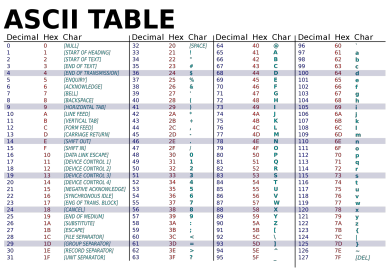

- `ord(c)`: returns Unicode (ASCII) of the character.
- Example: `ord('a')` returns 97.
- `chr(x)`: returns the character whose Unicode is x.
- Example: `chr(97)` returns 'a'.
- What is `chr(33)`?

In Pairs or Triples...

```
1  for c in range(65,90):
2      print(chr(c))
3
4  message = "I love Python"
5  newMessage = ""
6  for c in message:
7      print(ord(c))  #Print the Unicode of c
8      print(chr(ord(c)+1))  #Print the next
           character
9      newMessage = newMessage + chr(ord(c)+1) #
           add to the new message
10 print("The coded message is", newMessage)
```

link to python turtor demo

In Pairs or Triples...

Predict what will be printed.

```
1 for c in "World":
2     print(c, c, '#')
```

Ceasar Ciper: hints for P9 of programming assignments

```
1  word = input("Enter a string: ")
2  codedWord = ""
3  shift = 2 #shift two letters
4  for ch in word:
5      offset = ord(ch) - ord('A') #relative
           distance to 'A'
6      wrap = (offset + shift) % ? #what is ?
7      #TODO: compute the new letter
8      #TODO: add the newChar to the coded word
9
10 print("After shifting", shift, "letters,", \
11     word, "becomes", codedWord)
```

User Input

Enter name and the year you are a freshman, print and calculate graduate year. *Covered in detail in Lab 2:*

```
1 name = input("Enter name: ")
2 year = int(input("Enter freshman year: "))
3
4 print("Hello, " + name) #same as print("
    Hello,", name)
5 graduateYear = year + 4
6 print("Will graduate in "+str(graduateYear))
7 #same:print("Will graduate in",graduateYear)
8 #str(graduateYear) converts int graduateYear
    to string. Suppose graduateYear is 2023,
    then str(graduateYear) is "2023".
```

Side Note: '+' for numbers and strings

- `x = 3 + 5` stores the number 8 in memory location `x`.

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- `s = "hi" + "Mom"` stores `"hiMom"` in memory locations `s`.

Side Note: '+' for numbers and strings

- `x = 3 + 5` stores the number 8 in memory location `x`.
- `x = x + 1` increases `x` by 1.
- `s = "hi" + "Mom"` stores `"hiMom"` in memory locations `s`.
- `s = s + "A"` adds the letter `"A"` to the end of the strings `s`.

Today's Topics

- For-loops
- `range()`
- Variables
- Characters
- **Strings**

More on Strings: String Methods

```
s = "FridaysSaturdaysSundays"
num = s.count("s")
```

- The first line creates a variable, called `s`, that stores the string: `"FridaysSaturdaysSundays"`

More on Strings: String Methods

```
s = "FridaysSaturdaysSundays"
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- The first line creates a variable, called `s`, that stores the string: `"FridaysSaturdaysSundays"`
- There are many useful functions for strings (more in Lab 2).

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  - What would `print(s.count("sS"))` output?

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  - `num = s.count("s")` stores the result in the variable `num`, for later.
  - What would `print(s.count("sS"))` output?
  - What about:

    ```
    mess = "10 20 21 9 101 35"
    mults = mess.count("0 ")
    print(mults)
    ```

More on Strings: Indexing & Substrings

```
s = "FridaysSaturdaysSundays"
days = s[7]
days = s[7:15]
days = s[:-1]
```

- Strings are made up of individual characters (letters, numbers, etc.)

More on Strings: Indexing & Substrings

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s = "FridaysSaturdaysSundays"
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0	1	2	3	4	5	6	7	8	...	16	17	18	19	20	21	22
F	r	i	d	a	y	s	S	a	...	S	u	n	d	a	y	s

More on Strings: Indexing & Substrings

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												...	-4	-3	-2	-1

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F	r	i	d	a	y	s	S	a	...	S	u	n	d	a	y	s
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- `s[0]` is

More on Strings: Indexing & Substrings

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F	r	i	d	a	y	s	S	a	...	S	u	n	d	a	y	s
												...	-4	-3	-2	-1

- `s[0]` is `'F'`.

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- `s[1]` is

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F	r	i	d	a	y	s	S	a	...	S	u	n	d	a	y	s
												...	-4	-3	-2	-1

- `s[1]` is `'r'`.

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- `s[-1]` is

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												...	-4	-3	-2	-1

- `s[-1]` is `'s'`.

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F	r	i	d	a	y	s	S	a	...	S	u	n	d	a	y	s
												...	-4	-3	-2	-1

- `s[3:6]` is

More on Strings: Indexing & Substrings

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- `s[3:6]` is `'day'`.

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F	r	i	d	a	y	s	S	a	...	S	u	n	d	a	y	s
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- `s[:3]` is

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- `s[:3]` is `'Fri'`.

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- `s[:-1]` is 'FridaysSaturdaysSunday'.
(no trailing 's' at the end)

Today's Topics

- For-loops
- `range()`
- Variables
- Characters
- Strings

Recap

- In Python, we introduced:

```
#Predict what will be printed:
for i in range(4):
    print('The world turned upside down')
for j in [0,1,2,3,4,5]:
    print(j)
for count in range(6):
    print(count)
for color in ['red', 'green', 'blue']:
    print(color)
for i in range(2):
    for j in range(2):
        print('Look around,')
    print('How lucky we are to be alive!')
```

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  - String concatenation
  - Functions: `ord()` and `chr()`

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  - Functions: `ord()` and `chr()`
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  - Functions: `ord()` and `chr()`
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Practice Quiz & Final Questions



- Since you must pass the final exam to pass the course, we end every lecture with final exam review.

Practice Quiz & Final Questions



- Since you must pass the final exam to pass the course, we end every lecture with final exam review.
- Pull out something to write on (not to be turned in).
- Lightning rounds:
  - write as much you can for 60 seconds;
  - followed by answer; and
  - repeat.
- Past exams are on the webpage (under Final Exam Information).
- We're starting with Spring 2018, Mock Exam.

Weekly Reminders!

Before next lecture, don't forget to:

- Work on this week's Online Lab

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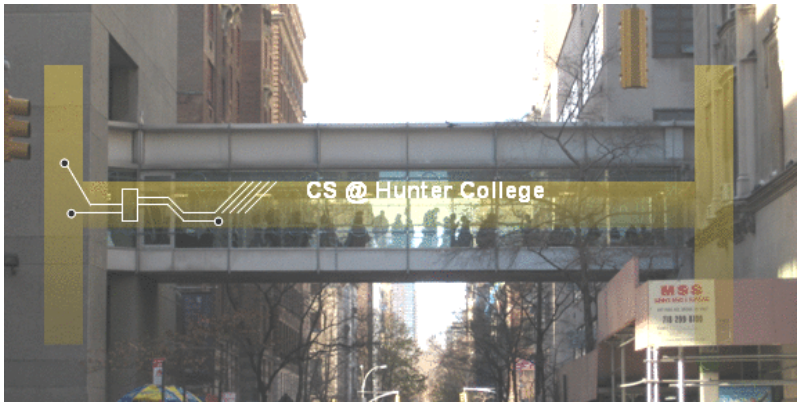
- Work on this week's Online Lab
- Schedule an appointment to take the Quiz in lab 1001G Hunter North

Weekly Reminders!



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- Work on this week's Online Lab
- Schedule an appointment to take the Quiz in lab 1001G Hunter North
- If you haven't already, schedule an appointment to take the Code Review (**one every week**) in lab 1001G Hunter North

Weekly Reminders!

Before next lecture, don't forget to:

- Work on this week's Online Lab
- Schedule an appointment to take the Quiz in lab 1001G Hunter North
- If you haven't already, schedule an appointment to take the Code Review (**one every week**) in lab 1001G Hunter North
- Submit this week's 5 programming assignments **(programs 6-10)**

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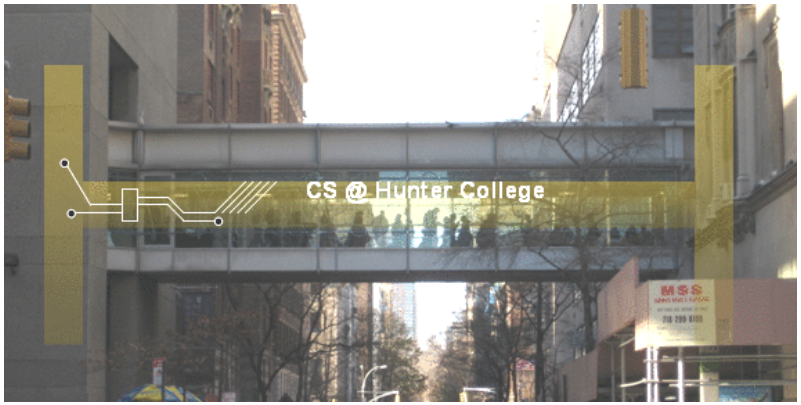

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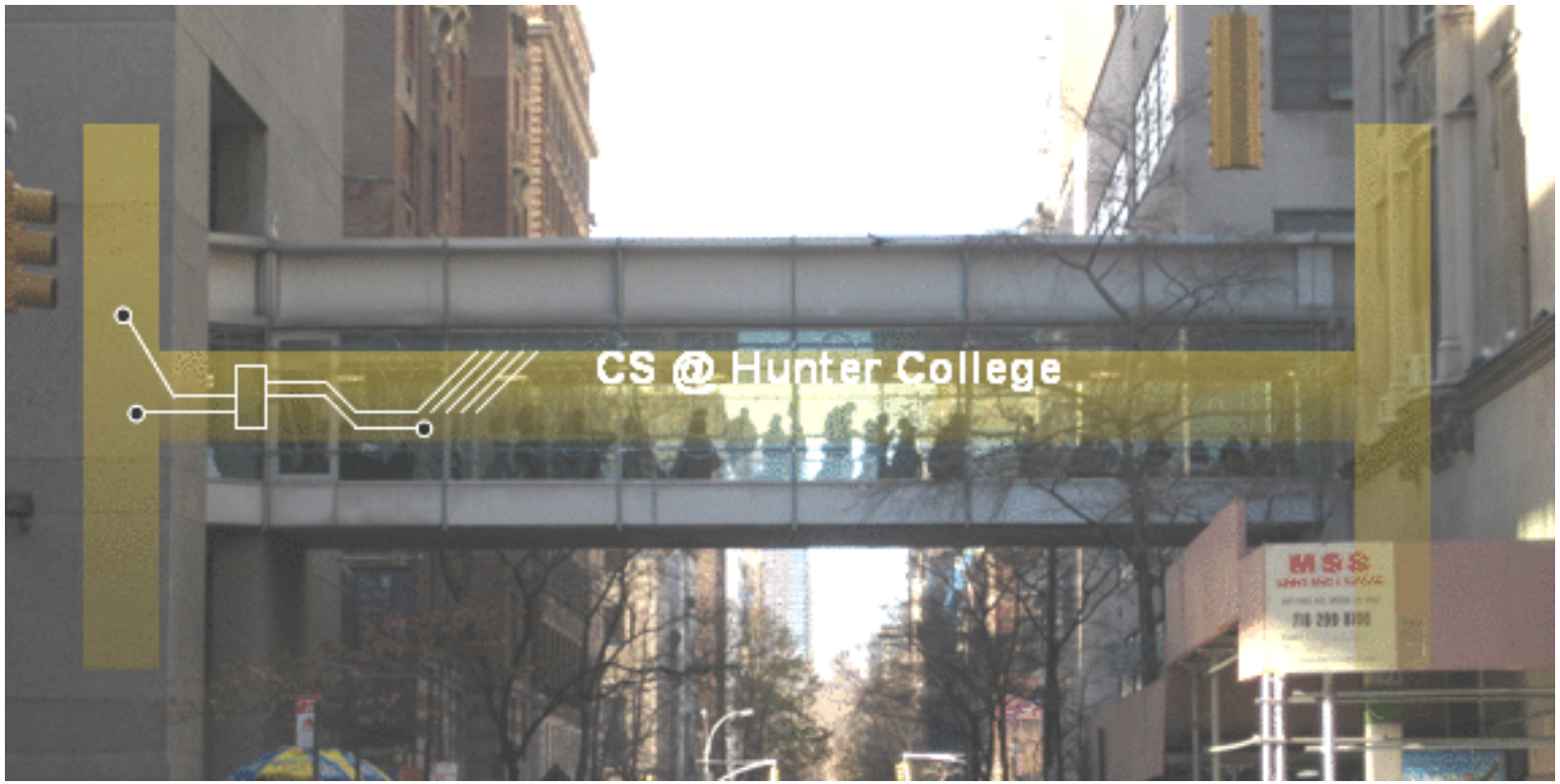
- Take the Lecture Preview on Blackboard on Monday (or no later than 10am on Tuesday)

Lecture Slips & Writing Boards



- Hand your lecture slip to a UTA.
- Return writing boards as you leave.