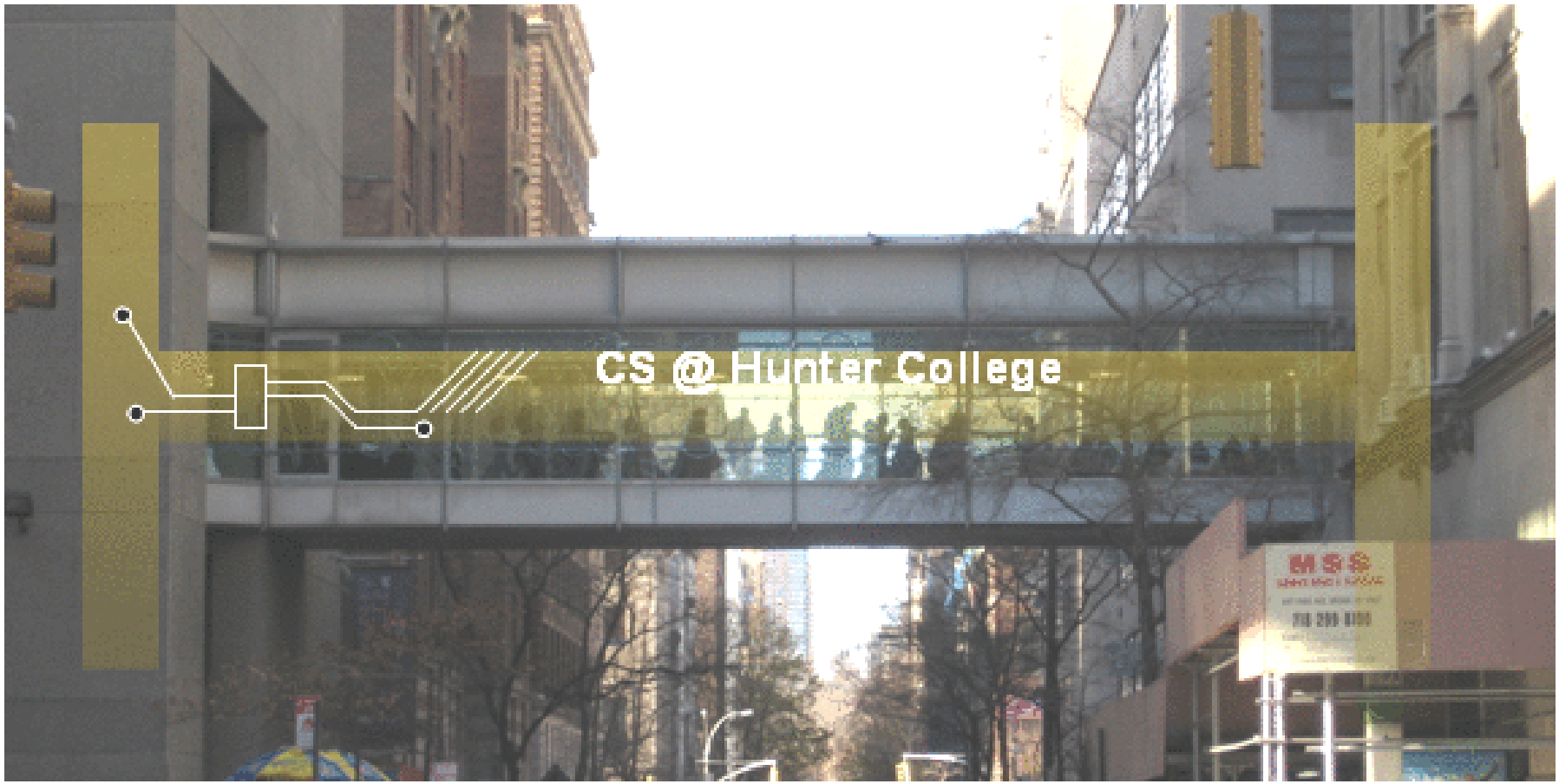
CSci 127: Introduction to Computer Science



hunter.cuny.edu/csci

- This lecture will be recorded

Frequently Asked Questions I

From emails.

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- **I want to change my email on Blackboard**

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  Our wonderful UTAs are available for Drop-in Tutoring **Mo-Fr 11am-5pm** *Follow this link, or find it under* **Synchronous Meetings** *on the purple menu on Blackboard*

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- **I accidentally submitted the quiz before I was done. What should I do?**

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From emails.

- **I want to change my email on Blackboard**
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- **My program doesn't work correctly, what do I do?**
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- **I accidentally submitted the quiz before I was done. What should I do?**
  We cannot reopen quizzes. Before starting a quiz, please make sure you are ready and have a steady internet connection. You have 15 minutes to take the quiz. Good practice for final exam which will be in same format.

Frequently Asked Questions II

From emails.

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  You must submit your program to Gradescope with the indicated extension (for now .py for python). The grading script will execute your program, it cannot execute screenshots! **Test your code!!!** *Run the program on your computer to make sure it is correct, than submit that file.*

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- **I missed the deadline for a programming assignment. What should I do?**

Frequently Asked Questions II

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- **I missed the deadline for a programming assignment. What should I do?**
  We do not accept late work but we drop the lowest 5 program grades. Due dates are one week late to allow for emergencies. **You must work on THIS WEEK'S PROGRAMS**, *that way you will never miss a deadline!!!.*

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

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Output:

- Some we have seen before, some we haven't.
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- First, go through and write down what we know:
  - There are 3 `print()`.

More on Strings...

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- Some we have seen before, some we haven't.
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- First, go through and write down what we know:
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    `There are ???  fun days in a week`

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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`

    `Two of them are ???`

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There are ???  fun days in a week
Two of them are ???
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(x)` will count the number of times the pattern, `x`, appears in s.

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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?

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- `s.count(x)` will count the number of times the pattern, `x`, appears in s.
  - `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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Output:

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

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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

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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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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
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- `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'`.

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

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

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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[3:6]` is

More on Strings: Indexing & Substrings

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

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]` is

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]` is `'Fri'`.

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```

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- `s[:-1]` is

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- `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")
"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.

```
"FridayXSaturdayXSunday"
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.")
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In particular, what is printed...

- If the user enters, 9 and 2.

Challenge:

What does this code do?

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#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.

```
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])
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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!")
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5  for num in range(5,8):
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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"
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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:
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```

- 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):
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3  print("Blast off!")
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5  for num in range(5,8):
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8  s = "City University of New York"
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12 names = ["Eleanor", "Anna", "Alice", "Edith"]
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```

- 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`.

Lecture Quiz

- Log-in to Gradescope
- Find LECTURE 3 Quiz
- Take the quiz
- **You have 3 minutes**

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

Colors

Color Name	HEX	Color
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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.

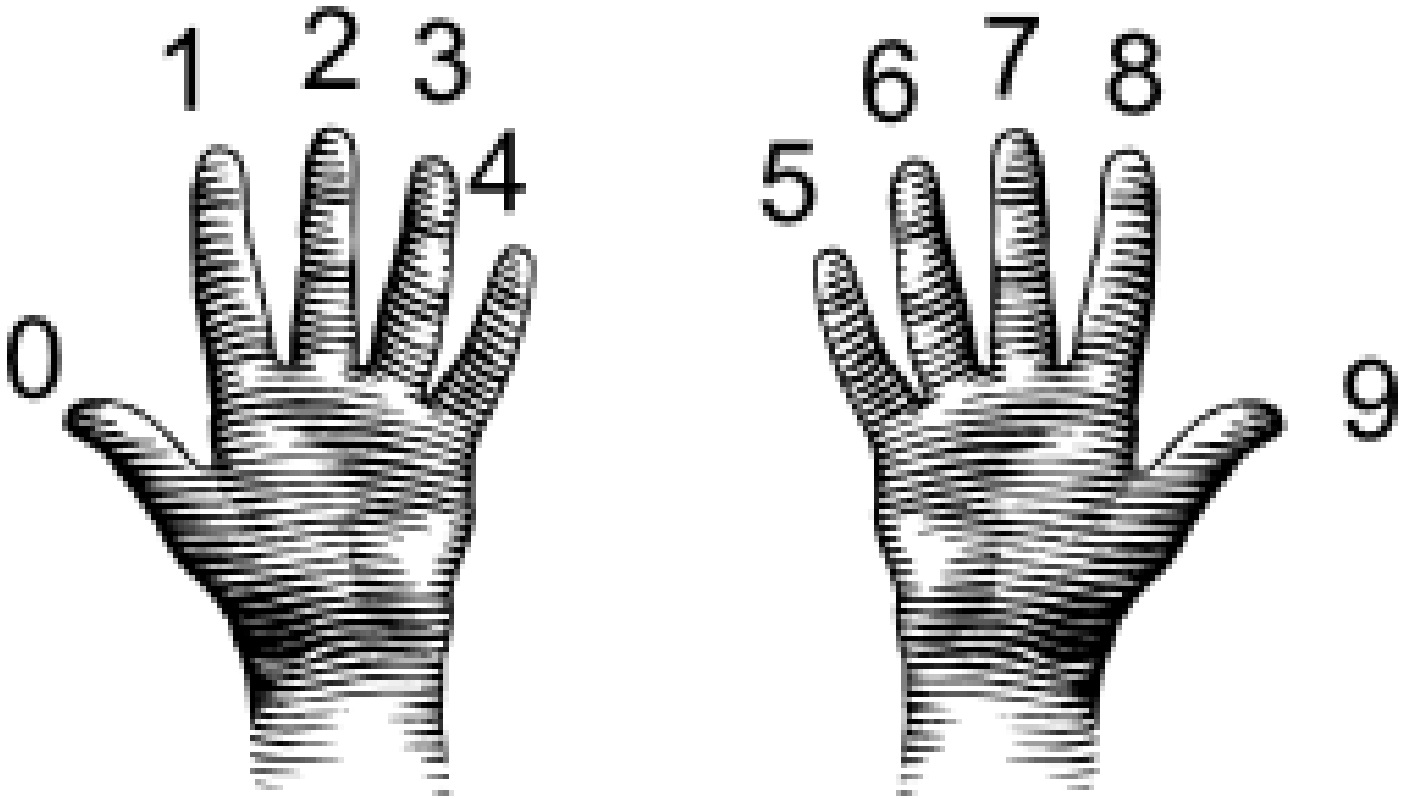
Colors

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)...

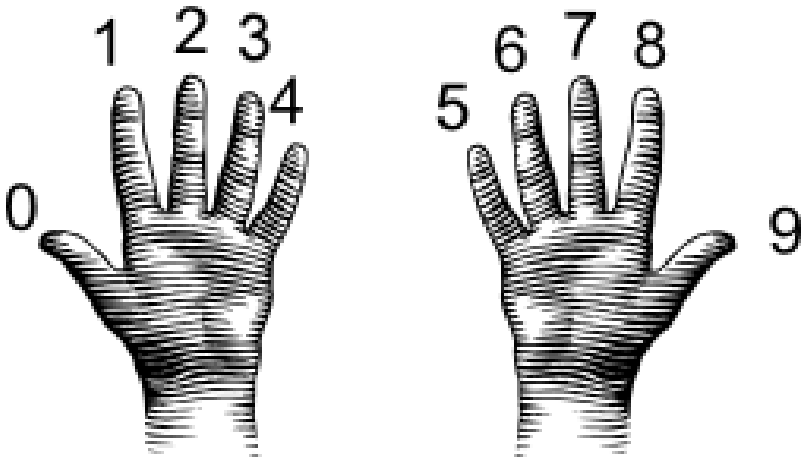
Decimal & Hexadecimal Numbers

Counting with 10 digits:



(from i-programmer.info)

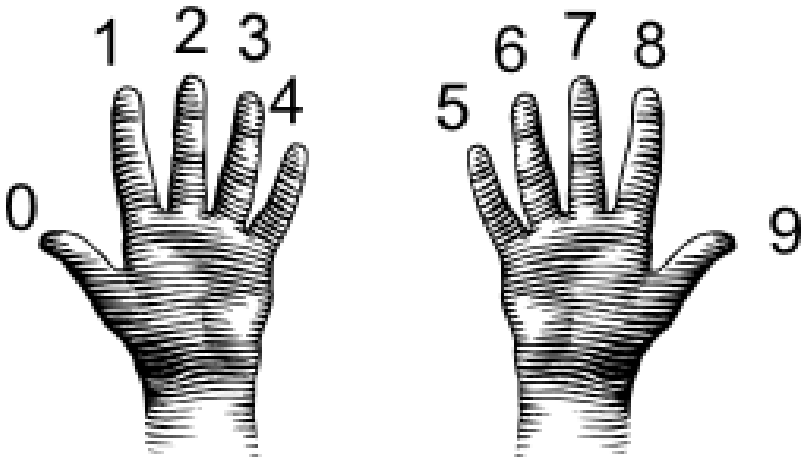
Decimal



(from i-programmer.info)

Decimal

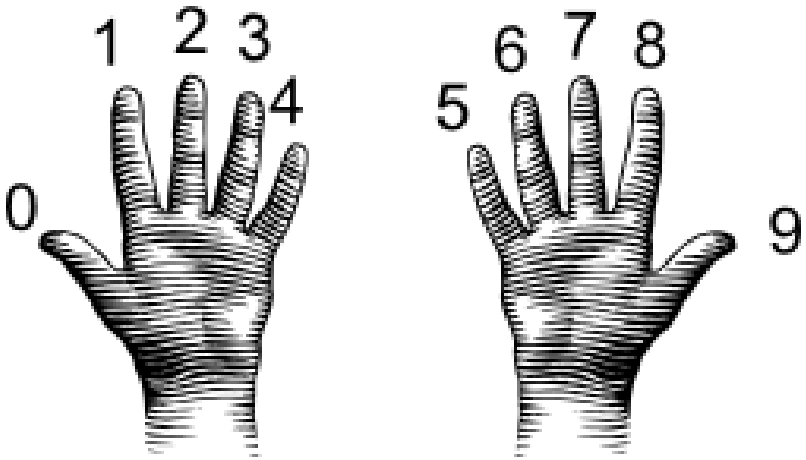
00 01 02 03 04 05 06 07 08 09



(from i-programmer.info)

Decimal

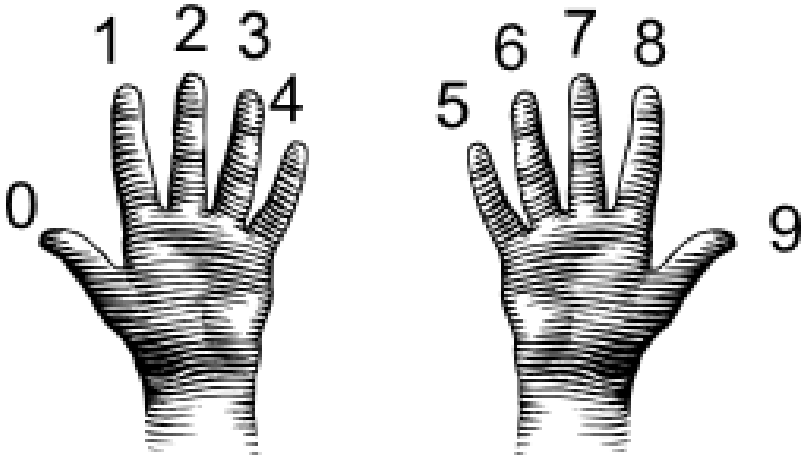
00 01 02 03 04 05 06 07 08 09
10 11 12 13 14 15 16 17 18 19



(from i-programmer.info)

Decimal

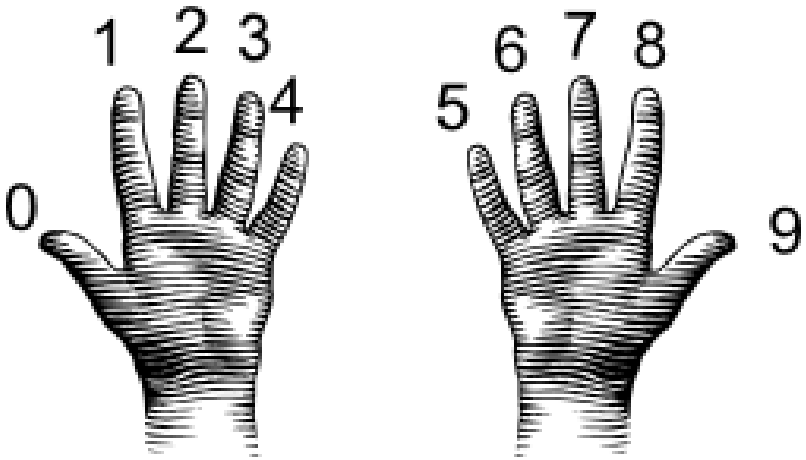
00	01	02	03	04	05	06	07	08	09
10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27	28	29



(from i-programmer.info)

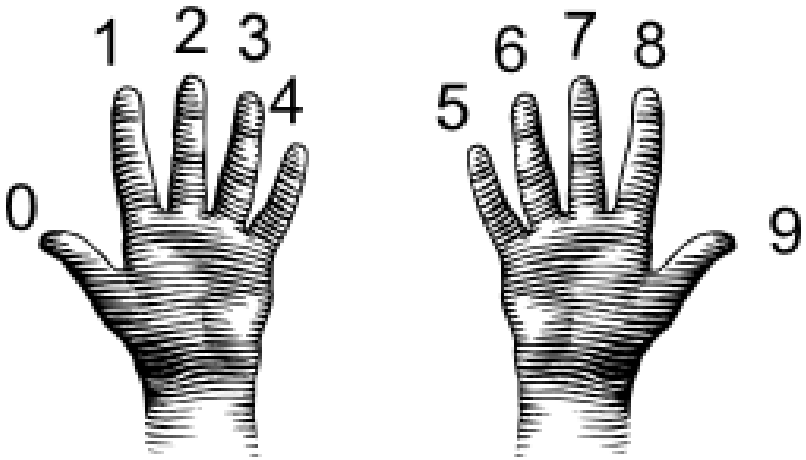
Decimal

00	01	02	03	04	05	06	07	08	09
10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27	28	29
30	31	32	33	34	35	36	37	38	39



(from i-programmer.info)

Decimal



(from i-programmer.info)

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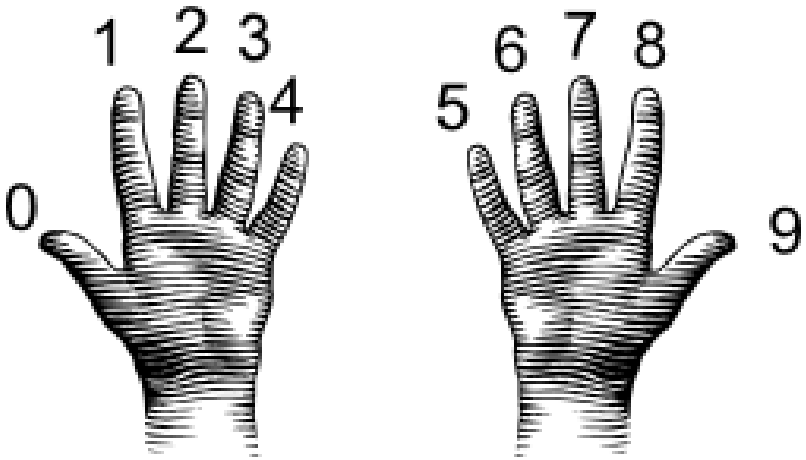
Decimal



(from i-programmer.info)

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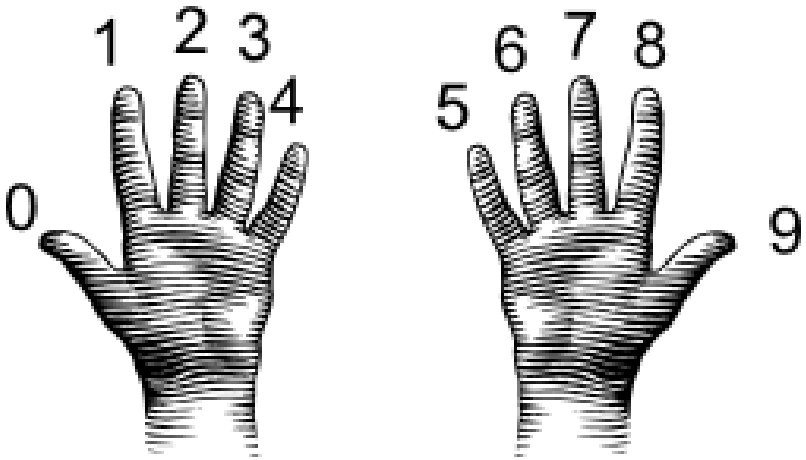
Decimal



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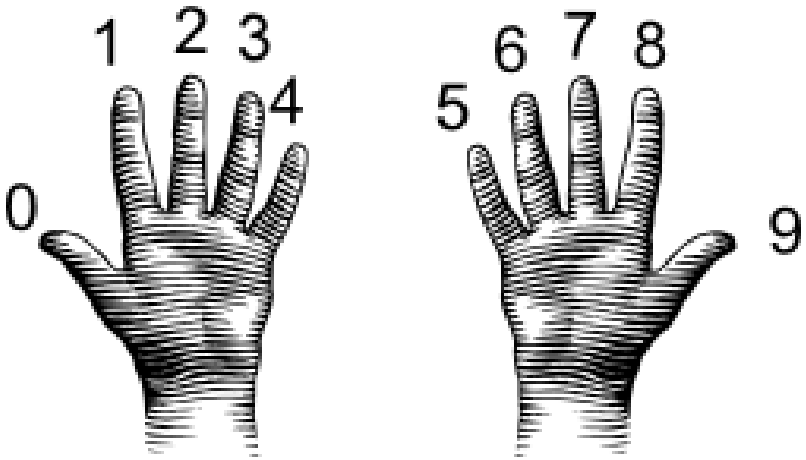
Decimal



(from i-programmer.info)

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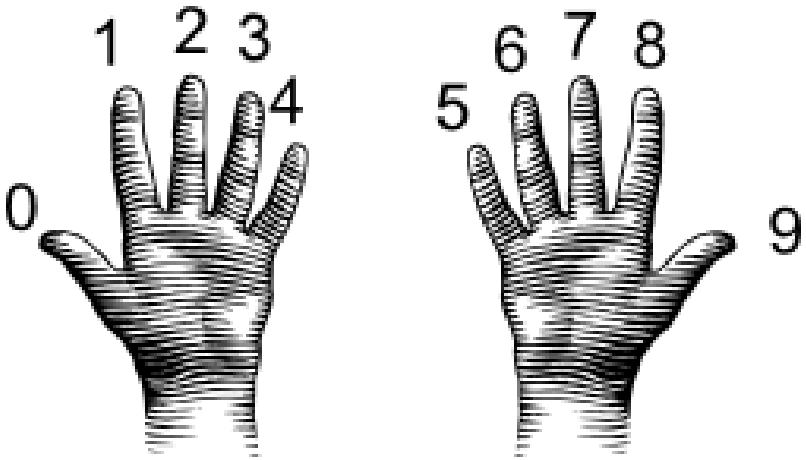
Decimal



(from i-programmer.info)

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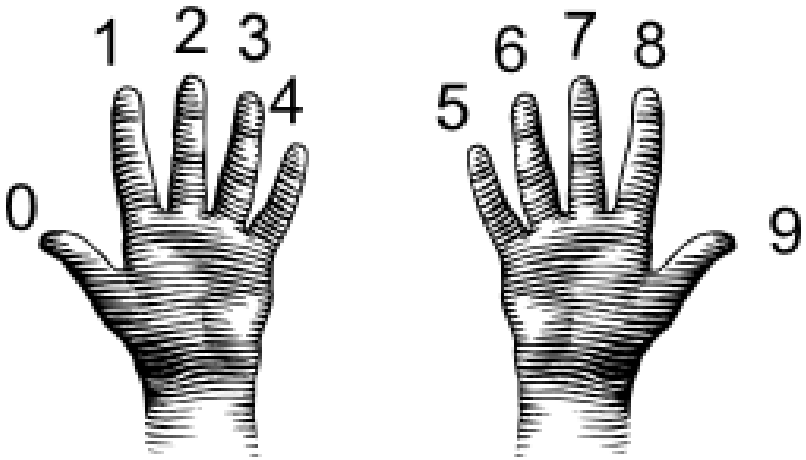
Decimal



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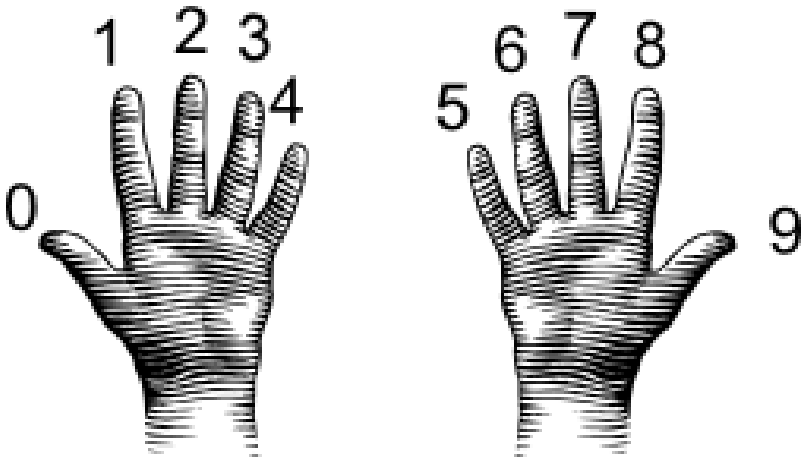
Decimal



(from i-programmer.info)

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70	71	72	73	74	75	76	77	78	79
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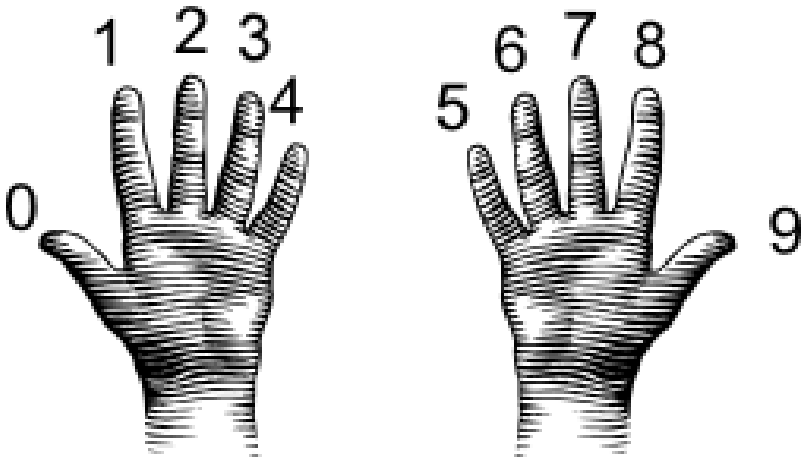
90	91	92	93	94	95	96	97	98	99

$10^1 + 10^0$

Max Number = 99

Decimal



(from i-programmer.info)

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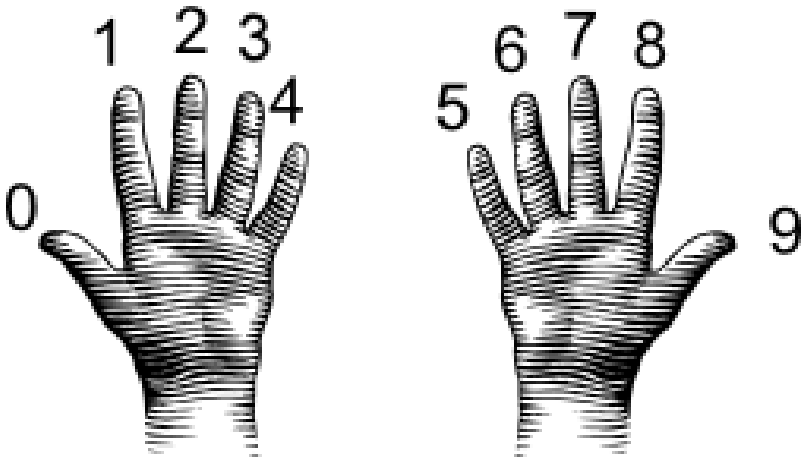
70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89
90	91	92	93	94	95	96	97	98	99

$10^1 + 10^0$

Max Number = 99

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

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

$10^1 + 10^0$

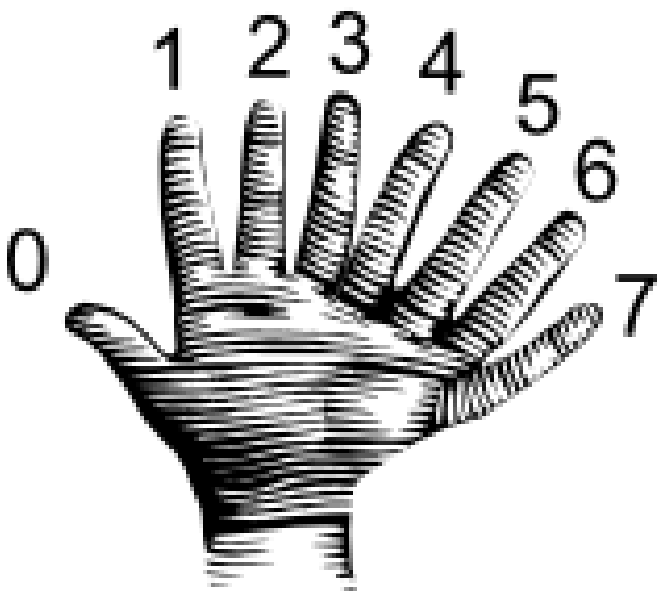
Max Number = 99

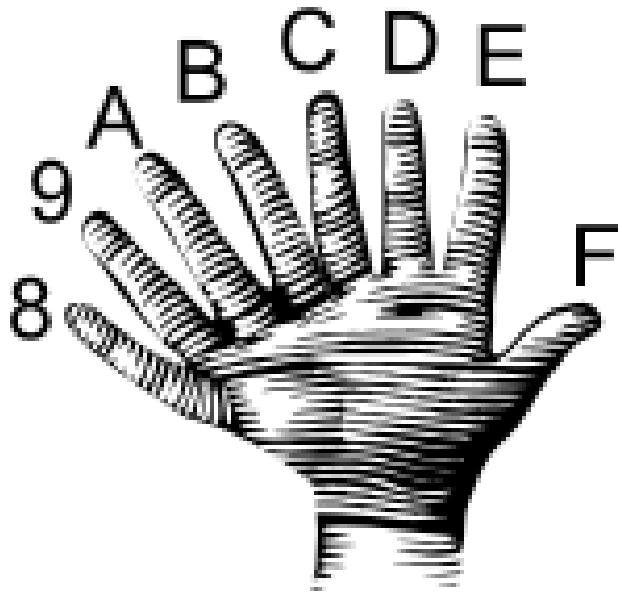
$$90 = (9 * 10^1) + (0 * 10^0)$$

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

Decimal & Hexadecimal Numbers

Counting with 16 digits:





(from i-programmer.info)

Hexadecimal

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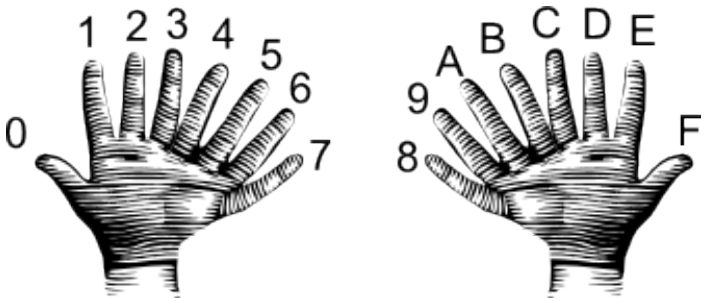

(from i-programmer.info)

Hexadecimal

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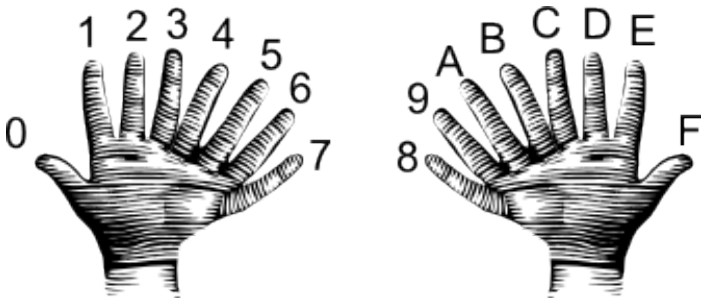
10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F
```



(from i-programmer.info)

Hexadecimal

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20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F
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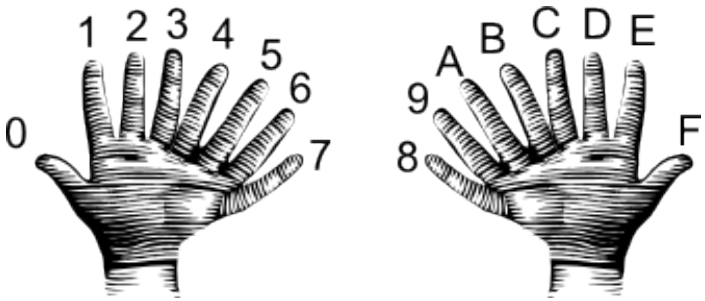

(from i-programmer.info)

Hexadecimal

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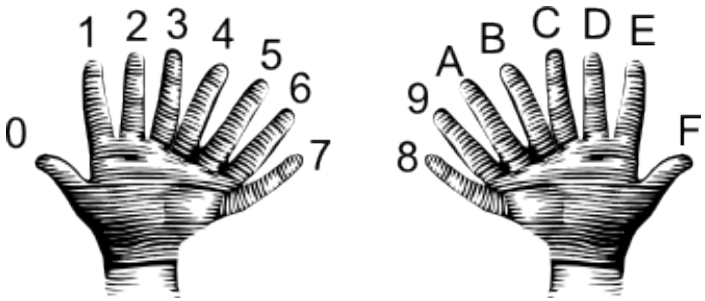

(from i-programmer.info)

Hexadecimal

```
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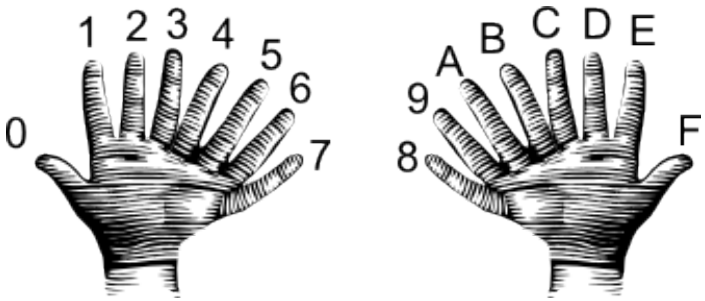
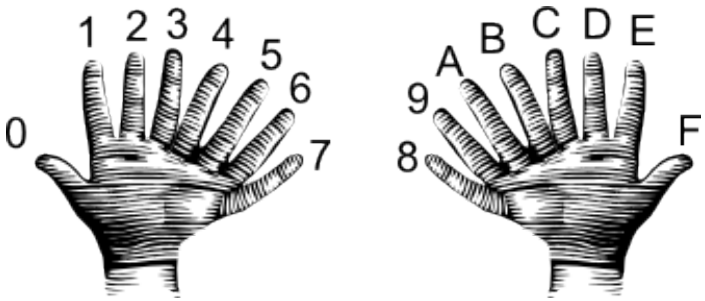


(from i-programmer.info)

Hexadecimal



(from i-programmer.info)

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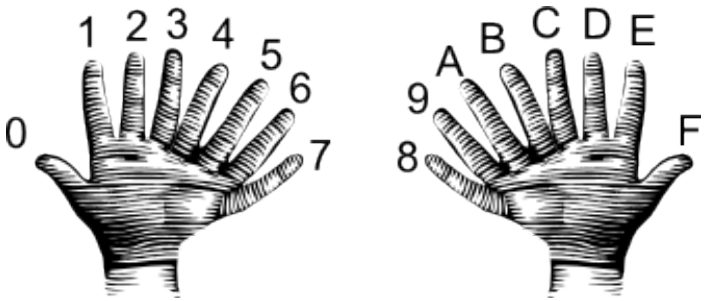
Hexadecimal



(from i-programmer.info)

```
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```
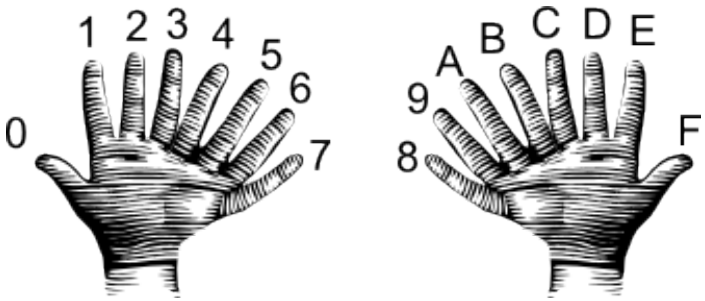

Hexadecimal



(from i-programmer.info)

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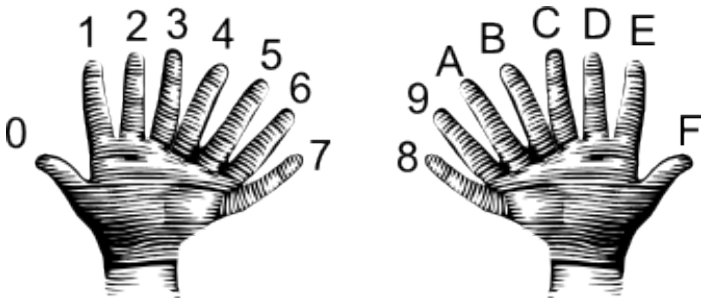
Hexadecimal



(from i-programmer.info)

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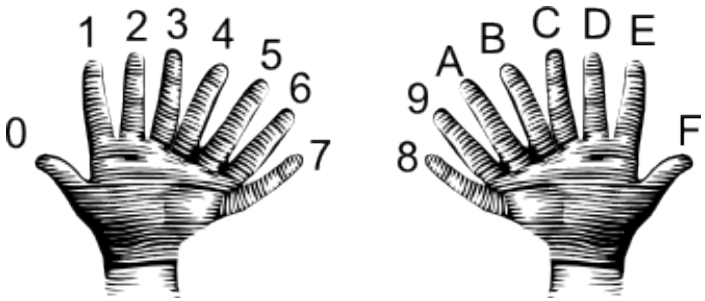
Hexadecimal



(from i-programmer.info)

```
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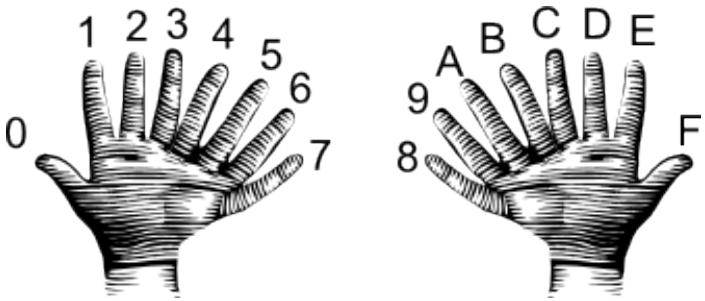
Hexadecimal



(from i-programmer.info)

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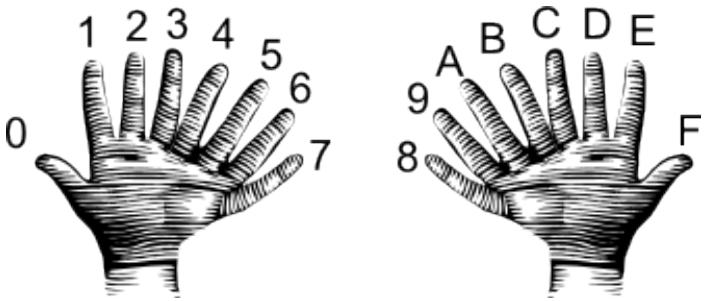
Hexadecimal



(from i-programmer.info)

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B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 BA BB BC BD BE BF
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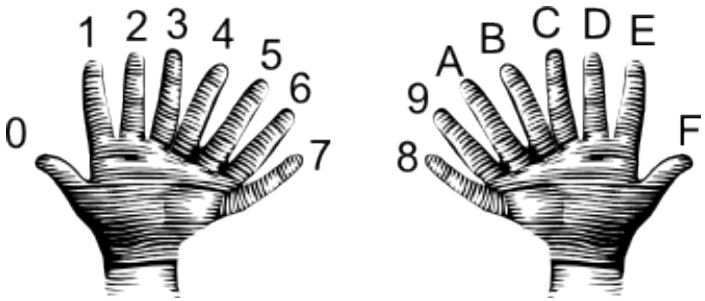
Hexadecimal



(from i-programmer.info)

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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
```
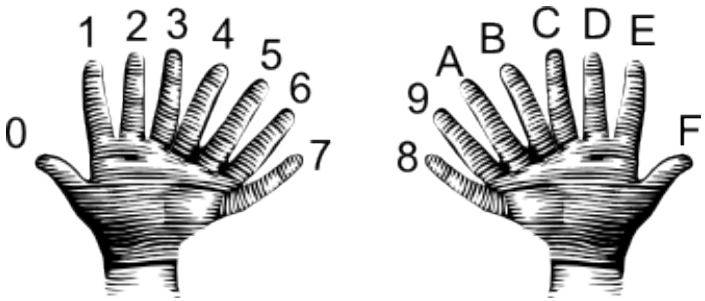

Hexadecimal



(from i-programmer.info)

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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
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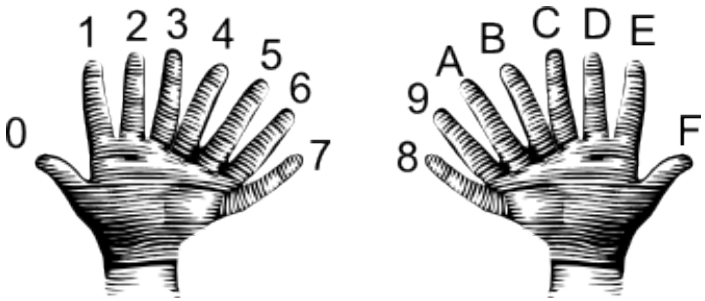
```

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
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
```
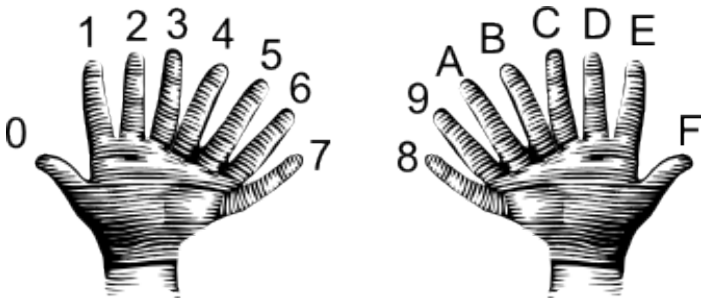
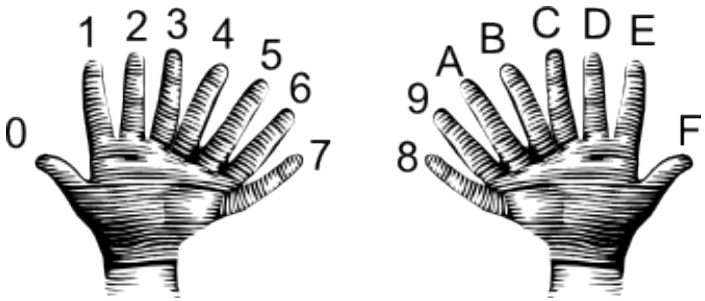

Hexadecimal



(from i-programmer.info)

```
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
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
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)

```
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
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
```
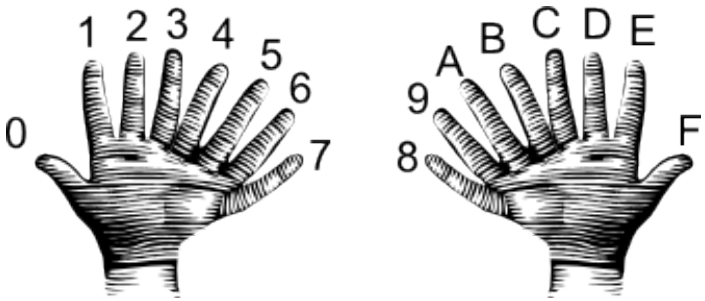

$16^1 + 16^0$

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
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
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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
```
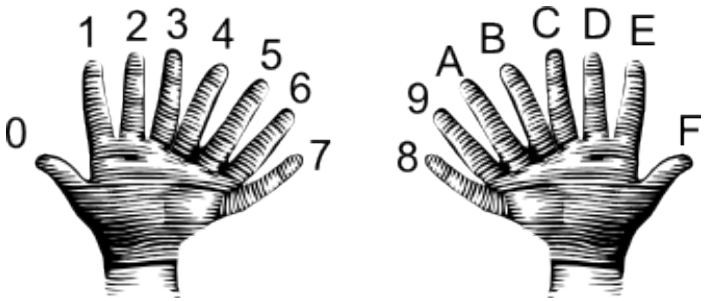

$16^1 + 16^0$

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
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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
```

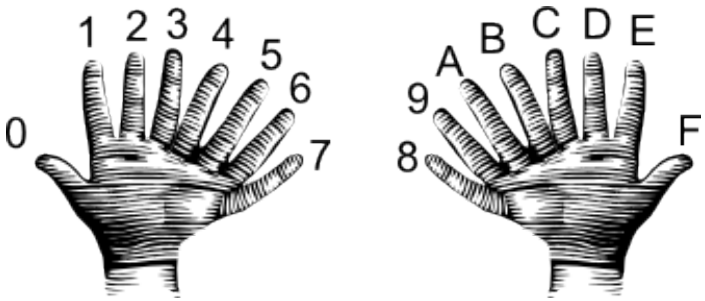
$16^1 + 16^0$

Max Number = 255

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

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

Hexadecimal



(from i-programmer.info)

```
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
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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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):

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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
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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

Practice Quiz & Final Questions

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

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  - repeat.
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- We're starting with Fall 2017, Version 2.

See you next week!

Before next lecture, don't forget to:

- Work on this week's Online Lab
- Take the Lab Quiz on Gradescope by 6pm on Wednesday
- Submit this week's 5 programming assignments (programs 11-15)