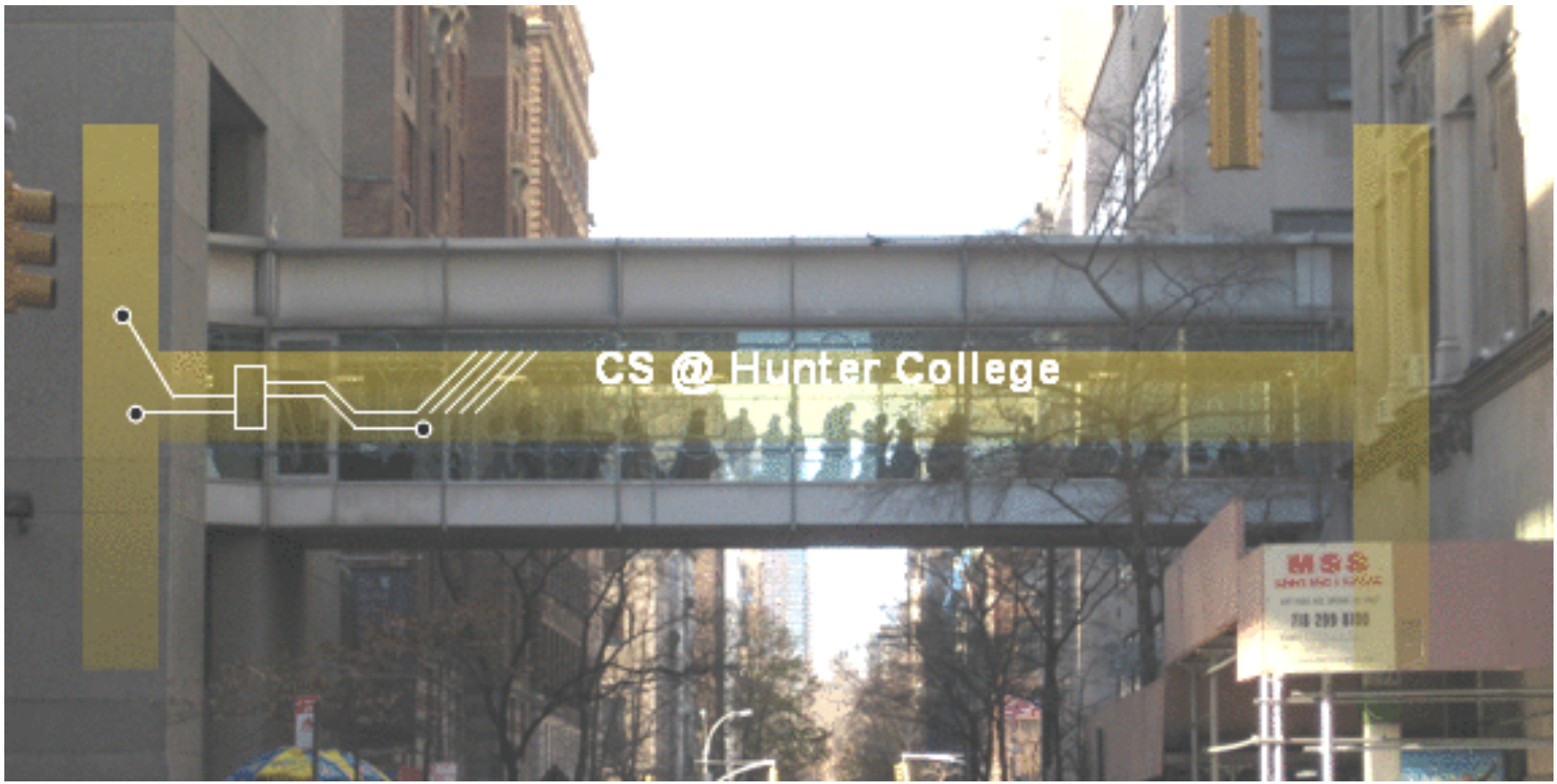
CSci 127: Introduction to Computer Science



hunter.cuny.edu/csci

Today's Topics

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

In Pairs or Triples...

Some review and some novel challenges:

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

Python Tutor

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1  #Predict what will be printed:
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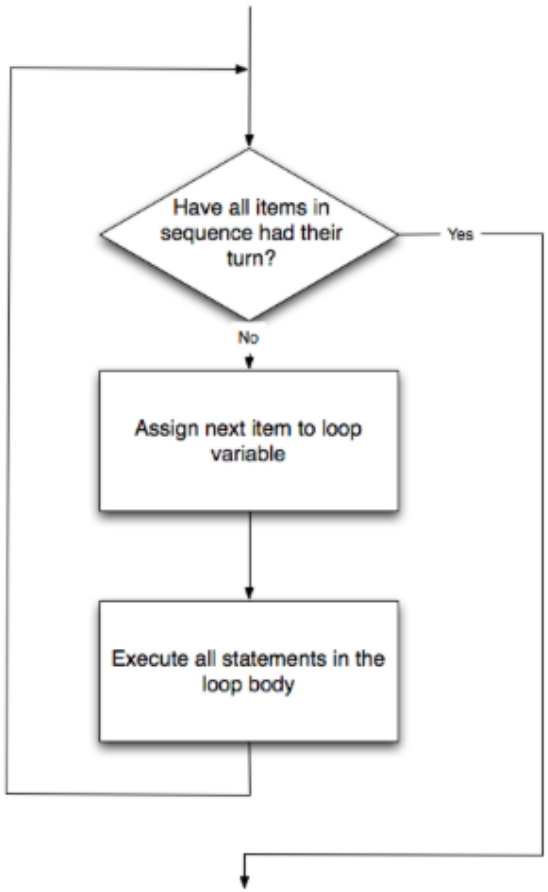
(Demo with pythonTutor)

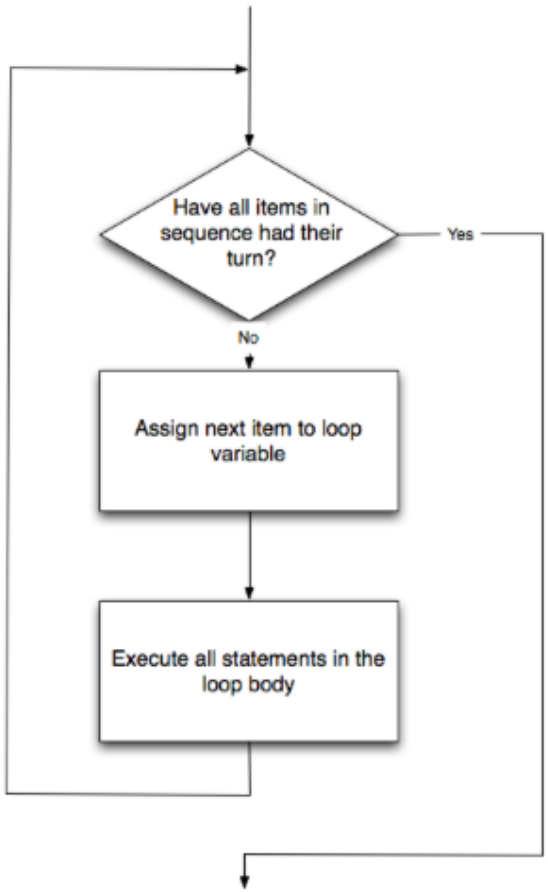
for-loop



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()`.

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More on `range()`:

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

Python Tutor

```
1  #Predict what will be printed:
2
3  for num in [2,4,6,8,10]:
4      print(num)
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(Demo with pythonTutor)

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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:

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- `range(start, stop)`
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  [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:

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- `range(start, stop, step)`

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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:

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- `range(start, stop, step)`

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  - **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.

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- 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

Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char
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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
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	[ENG 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
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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]

(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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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
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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
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28	1C	[FILE SEPARATOR]	60	3C	<	92	5C	\	124	7C	|
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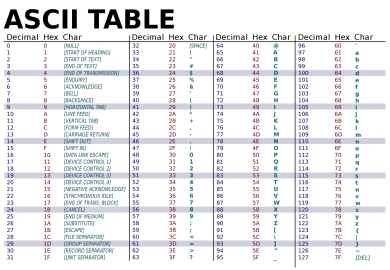

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- `ord(c)`: returns Unicode (ASCII) of the character.

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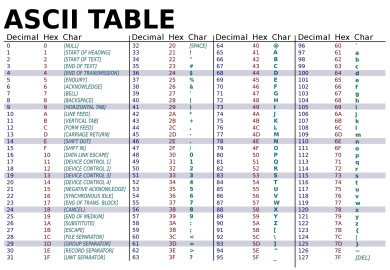

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29	1D	[GROUP SEPARATOR]	61	3D	=	93	5D	]	125	7D	}
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- `ord(c)`: returns Unicode (ASCII) of the character.
- Example: `ord('a')` returns 97.

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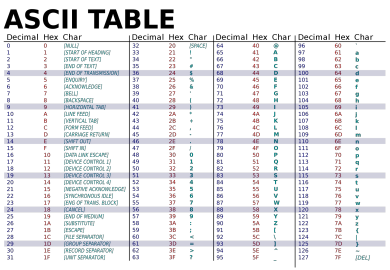

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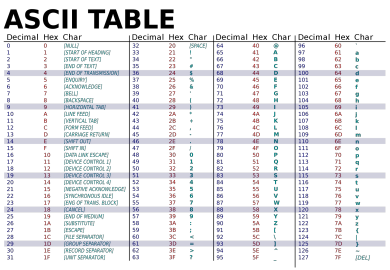
2	2	[START OF TEXT]	34	22	"	66	42	B	98	62	b
3	3	[END OF TEXT]	35	23	#	67	43	C	99	63	c
4	4	[END OF TRANSMISSION]	36	24	$	68	44	D	100	64	d
5	5	[ENQUIRY]	37	25	%	69	45	E	101	65	e
6	6	[ACKNOWLEDGE]	38	26	&	70	46	F	102	66	f
7	7	[BELL]	39	27	'	71	47	G	103	67	g
8	8	[BACKSPACE]	40	28	(	72	48	H	104	68	h
9	9	[HORIZONTAL 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
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.

Converting from Character to Code:

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



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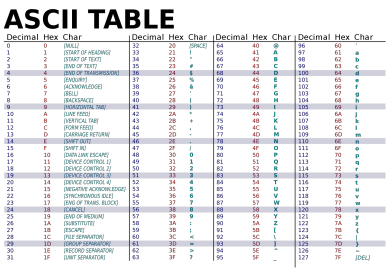

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- Example: `ord('a')` returns 97.
- `chr(x)`: returns the character whose Unicode is x.
- Example: `chr(97)` returns 'a'.
- What is `chr(33)`?

In Pairs or Triples...

Some review and some novel challenges:

```
1  #Predict what will be printed:
2
3  for c in range(65,90):
4      print(chr(c))
5
6  message = "I love Python"
7  newMessage = ""
8  for c in message:
9      print(ord(c))   #Print the Unicode of each number
10     print(chr(ord(c)+1))    #Print the next character
11     newMessage = newMessage + chr(ord(c)+1) #add to the new message
12 print("The coded message is", newMessage)
13
14 word = "zebra"
15 codedWord = ""
16 for ch in word:
17     offset = ord(ch) - ord('a') + 1 #how many letters past 'a'
18     wrap = offset % 26  #if larger than 26, wrap back to 0
19     newChar = chr(ord('a') + wrap)  #compute the new letter
20     print(wrap, chr(ord('a') + wrap))    #print the wrap & new lett
21     codedWord = codedWord + newChar #add the newChar to the coded w
22
23 print("The coded word (with wrap) is", codedWord)
```

Python Tutor

```
#Predict what will be printed:

for c in range(65,90):
    print(chr(c))

message = "I love Python"
newMessage = ""
for c in message:
    print(ord(c))   #Print the Unicode of each number
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word = "zebra"
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for ch in word:
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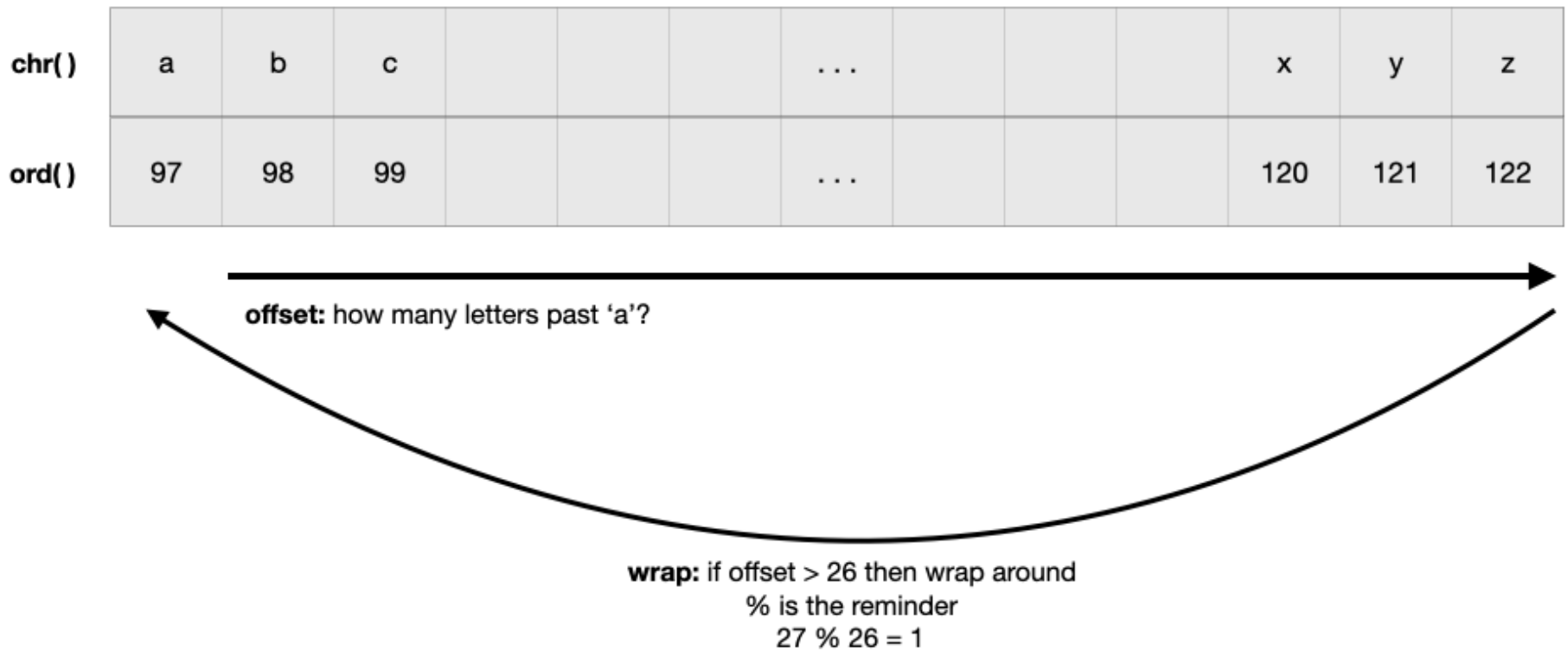
    codedWord = codedWord + newChar #add the newChar to the coded w

print("The coded word (with wrap) is", codedWord)
```

(Demo with `pythonTutor`)

Wrap


chr( )
a
b
c
. . .
x
y
z
ord( )
97
98
99
. . .
120
121
122
offset: how many letters past ‘a’?
wrap: if offset > 26 then wrap around
% is the reminder
27 % 26 = 1

User Input

Covered in detail in Lab 2:

```
1 mess = input('Please enter a message: ')
2 print("You entered", mess)
```

(Demo with `pythonTutor`)

Side Note: '+' for numbers and strings

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

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

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- There are many useful functions for strings (more in Lab 2).

More on Strings: String Methods

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  - `s.count("s")` counts the number of lower case `s` that occurs.

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  - `num = s.count("s")` stores the result in the variable `num`, for later.

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

More on Strings: String Methods

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  - `s.count("s")` counts the number of lower case `s` that occurs.
  - `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[:-1].split("s")
```

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

More on Strings: Indexing & Substrings

```
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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days = s[:-1].split("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

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

More on Strings: Indexing & Substrings

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```

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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
												...	-4	-3	-2	-1

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

More on Strings: Indexing & Substrings

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

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- `s[1]` is

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
												...	-4	-3	-2	-1

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

More on Strings: Indexing & Substrings

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

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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
												...	-4	-3	-2	-1

- `s[-1]` is

More on Strings: Indexing & Substrings

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```

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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
												...	-4	-3	-2	-1

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

More on Strings: Indexing & Substrings

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```

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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

```
s = "FridaysSaturdaysSundays"
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```

- Strings are made up of individual characters (letters, numbers, etc.)
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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
												...	-4	-3	-2	-1

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

More on Strings: Indexing & Substrings

```
s = "FridaysSaturdaysSundays"
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```

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- Useful to be able to refer to pieces of a string, either an individual location or a "substring" of the string.

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
												...	-4	-3	-2	-1

- `s[:3]` is

More on Strings: Indexing & Substrings

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- Strings are made up of individual characters (letters, numbers, etc.)
- Useful to be able to refer to pieces of a string, either an individual location or a "substring" of the string.

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
												...	-4	-3	-2	-1

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

More on Strings: Indexing & Substrings

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

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- Useful to be able to refer to pieces of a string, either an individual location or a "substring" of the string.

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
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- `s[:-1]` is

More on Strings: Indexing & Substrings

```
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```

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												...	-4	-3	-2	-1

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

More on Strings: Splits

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- `split()` divides a string into a list.

More on Strings: Splits

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- `split()` divides a string into a list.
- Cross out the delimiter, and the remaining items are the list.

More on Strings: Splits

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- `split()` divides a string into a list.
- Cross out the delimiter, and the remaining items are the list.

"Friday~~s~~Saturday~~s~~Sunday"

More on Strings: Splits

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- `split()` divides a string into a list.
- Cross out the delimiter, and the remaining items are the list.

```
"FridaysSaturdaysSunday"
days = ['Friday', 'Saturday', 'Sunday']
```

More on Strings: Splits

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- `split()` divides a string into a list.
- Cross out the delimiter, and the remaining items are the list.

```
"FridaysSaturdaysSunday"
days = ['Friday', 'Saturday', 'Sunday']
```

- Different delimiters give different lists:

More on Strings: Splits

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- `split()` divides a string into a list.
- Cross out the delimiter, and the remaining items are the list.

```
"FridaysSaturdaysSunday"
days = ['Friday', 'Saturday', 'Sunday']
```

- Different delimiters give different lists:

```
days = s[:-1].split("day")
```

More on Strings: Splits

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- `split()` divides a string into a list.
- Cross out the delimiter, and the remaining items are the list.

```
"FridayXSaturdayXSunday"
days = ['Friday', 'Saturday', 'Sunday']
```

- Different delimiters give different lists:

```
days = s[:-1].split("day")
"FridaysSaturdaysSundays"
```

More on Strings: Splits

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- `split()` divides a string into a list.
- Cross out the delimiter, and the remaining items are the list.

```
"FridayXSaturdayXSunday"
days = ['Friday', 'Saturday', 'Sunday']
```

- Different delimiters give different lists:

```
days = s[:-1].split("day")
"FridaysSaturdaysSunday"
days = ['Fri', 'sSatur', 'sSun']
```

Today's Topics

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

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!')
```

Recap

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

- In Python, we introduced:
  - For-loops

Recap

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- In Python, we introduced:
  - For-loops
  - `range()`

Recap

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for color in ['red', 'green', 'blue']:
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for i in range(2):
    for j in range(2):
        print('Look around,')
    print('How lucky we are to be alive!')
```

- In Python, we introduced:
  - For-loops
  - `range()`
  - Variables: ints and strings

Recap

```
#Predict what will be printed:
for i in range(4):
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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!')
```

- In Python, we introduced:
  - For-loops
  - `range()`
  - Variables: ints and strings
  - Some arithmetic

Recap

```
#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):
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5 Minute Break!

Today we have a second lecture portion! Take a quick break.

Frequently Asked Questions

From emails.

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  We do not accept late work but we drop the lowest 5 program grades.

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  You must work on THIS WEEK'S PROGRAMS, *that way you will never miss a deadline!!!*
- **There is a typo in the slides, should I report it?**
  Yes, great catch! We really appreciate it when you tell us about any typos or errors, please send us email.

Today's Topics

- More on Strings
- Arithmetic
- Indexing and Slicing Lists
- Colors & Hexadecimal Notation

Today's Topics

- **More on Strings**
- Arithmetic
- Indexing and Slicing Lists
- Colors & Hexadecimal Notation

More on Strings...

From Final Exam, Fall 2017, Version 1, #1:

Name: **EmpID:** CSci 127 Final, V1, F17

1. (a) What will the following Python code print:

```
s = "FridaysSaturdaysSundays"
num = s.count("s")
days = s[:-1].split("s")
print("There are", num, "fun days in a week")
mess = days[0]
print("Two of them are", mess, days[-1])
result = ""
for i in range(len(mess)):
    if i > 2:
        result = result + mess[i]
print("My favorite", result, "is Saturday.")
```

Output:

More on Strings...

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Output:

- Some we have seen before, some we haven't.

More on Strings...

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- First, go through and write down what we know:

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Output:

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- First, go through and write down what we know:
  - There are 3 `print()`.

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- First, go through and write down what we know:
  - There are 3 `print()`.
  - Output will have at least:
    `There are ???  fun days in a week`

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```
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Two of them are ???
```

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```
There are ???  fun days in a week
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My favorite ???  is Saturday.
```

- *Will get* 1/3 *to* 1/2 *points for writing down the basic structure.*

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

More on Strings: String Methods

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  - `s.count("s")` counts the number of lower case `s` that occurs.

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  - `num = s.count("s")` stores the result in the variable `num`, for later.

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

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  - `s.count("s")` counts the number of lower case `s` that occurs.
  - `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...

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mess = days[0]
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result = ""
for i in range(len(mess)):
    if i > 2:
        result = result + mess[i]
print("My favorite", result, "is Saturday.")
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Output:

- Don't leave it blank– write what you know & puzzle out as much as possible:

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Output:

- Don't leave it blank– write what you know & puzzle out as much as possible:

```
There are 3 fun days in a week
Two of them are ???
My favorite ???  is Saturday.
```

More on Strings: Indexing & Substrings

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

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

More on Strings: Indexing & Substrings

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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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- `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'`.

More on Strings: Indexing & Substrings

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```

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- `s[1]` is

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												...	-4	-3	-2	-1

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

More on Strings: Indexing & Substrings

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days = s[:-1].split("s")
```

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- `s[-1]` is

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

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

More on Strings: Indexing & Substrings

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- Strings are made up of individual characters (letters, numbers, etc.)
- Useful to be able to refer to pieces of a string, either an individual location or a "substring" of the string.

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
												...	-4	-3	-2	-1

- `s[:3]` is

More on Strings: Indexing & Substrings

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- Strings are made up of individual characters (letters, numbers, etc.)
- Useful to be able to refer to pieces of a string, either an individual location or a "substring" of the string.

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
												...	-4	-3	-2	-1

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

More on Strings: Indexing & Substrings

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- Strings are made up of individual characters (letters, numbers, etc.)
- Useful to be able to refer to pieces of a string, either an individual location or a "substring" of the string.

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
												...	-4	-3	-2	-1

- `s[:-1]` is

More on Strings: Indexing & Substrings

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- Strings are made up of individual characters (letters, numbers, etc.)
- Useful to be able to refer to pieces of a string, either an individual location or a "substring" of the string.

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
												...	-4	-3	-2	-1

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

More on Strings: Splits

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- `split()` divides a string into a list.

More on Strings: Splits

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- `split()` divides a string into a list.
- Cross out the delimiter, and the remaining items are the list.

More on Strings: Splits

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- `split()` divides a string into a list.
- Cross out the delimiter, and the remaining items are the list.

"Friday~~s~~Saturday~~s~~Sunday"

More on Strings: Splits

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- `split()` divides a string into a list.
- Cross out the delimiter, and the remaining items are the list.

```
"FridaysSaturdaysSunday"
days = ['Friday', 'Saturday', 'Sunday']
```

More on Strings: Splits

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- `split()` divides a string into a list.
- Cross out the delimiter, and the remaining items are the list.

```
"FridaysSaturdaysSunday"
days = ['Friday', 'Saturday', 'Sunday']
```

- Different delimiters give different lists:

More on Strings: Splits

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- `split()` divides a string into a list.
- Cross out the delimiter, and the remaining items are the list.

```
"FridaysSaturdaysSunday"
days = ['Friday', 'Saturday', 'Sunday']
```

- Different delimiters give different lists:

```
days = s[:-1].split("day")
```

More on Strings: Splits

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- `split()` divides a string into a list.
- Cross out the delimiter, and the remaining items are the list.

```
"FridaysSaturdaysSunday"
days = ['Friday', 'Saturday', 'Sunday']
```

- Different delimiters give different lists:

```
days = s[:-1].split("day")
"FridaysSaturdaysSunday"
```

More on Strings: Splits

```
s = "FridaysSaturdaysSundays"
days = s[:-1].split("s")
```

- `split()` divides a string into a list.
- Cross out the delimiter, and the remaining items are the list.

```
"FridaysSaturdaysSunday"
days = ['Friday', 'Saturday', 'Sunday']
```

- Different delimiters give different lists:

```
days = s[:-1].split("day")
"FridaysSaturdaysSunday"
days = ['Fri', 'sSatur', 'sSun']
```

More on Strings...

Name: **EmpID:** CSci 127 Final, V1, F17

1. (a) What will the following Python code print:

```
s = "FridaysSaturdaysSundays"
num = s.count("s")
days = s[:-1].split("s")
print("There are", num, "fun days in a week")
mess = days[0]
print("Two of them are", mess, days[-1])
result = ""
for i in range(len(mess)):
    if i > 2:
        result = result + mess[i]
print("My favorite", result, "is Saturday.")
```

Output:

- Don't leave it blank– write what you know & puzzle out as much as possible:

More on Strings...

Name: **EmpID:** CSci 127 Final, V1, F17

1. (a) What will the following Python code print:

```
s = "FridaysSaturdaysSundays"
num = s.count("s")
days = s[:-1].split("s")
print("There are", num, "fun days in a week")
mess = days[0]
print("Two of them are", mess, days[-1])
result = ""
for i in range(len(mess)):
    if i > 2:
        result = result + mess[i]
print("My favorite", result, "is Saturday.")
```

Output:

- Don't leave it blank– write what you know & puzzle out as much as possible:

```
There are 3 fun days in a week
Two of them are Friday Sunday
My favorite ???  is Saturday.
```

Today's Topics

- More on Strings
- **Arithmetic**
- Indexing and Slicing Lists
- Colors & Hexadecimal Notation

Arithmetic

Some arithmetic operators in Python:

- Addition:

Arithmetic

Some arithmetic operators in Python:

- Addition: `sum = sum + 3`

Arithmetic

Some arithmetic operators in Python:

- Addition: `sum = sum + 3`
- Subtraction:

Arithmetic

Some arithmetic operators in Python:

- Addition: `sum = sum + 3`
- Subtraction: `deb = deb - item`

Arithmetic

Some arithmetic operators in Python:

- Addition: `sum = sum + 3`
- Subtraction: `deb = deb - item`
- Multiplication:

Arithmetic

Some arithmetic operators in Python:

- Addition: `sum = sum + 3`
- Subtraction: `deb = deb - item`
- Multiplication: `area = h * w`

Arithmetic

Some arithmetic operators in Python:

- Addition: `sum = sum + 3`
- Subtraction: `deb = deb - item`
- Multiplication: `area = h * w`
- Division:

Arithmetic

Some arithmetic operators in Python:

- Addition: `sum = sum + 3`
- Subtraction: `deb = deb - item`
- Multiplication: `area = h * w`
- Division: `ave = total / n`

Arithmetic

Some arithmetic operators in Python:

- Addition: `sum = sum + 3`
- Subtraction: `deb = deb - item`
- Multiplication: `area = h * w`
- Division: `ave = total / n`
- Floor or Integer Division:

Arithmetic

Some arithmetic operators in Python:

- Addition: `sum = sum + 3`
- Subtraction: `deb = deb - item`
- Multiplication: `area = h * w`
- Division: `ave = total / n`
- Floor or Integer Division:
  `weeks = totalDays // 7`

15 // 7 = 2

Arithmetic

Some arithmetic operators in Python:

- Addition: `sum = sum + 3`
- Subtraction: `deb = deb - item`
- Multiplication: `area = h * w`
- Division: `ave = total / n`
- Floor or Integer Division:
  `weeks = totalDays // 7`

  15 // 7 = 2
- Remainder or Modulus:

Arithmetic

Some arithmetic operators in Python:

- Addition: `sum = sum + 3`
- Subtraction: `deb = deb - item`
- Multiplication: `area = h * w`
- Division: `ave = total / n`
- Floor or Integer Division:
  `weeks = totalDays // 7` *15 // 7 = 2*
- Remainder or Modulus:
  `days = totalDays % 7` *15 % 7 = 1*

Arithmetic

Some arithmetic operators in Python:

- Addition: `sum = sum + 3`
- Subtraction: `deb = deb - item`
- Multiplication: `area = h * w`
- Division: `ave = total / n`
- Floor or Integer Division:
  `weeks = totalDays // 7` *15 // 7 = 2*
- Remainder or Modulus:
  `days = totalDays % 7` *15 % 7 = 1*
- Exponentiaion:

Arithmetic

Some arithmetic operators in Python:

- Addition: `sum = sum + 3`
- Subtraction: `deb = deb - item`
- Multiplication: `area = h * w`
- Division: `ave = total / n`
- Floor or Integer Division:
  `weeks = totalDays // 7`
  15 // 7 = 2
- Remainder or Modulus:
  `days = totalDays % 7`
  15 % 7 = 1
- Exponentiaion:
  `pop = 2**time`

Challenge:

What does this code do?

```
#Mystery code for lecture 3

startTime = int(input('Enter starting time: '))
duration = int(input('Enter how long: '))

print('Your event starts at', startTime, "o'clock.")

endTime = (startTime+duration)%12
print('Your event ends at', endTime, "o'clock.")
```

Challenge:

What does this code do?

```
#Mystery code for lecture 3

startTime = int(input('Enter starting time: '))
duration = int(input('Enter how long: '))

print('Your event starts at', startTime, "o'clock.")

endTime = (startTime+duration)%12
print('Your event ends at', endTime, "o'clock.")
```

In particular, what is printed...

- If the user enters, 9 and 2.

Challenge:

What does this code do?

```
#Mystery code for lecture 3

startTime = int(input('Enter starting time: '))
duration = int(input('Enter how long: '))

print('Your event starts at', startTime, "o'clock.")

endTime = (startTime+duration)%12
print('Your event ends at', endTime, "o'clock.")
```

In particular, what is printed...

- If the user enters, 9 and 2.
- If the user enters, 12 and 4.

Challenge:

What does this code do?

```
#Mystery code for lecture 3

startTime = int(input('Enter starting time: '))
duration = int(input('Enter how long: '))

print('Your event starts at', startTime, "o'clock.")

endTime = (startTime+duration)%12
print('Your event ends at', endTime, "o'clock.")
```

In particular, what is printed...

- If the user enters, 9 and 2.
- If the user enters, 12 and 4.
- If the user enters, 8 and 20.

Challenge:

What does this code do?

```
#Mystery code for lecture 3

startTime = int(input('Enter starting time: '))
duration = int(input('Enter how long: '))

print('Your event starts at', startTime, "o'clock.")

endTime = (startTime+duration)%12
print('Your event ends at', endTime, "o'clock.")
```

In particular, what is printed...

- If the user enters, 9 and 2.
- If the user enters, 12 and 4.
- If the user enters, 8 and 20.
- If the user enters, 11 and 1.

Challenge:

What does this code do?

```
#Mystery code for lecture 3

startTime = int(input('Enter starting time: '))
duration = int(input('Enter how long: '))

print('Your event starts at', startTime, "o'clock.")

endTime = (startTime+duration)%12
print('Your event ends at', endTime, "o'clock.")
```

In particular, what is printed...

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Challenge:

What does this code do?

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startTime = int(input('Enter starting time: '))
duration = int(input('Enter how long: '))

print('Your event starts at', startTime, "o'clock.")

endTime = (startTime+duration)%12
print('Your event ends at', endTime, "o'clock.")
```

In particular, what is printed...

- If the user enters, 9 and 2.

```
Enter starting time: 9
Enter how long: 2
Your event starts at 9 o'clock.
Your event ends at 11 o'clock.
```

Challenge:

What does this code do?

```
#Mystery code for lecture 3

startTime = int(input('Enter starting time: '))
duration = int(input('Enter how long: '))

print('Your event starts at', startTime, "o'clock.")

endTime = (startTime+duration)%12
print('Your event ends at', endTime, "o'clock.")
```

In particular, what is printed...

- If the user enters, 12 and 4.

Challenge:

What does this code do?

```
#Mystery code for lecture 3

startTime = int(input('Enter starting time: '))
duration = int(input('Enter how long: '))

print('Your event starts at', startTime, "o'clock.")

endTime = (startTime+duration)%12
print('Your event ends at', endTime, "o'clock.")
```

In particular, what is printed...

- If the user enters, 12 and 4.

```
Enter starting time: 12
Enter how long: 4
Your event starts at 12 o'clock.
Your event ends at 4 o'clock.
```

Challenge:

What does this code do?

```
#Mystery code for lecture 3

startTime = int(input('Enter starting time: '))
duration = int(input('Enter how long: '))

print('Your event starts at', startTime, "o'clock.")

endTime = (startTime+duration)%12
print('Your event ends at', endTime, "o'clock.")
```

In particular, what is printed...

- If the user enters, 8 and 20.

Challenge:

What does this code do?

```
#Mystery code for lecture 3

startTime = int(input('Enter starting time: '))
duration = int(input('Enter how long: '))

print('Your event starts at', startTime, "o'clock.")

endTime = (startTime+duration)%12
print('Your event ends at', endTime, "o'clock.")
```

In particular, what is printed...

- If the user enters, 8 and 20.

```
Enter starting time: 8
Enter how long: 20
Your event starts at 8 o'clock.
Your event ends at 4 o'clock.
```

Challenge:

What does this code do?

```
#Mystery code for lecture 3

startTime = int(input('Enter starting time: '))
duration = int(input('Enter how long: '))

print('Your event starts at', startTime, "o'clock.")

endTime = (startTime+duration)%12
print('Your event ends at', endTime, "o'clock.")
```

In particular, what is printed...

- If the user enters, 11 and 1.

Challenge:

What does this code do?

```
#Mystery code for lecture 3

startTime = int(input('Enter starting time: '))
duration = int(input('Enter how long: '))

print('Your event starts at', startTime, "o'clock.")

endTime = (startTime+duration)%12
print('Your event ends at', endTime, "o'clock.")
```

In particular, what is printed...

- If the user enters, 11 and 1.

```
Enter starting time: 11
Enter how long: 1
Your event starts at 11 o'clock.
Your event ends at 0 o'clock.
```

Today's Topics

- More on Strings
- Arithmetic
- **Indexing and Slicing Lists**
- Colors & Hexadecimal Notation

Challenge:

Mostly review:

```
1  for d in range(10, 0, -1):
2      print(d)
3  print("Blast off!")
4
5  for num in range(5,8):
6      print(num, 2*num)
7
8  s = "City University of New York"
9  print(s[3], s[0:3], s[:3])
10 print(s[5:8], s[-1])
11
12 names = ["Eleanor", "Anna", "Alice", "Edith"]
13 for n in names:
14     print(n)
```

Python Tutor

```
1  for d in range(10, 0, -1):
2      print(d)
3  print("Blast off!")
4
5  for num in range(5,8):
6      print(num, 2*num)
7
8  s = "City University of New York"
9  print(s[3], s[0:3], s[:3])
10 print(s[5:8], s[-1])
11
12 names = ["Eleanor", "Anna", "Alice", "Edith"]
13 for n in names:
14     print(n)
```

(Demo with pythonTutor)

Review: range()

The three versions:

Review: range()

The three versions:

- `range(stop)`

Review: range()

The three versions:

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

Review: range()

The three versions:

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

Slices

- Similar to `range()`, you can take portions or **slices** of lists and strings:

```
1  for d in range(10, 0, -1):
2      print(d)
3  print("Blast off!")
4
5  for num in range(5,8):
6      print(num, 2*num)
7
8  s = "City University of New York"
9  print(s[3], s[0:3], s[:3])
10 print(s[5:8], s[-1])
11
12 names = ["Eleanor", "Anna", "Alice", "Edith"]
13 for n in names:
14     print(n)
```

Slices

```
1  for d in range(10, 0, -1):
2      print(d)
3  print("Blast off!")
4
5  for num in range(5,8):
6      print(num, 2*num)
7
8  s = "City University of New York"
9  print(s[3], s[0:3], s[:3])
10 print(s[5:8], s[-1])
11
12 names = ["Eleanor", "Anna", "Alice", "Edith"]
13 for n in names:
14     print(n)
```

- Similar to `range()`, you can take portions or **slices** of lists and strings:

  `s[5:8]`

  gives: `"Uni"`

Slices

```
1  for d in range(10, 0, -1):
2      print(d)
3  print("Blast off!")
4
5  for num in range(5,8):
6      print(num, 2*num)
7
8  s = "City University of New York"
9  print(s[3], s[0:3], s[:3])
10 print(s[5:8], s[-1])
11
12 names = ["Eleanor", "Anna", "Alice", "Edith"]
13 for n in names:
14     print(n)
```

- Similar to `range()`, you can take portions or **slices** of lists and strings:

  `s[5:8]`

  gives: `"Uni"`
- Also works for lists:

Slices

```
1  for d in range(10, 0, -1):
2      print(d)
3  print("Blast off!")
4
5  for num in range(5,8):
6      print(num, 2*num)
7
8  s = "City University of New York"
9  print(s[3], s[0:3], s[:3])
10 print(s[5:8], s[-1])
11
12 names = ["Eleanor", "Anna", "Alice", "Edith"]
13 for n in names:
14     print(n)
```

- Similar to `range()`, you can take portions or **slices** of lists and strings:

  `s[5:8]`

  gives: `"Uni"`
- Also works for lists:

  `names[1:3]`

Slices

```
1  for d in range(10, 0, -1):
2      print(d)
3  print("Blast off!")
4
5  for num in range(5,8):
6      print(num, 2*num)
7
8  s = "City University of New York"
9  print(s[3], s[0:3], s[:3])
10 print(s[5:8], s[-1])
11
12 names = ["Eleanor", "Anna", "Alice", "Edith"]
13 for n in names:
14     print(n)
```

- Similar to `range()`, you can take portions or **slices** of lists and strings:

  `s[5:8]`

  gives: `"Uni"`
- Also works for lists:

  `names[1:3]`

  gives: `["Anna", "Alice"]`

Slices

```
1  for d in range(10, 0, -1):
2      print(d)
3  print("Blast off!")
4
5  for num in range(5,8):
6      print(num, 2*num)
7
8  s = "City University of New York"
9  print(s[3], s[0:3], s[:3])
10 print(s[5:8], s[-1])
11
12 names = ["Eleanor", "Anna", "Alice", "Edith"]
13 for n in names:
14     print(n)
```

- Similar to `range()`, you can take portions or **slices** of lists and strings:

  `s[5:8]`

  gives: `"Uni"`
- Also works for lists:

  `names[1:3]`

  gives: `["Anna", "Alice"]`
- Python also lets you "count backwards": last element has index: `-1`.

Today's Topics

- More on Strings
- Arithmetic
- Indexing and Slicing Lists
- **Colors & Hexadecimal Notation**

Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by name.

Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by name.
- Can specify by numbers:

Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by name.
- Can specify by numbers:
  - Amount of Red, Green, and Blue (RGB).

Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by name.
- Can specify by numbers:
  - Amount of Red, Green, and Blue (RGB).
  - Adding light, not paint:

Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by name.
- Can specify by numbers:
  - Amount of Red, Green, and Blue (RGB).
  - Adding light, not paint:
    - ★ Black: 0% red, 0% green, 0% blue

Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by name.
- Can specify by numbers:
  - Amount of Red, Green, and Blue (RGB).
  - Adding light, not paint:
    - ★ Black: 0% red, 0% green, 0% blue
    - ★ White: 100% red, 100% green, 100% blue

Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by numbers (RGB):

Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by numbers (RGB):
  - Fractions of each:

Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by numbers (RGB):
  - Fractions of each:
    e.g. `(1.0, 0, 0)` is 100% red, no green, and no blue.

Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by numbers (RGB):
  - Fractions of each:
    e.g. `(1.0, 0, 0)` is 100% red, no green, and no blue.
  - 8-bit colors: numbers from 0 to 255:

Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by numbers (RGB):
  - Fractions of each:
    e.g. `(1.0, 0, 0)` is 100% red, no green, and no blue.
  - 8-bit colors: numbers from 0 to 255:
    e.g. `(0, 255, 0)` is no red, 100% green, and no blue.

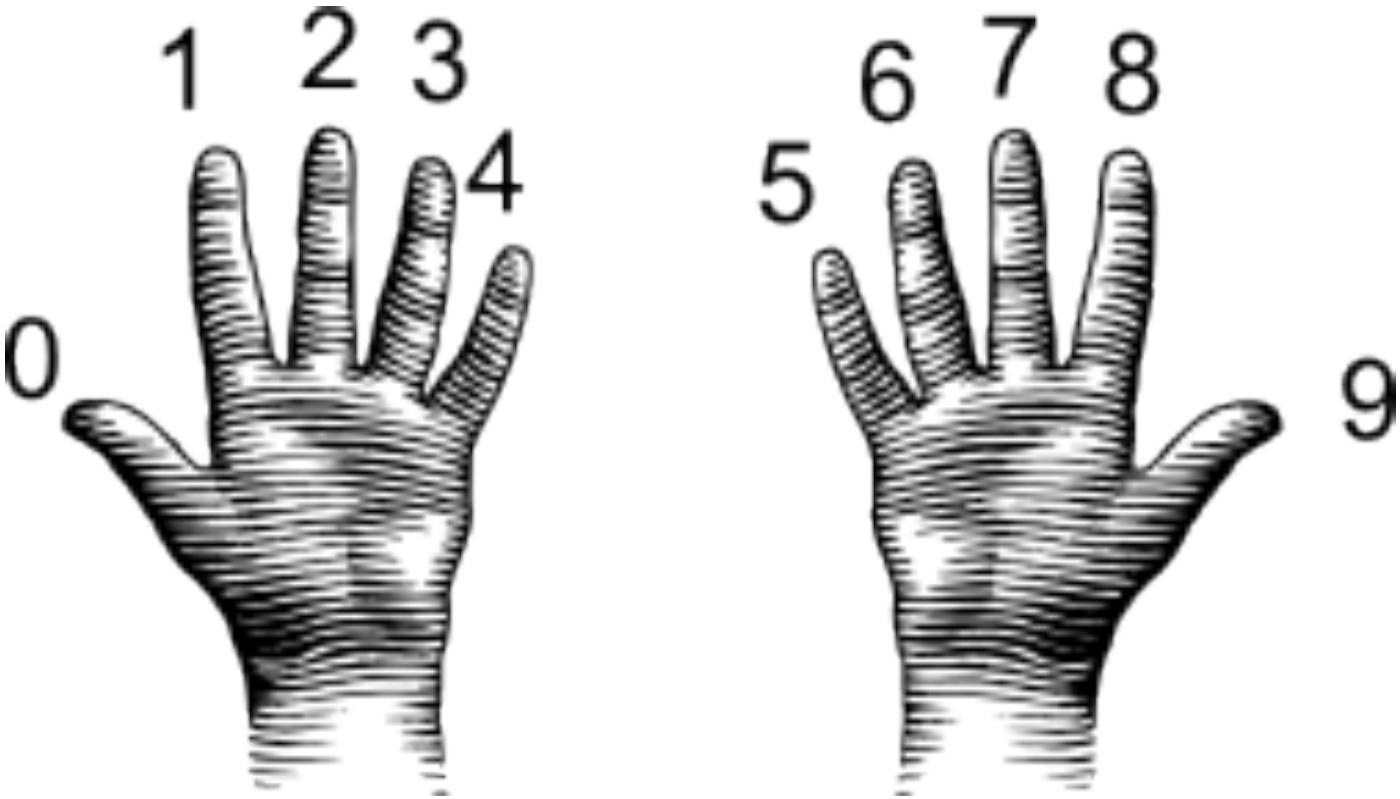
Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by numbers (RGB):
  - Fractions of each:
    e.g. `(1.0, 0, 0)` is 100% red, no green, and no blue.
  - 8-bit colors: numbers from 0 to 255:
    e.g. `(0, 255, 0)` is no red, 100% green, and no blue.
  - Hexcodes (base-16 numbers)...

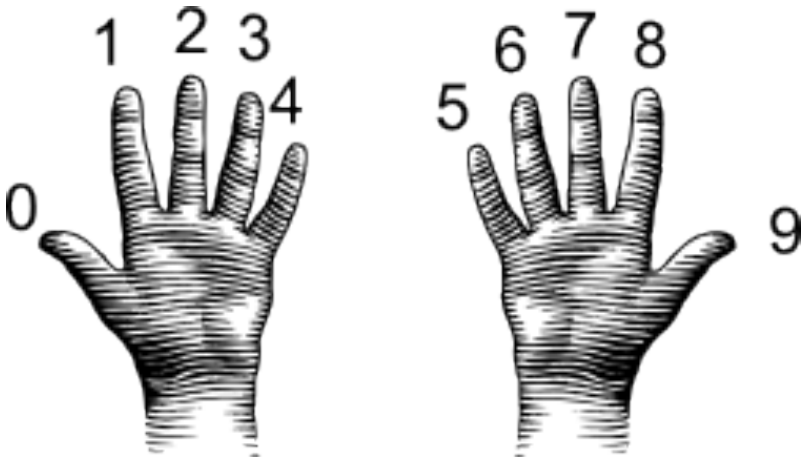
Decimal & Hexadecimal Numbers

Counting with 10 digits:



(from i-programmer.info)

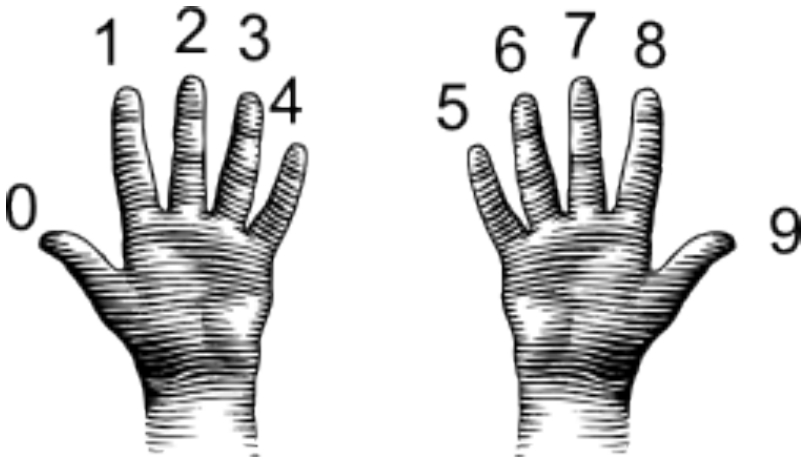
Decimal



(from i-programmer.info)

Decimal

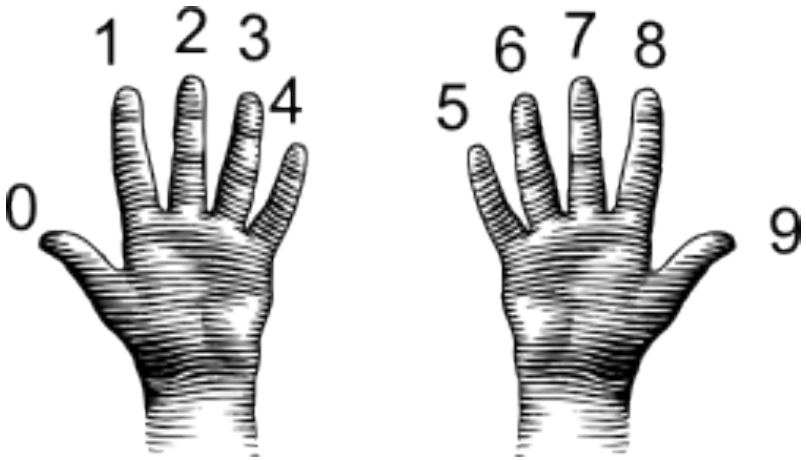
00 01 02 03 04 05 06 07 08 09



(from i-programmer.info)

Decimal

00 01 02 03 04 05 06 07 08 09
10 11 12 13 14 15 16 17 18 19



(from i-programmer.info)

Decimal

00 01 02 03 04 05 06 07 08 09
10 11 12 13 14 15 16 17 18 19
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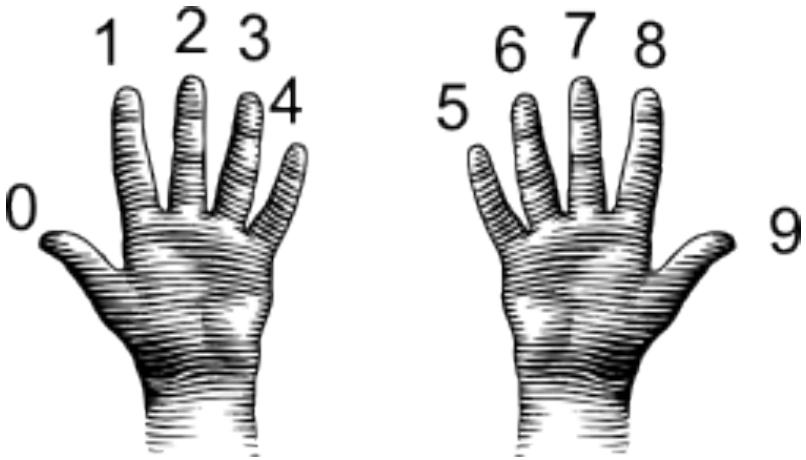

(from i-programmer.info)

Decimal

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20	21	22	23	24	25	26	27	28	29
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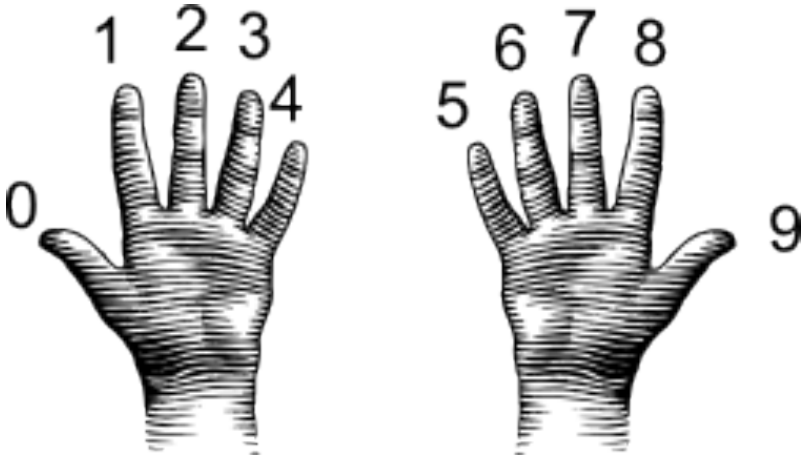
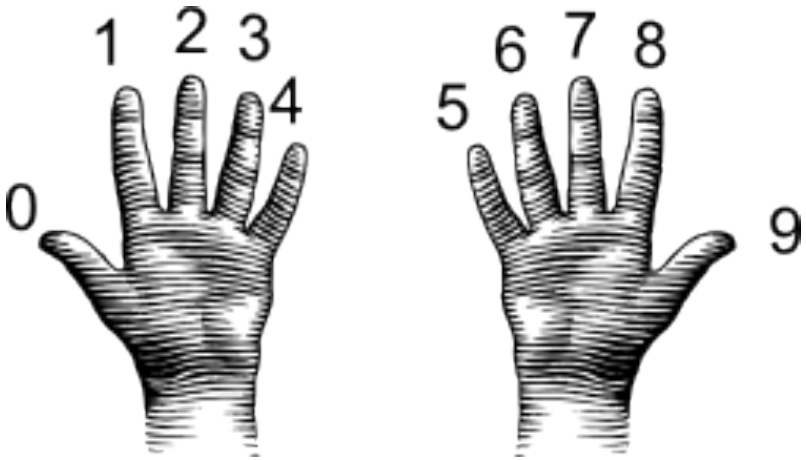


(from i-programmer.info)

Decimal



(from i-programmer.info)

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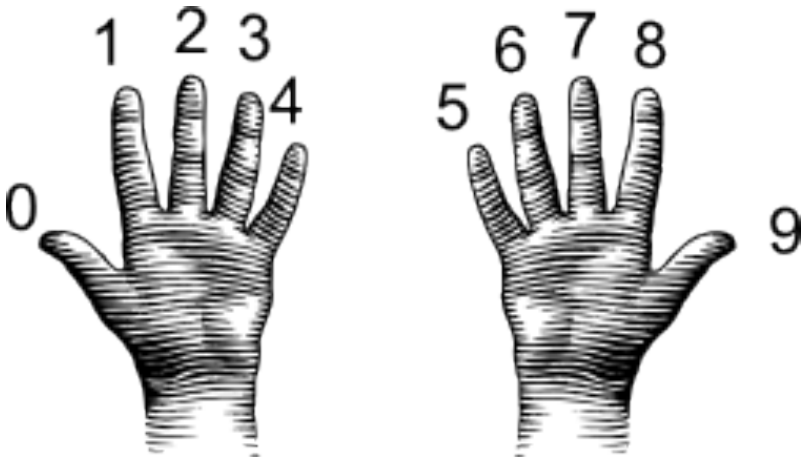
Decimal



(from i-programmer.info)

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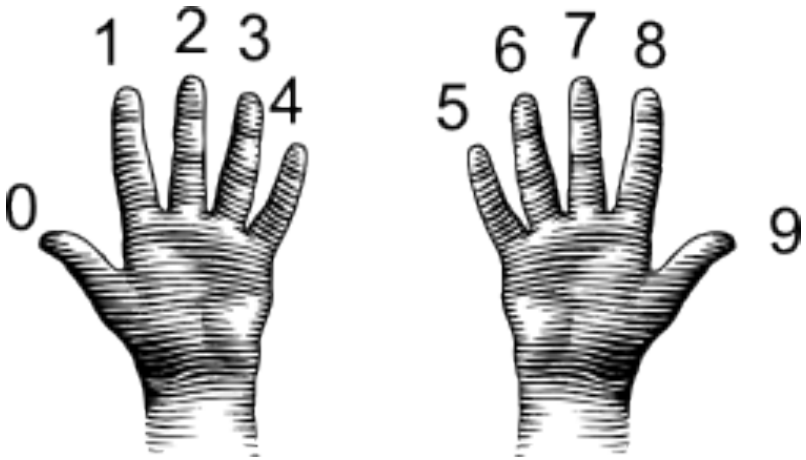
50	51	52	53	54	55	56	57	58	59

Decimal



(from i-programmer.info)

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50	51	52	53	54	55	56	57	58	59
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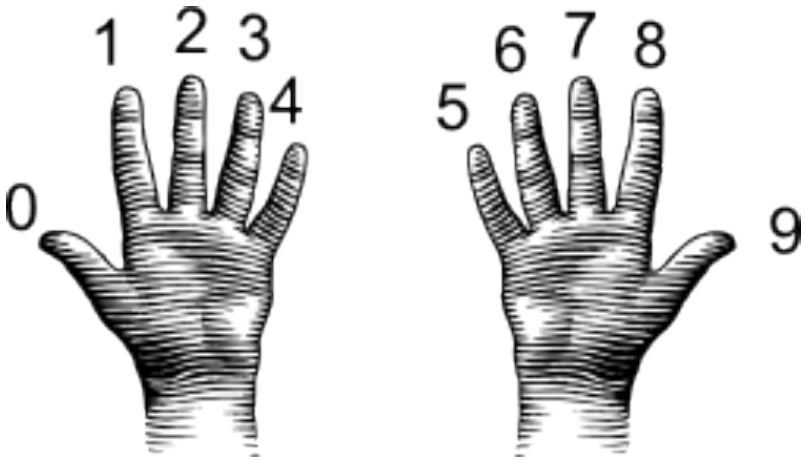
Decimal



(from i-programmer.info)

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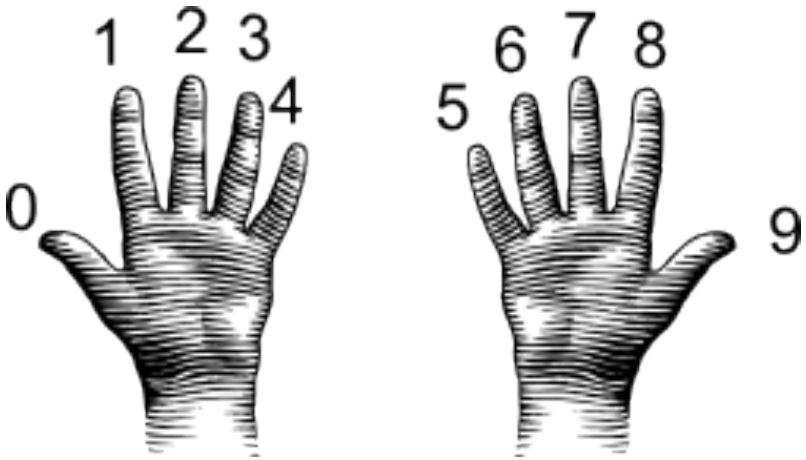
50	51	52	53	54	55	56	57	58	59
60	61	62	63	64	65	66	67	68	69
70	71	72	73	74	75	76	77	78	79

Decimal



(from i-programmer.info)

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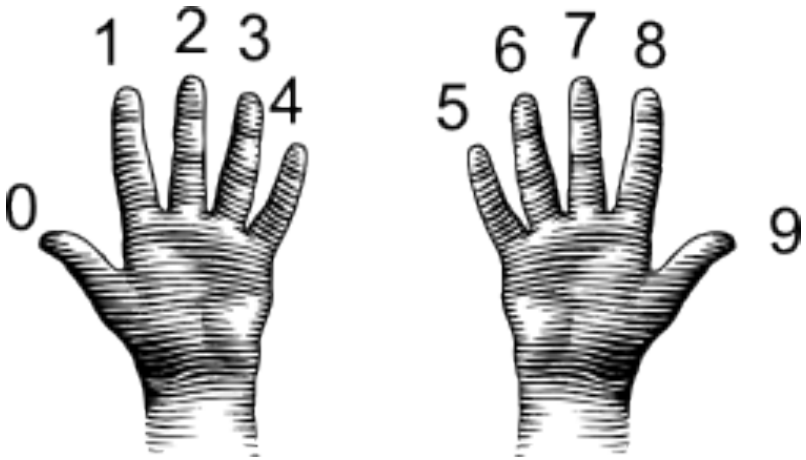
80	81	82	83	84	85	86	87	88	89

Decimal



(from i-programmer.info)

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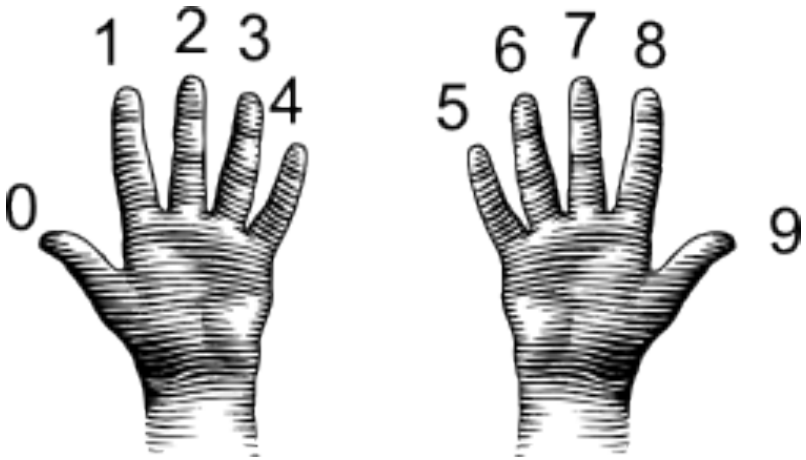
70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89
90	91	92	93	94	95	96	97	98	99

Decimal



(from i-programmer.info)

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50	51	52	53	54	55	56	57	58	59
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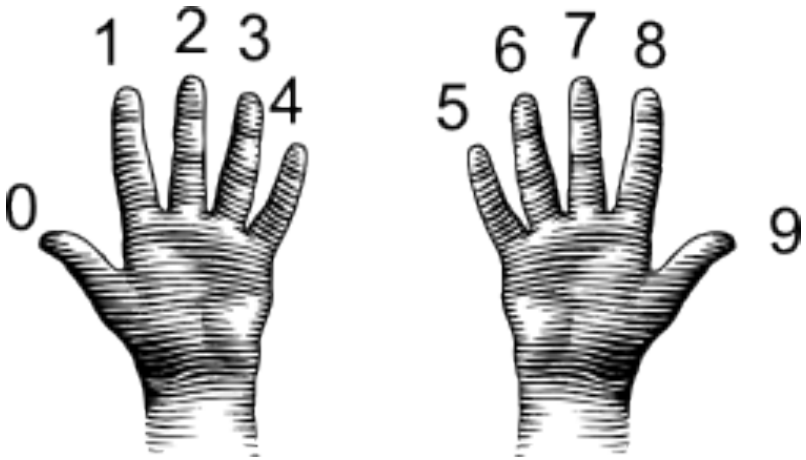
70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89
90	91	92	93	94	95	96	97	98	99

$10^1 + 10^0$

Max Number = 99

Decimal



(from i-programmer.info)

00	01	02	03	04	05	06	07	08	09
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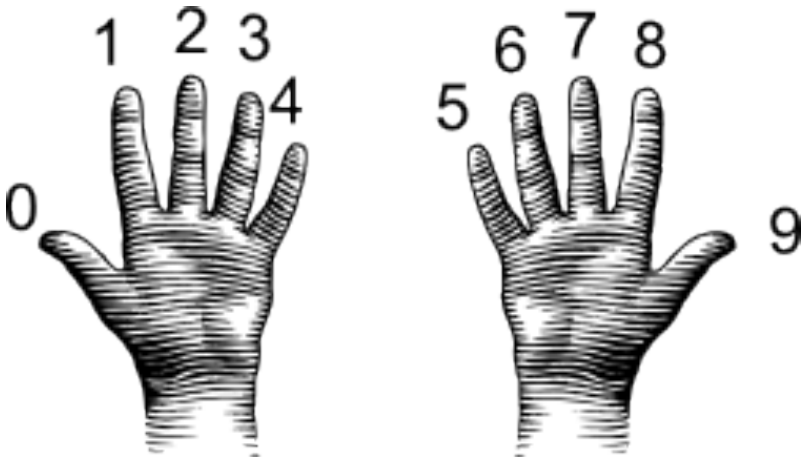
70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89
90	91	92	93	94	95	96	97	98	99

$10^1 + 10^0$

Max Number = 99

$$90 = (9 * 10^1) + (0 * 10^0)$$

Decimal



(from i-programmer.info)

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50	51	52	53	54	55	56	57	58	59
60	61	62	63	64	65	66	67	68	69
70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89
90	91	92	93	94	95	96	97	98	99

$$10^1 + 10^0$$

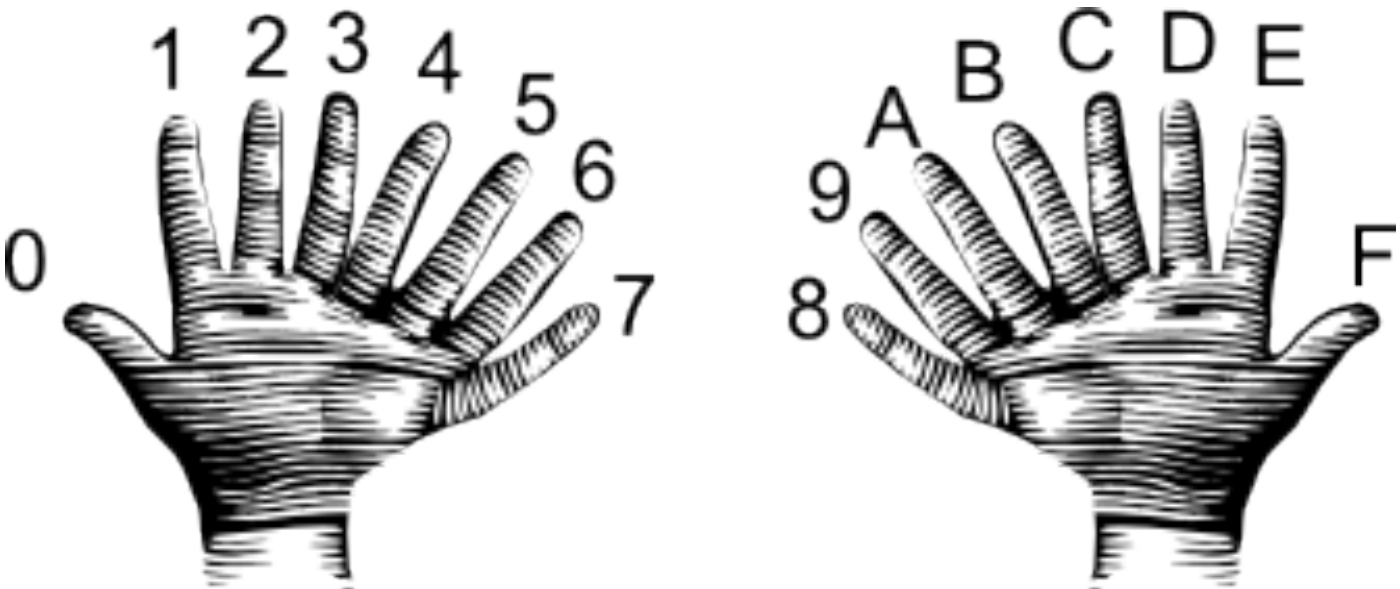
Max Number = 99

$$90 = (9 * 10^1) + (0 * 10^0)$$

$$99 = (9 * 10^1) + (9 * 10^0)$$

Decimal & Hexadecimal Numbers

Counting with 16 digits:



(from i-programmer.info)

Hexadecimal

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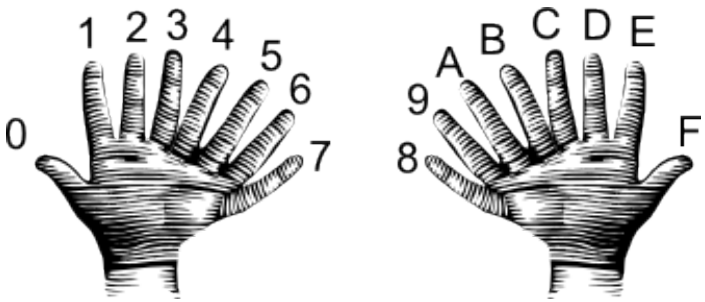

(from i-programmer.info)

Hexadecimal

```
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10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F
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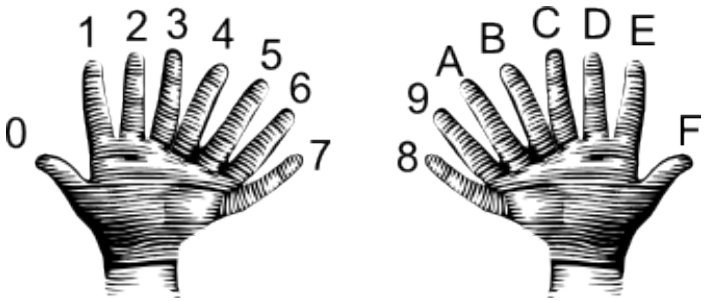

(from i-programmer.info)

Hexadecimal

```
00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F
20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F
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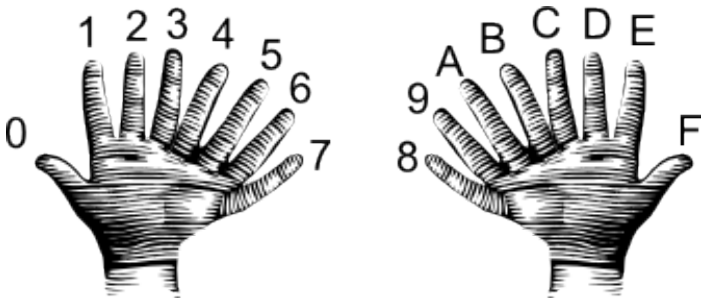

(from i-programmer.info)

Hexadecimal

```
00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F
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30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F
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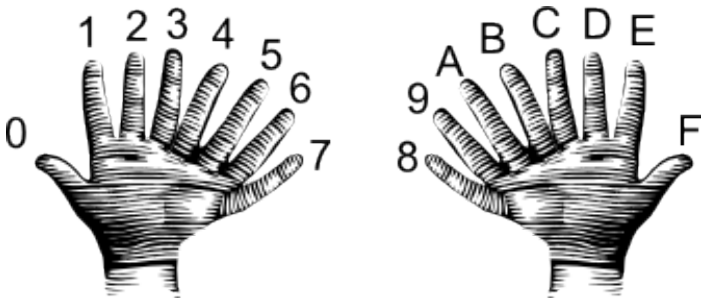

(from i-programmer.info)

Hexadecimal

```
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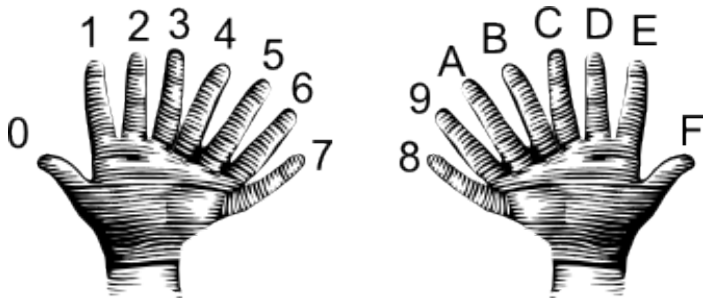
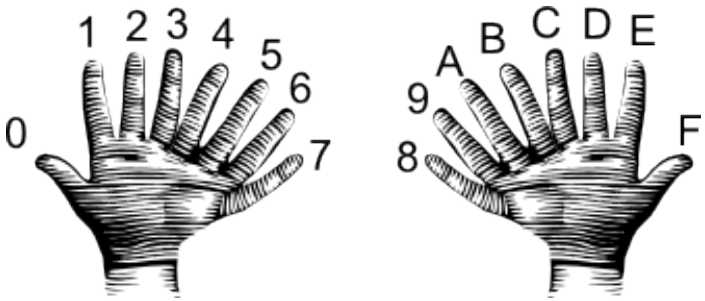


(from i-programmer.info)

Hexadecimal



(from i-programmer.info)

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30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F
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```
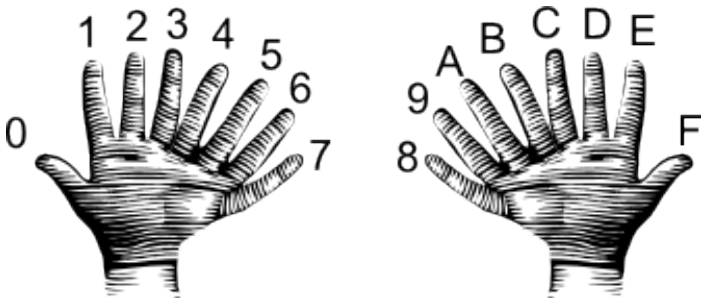

Hexadecimal



(from i-programmer.info)

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40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F
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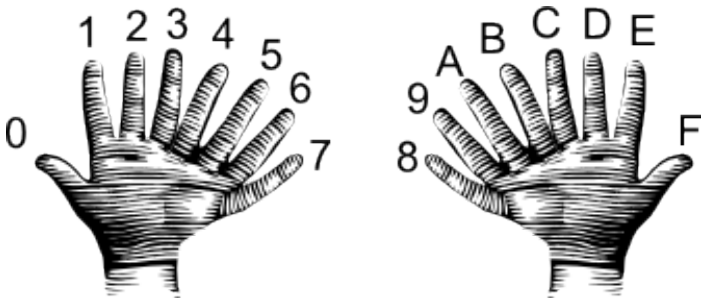
```

Hexadecimal



(from i-programmer.info)

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40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F
50 51 52 53 54 55 56 57 58 59 5A 5B 5C 5D 5E 5F
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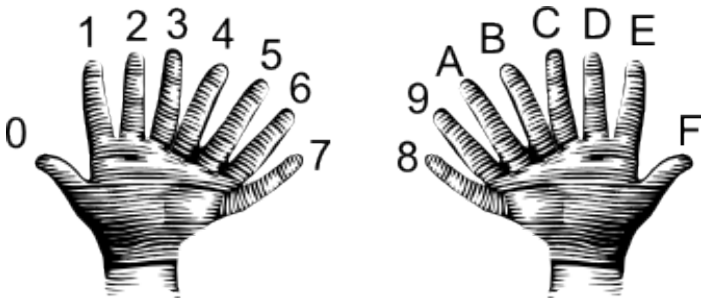
Hexadecimal



(from i-programmer.info)

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```
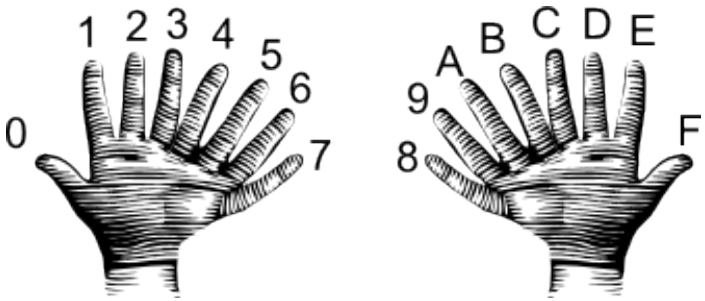

Hexadecimal



(from i-programmer.info)

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70 71 72 73 74 75 76 77 78 79 7A 7B 7C 7D 7E 7F
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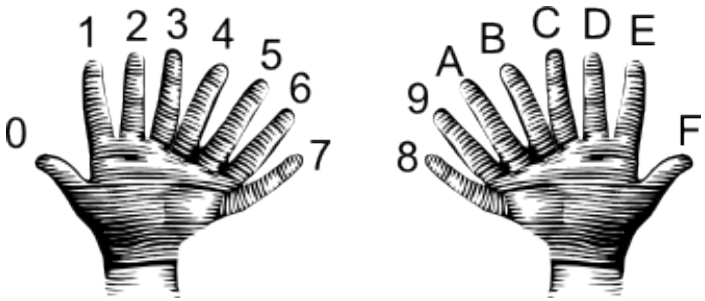
```

Hexadecimal



(from i-programmer.info)

```
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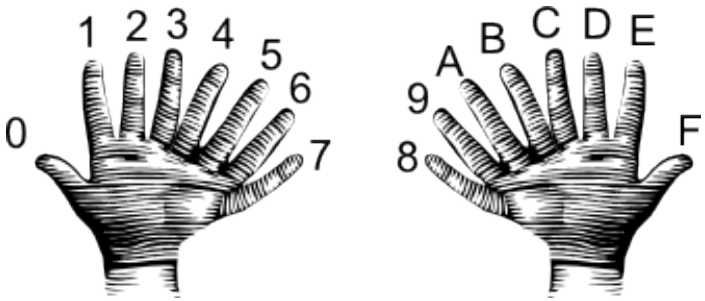
Hexadecimal



(from i-programmer.info)

```
00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
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20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F
30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F
40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F
50 51 52 53 54 55 56 57 58 59 5A 5B 5C 5D 5E 5F
60 61 62 63 64 65 66 67 68 69 6A 6B 6C 6D 6E 6F
70 71 72 73 74 75 76 77 78 79 7A 7B 7C 7D 7E 7F
80 81 82 83 84 85 86 87 88 89 8A 8B 8C 8D 8E 8F
90 91 92 93 94 95 96 97 98 99 9A 9B 9C 9D 9E 9F
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 AA AB AC AD AE AF
B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 BA BB BC BD BE BF
```
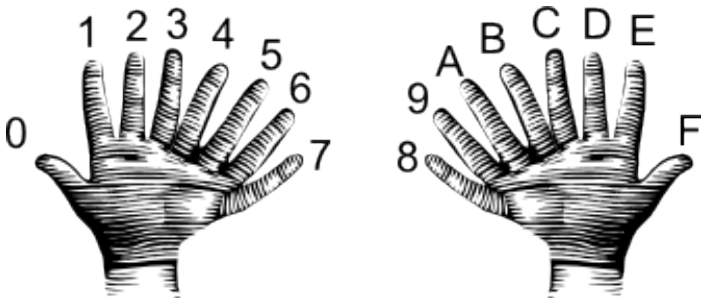

Hexadecimal



(from i-programmer.info)

```
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80 81 82 83 84 85 86 87 88 89 8A 8B 8C 8D 8E 8F
90 91 92 93 94 95 96 97 98 99 9A 9B 9C 9D 9E 9F
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 AA AB AC AD AE AF
B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 BA BB BC BD BE BF
C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 CA CB CC CD CE CF
```
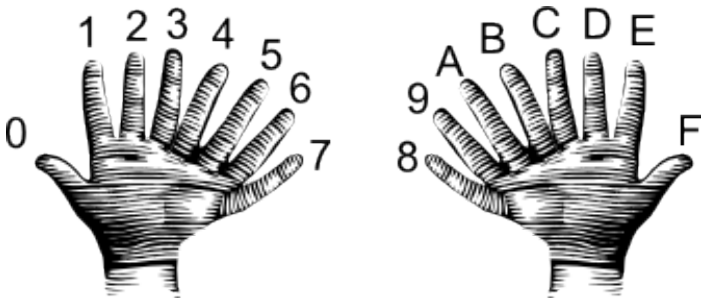

Hexadecimal



(from i-programmer.info)

```
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20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F
30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F
40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F
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60 61 62 63 64 65 66 67 68 69 6A 6B 6C 6D 6E 6F
70 71 72 73 74 75 76 77 78 79 7A 7B 7C 7D 7E 7F
80 81 82 83 84 85 86 87 88 89 8A 8B 8C 8D 8E 8F
90 91 92 93 94 95 96 97 98 99 9A 9B 9C 9D 9E 9F
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 AA AB AC AD AE AF
B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 BA BB BC BD BE BF
C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 CA CB CC CD CE CF
D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 DA DB DC DD DE DF
```
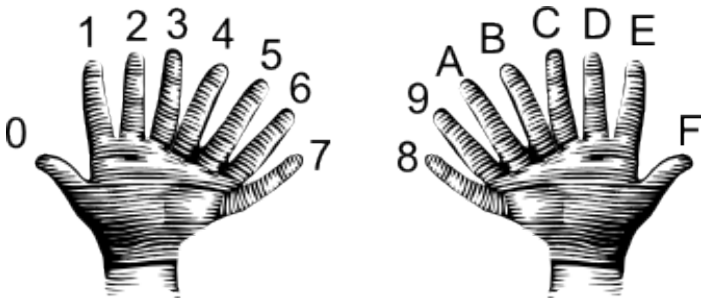

Hexadecimal



(from i-programmer.info)

```
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20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F
30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F
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70 71 72 73 74 75 76 77 78 79 7A 7B 7C 7D 7E 7F
80 81 82 83 84 85 86 87 88 89 8A 8B 8C 8D 8E 8F
90 91 92 93 94 95 96 97 98 99 9A 9B 9C 9D 9E 9F
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 AA AB AC AD AE AF
B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 BA BB BC BD BE BF
C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 CA CB CC CD CE CF
D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 DA DB DC DD DE DF
E0 E1 E2 E3 E4 E5 E6 E7 E8 E9 EA EB EC ED EE EF
```
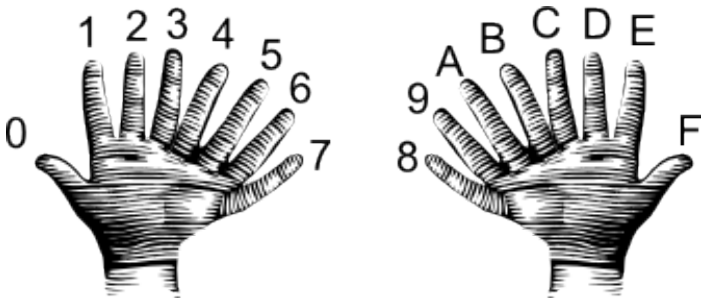

Hexadecimal



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10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F
20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F
30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F
40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F
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70 71 72 73 74 75 76 77 78 79 7A 7B 7C 7D 7E 7F
80 81 82 83 84 85 86 87 88 89 8A 8B 8C 8D 8E 8F
90 91 92 93 94 95 96 97 98 99 9A 9B 9C 9D 9E 9F
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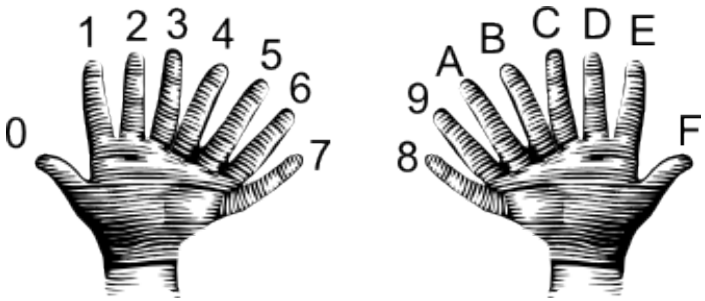
C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 CA CB CC CD CE CF
D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 DA DB DC DD DE DF
E0 E1 E2 E3 E4 E5 E6 E7 E8 E9 EA EB EC ED EE EF
F0 F1 F2 F3 F4 F5 F6 F7 F8 F9 FA FB FC FD FE FF
```

Hexadecimal



(from i-programmer.info)

```
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20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F
30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F
40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F
50 51 52 53 54 55 56 57 58 59 5A 5B 5C 5D 5E 5F
60 61 62 63 64 65 66 67 68 69 6A 6B 6C 6D 6E 6F
70 71 72 73 74 75 76 77 78 79 7A 7B 7C 7D 7E 7F
80 81 82 83 84 85 86 87 88 89 8A 8B 8C 8D 8E 8F
90 91 92 93 94 95 96 97 98 99 9A 9B 9C 9D 9E 9F
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 AA AB AC AD AE AF
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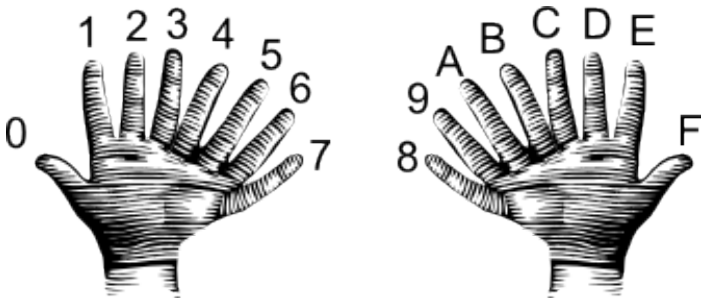
D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 DA DB DC DD DE DF
E0 E1 E2 E3 E4 E5 E6 E7 E8 E9 EA EB EC ED EE EF
F0 F1 F2 F3 F4 F5 F6 F7 F8 F9 FA FB FC FD FE FF
```

$16^1 + 16^0$

Hexadecimal



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00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F
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C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 CA CB CC CD CE CF
D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 DA DB DC DD DE DF
E0 E1 E2 E3 E4 E5 E6 E7 E8 E9 EA EB EC ED EE EF
F0 F1 F2 F3 F4 F5 F6 F7 F8 F9 FA FB FC FD FE FF
```
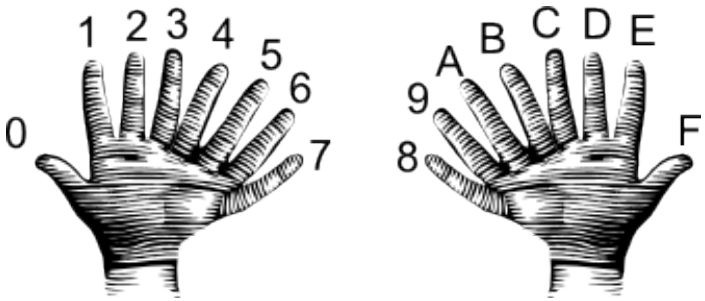

$16^1 + 16^0$

Max Number = 255

Hexadecimal



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00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F
20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F
30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F
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80 81 82 83 84 85 86 87 88 89 8A 8B 8C 8D 8E 8F
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A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 AA AB AC AD AE AF
B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 BA BB BC BD BE BF
C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 CA CB CC CD CE CF
D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 DA DB DC DD DE DF
E0 E1 E2 E3 E4 E5 E6 E7 E8 E9 EA EB EC ED EE EF
F0 F1 F2 F3 F4 F5 F6 F7 F8 F9 FA FB FC FD FE FF
```

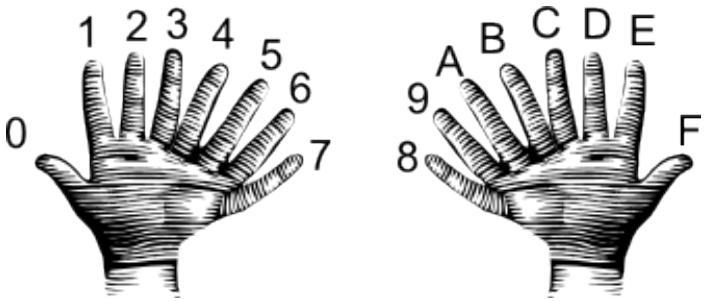
$16^1 + 16^0$

Max Number = 255

$$F0 = (F * 16^1) + (0 * 16^0)$$

$$F0 = (240) + (0) = 240$$

Hexadecimal



(from i-programmer.info)

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00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F
20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F
30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F
40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F
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60 61 62 63 64 65 66 67 68 69 6A 6B 6C 6D 6E 6F
70 71 72 73 74 75 76 77 78 79 7A 7B 7C 7D 7E 7F
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90 91 92 93 94 95 96 97 98 99 9A 9B 9C 9D 9E 9F
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 AA AB AC AD AE AF
B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 BA BB BC BD BE BF
C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 CA CB CC CD CE CF
D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 DA DB DC DD DE DF
E0 E1 E2 E3 E4 E5 E6 E7 E8 E9 EA EB EC ED EE EF
F0 F1 F2 F3 F4 F5 F6 F7 F8 F9 FA FB FC FD FE FF
```

$16^1 + 16^0$

Max Number = 255

$$F0 = (F * 16^1) + (0 * 16^0)$$

$$F0 = (240) + (0) = 240$$

$$FF = (F * 16^1) + (F * 16^0)$$

$$FF = (240) + (15) = 255$$

Colors

Color Name	HEX	Color
Black	#000000	
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	

- Can specify by numbers (RGB):
  - Fractions of each:
    e.g. `(1.0, 0, 0)` is 100% red, no green, and no blue.
  - 8-bit colors: numbers from 0 to 255:
    e.g. `(0, 255, 0)` is no red, 100% green, and no blue.
  - Hexcodes (base-16 numbers):

Colors

Color Name	HEX	Color
Black	#000000	
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  - Hexcodes (base-16 numbers):
    e.g. `#0000FF` is no red, no green, and 100% blue.

Challenge:

Some review and some novel challenges:

```
1  import turtle
2  teddy = turtle.Turtle()
3
4  names = ["violet", "purple", "indigo", "lavender"]
5  for c in names:
6    teddy.color(c)
7    teddy.left(60)
8    teddy.forward(40)
9    teddy.dot(10)
10
11 teddy.penup()
12 teddy.forward(100)
13 teddy.pendown()
14
15 hexNames = ["#FF00FF", "#990099", "#550055", "#111111"]
16 for c in hexNames:
17   teddy.color(c)
18   teddy.left(60)
19   teddy.forward(40)
20   teddy.dot(10)
```

Trinkets

```
1  import turtle
2  teddy = turtle.Turtle()
3
4  names = ["violet", "purple", "indigo", "lavender"]
5  for c in names:
6    teddy.color(c)
7    teddy.left(60)
8    teddy.forward(40)
9    teddy.dot(10)
10
11 teddy.penup()
12 teddy.forward(100)
13 teddy.pendown()
14
15 hexNames = ["#FF00FF", "#990099", "#550055", "#111111"]
16 for c in hexNames:
17   teddy.color(c)
18   teddy.left(60)
19   teddy.forward(40)
20   teddy.dot(10)
```

(Demo with `trinkets`)

Recap

- In Python, we introduced:

Recap

- In Python, we introduced:
  - Indexing and Slicing Lists

Recap

- In Python, we introduced:
  - Indexing and Slicing Lists
  - Arithmetic

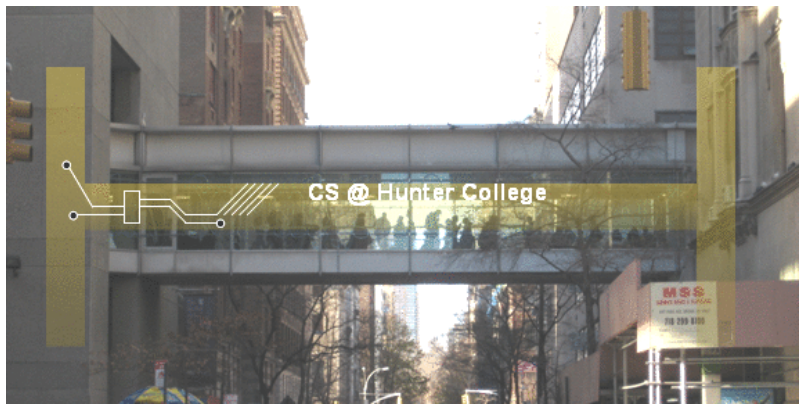
Recap

- In Python, we introduced:
  - Indexing and Slicing Lists
  - Arithmetic
  - Colors

Recap

- In Python, we introduced:
  - Indexing and Slicing Lists
  - Arithmetic
  - Colors
  - Hexadecimal Notation

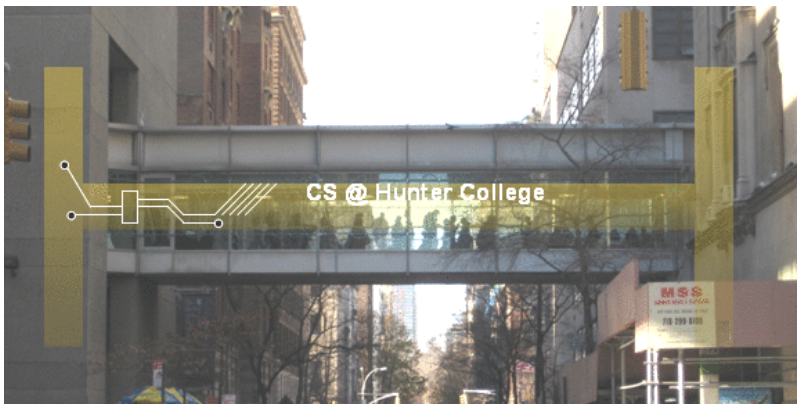
Class Reminders!



Before next class, don't forget to:

- Review this week's Lab

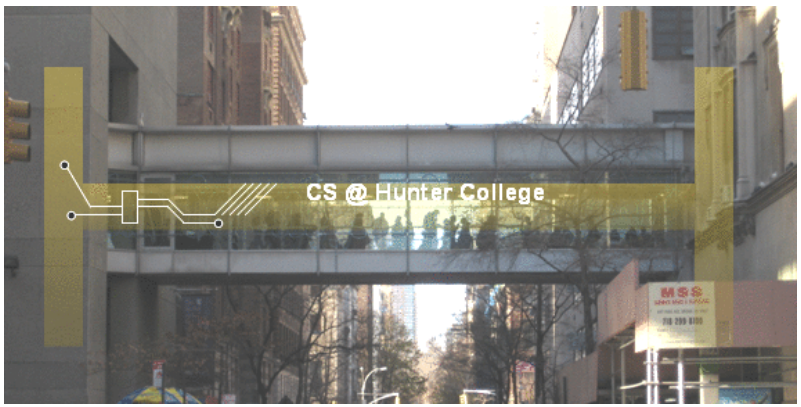
Class Reminders!



Before next class, don't forget to:

- Review this week's Lab
- Take the Lab Quiz [redacted]

Class Reminders!



Before next class, don't forget to:

- Review this week's Lab
- Take the Lab Quiz [redacted]
- Submit this class's 5 programming assignments (programs 6-15)