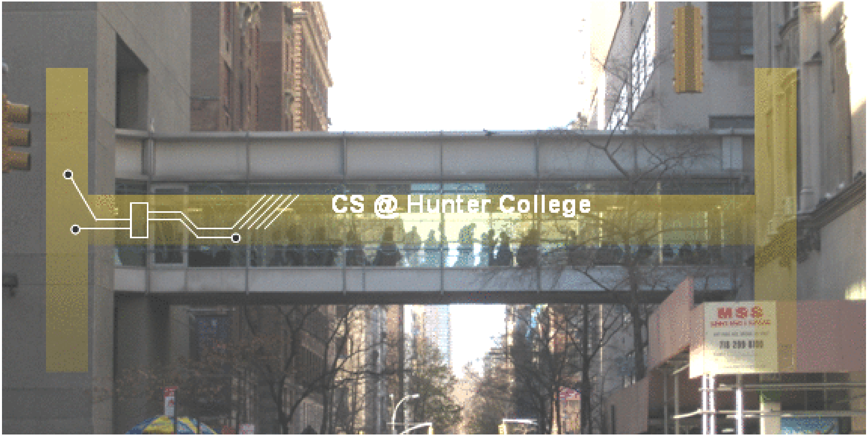
CSci 127: Introduction to Computer Science



hunter.cuny.edu/csci

Frequently Asked Questions

From email and tutoring.

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  - *If you are already acquainted with the logistics you will have less stress during the real event.*

Today's Topics

- Design Patterns: Searching
- Python Recap
- Machine Language
- Machine Language: Jumps & Loops
- Binary & Hex Arithmetic
- Final Exam: Format

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Predict what the code will do:

```
def search(nums, locate):
    found = False
    i = 0
    while not found and i < len(nums):
        print(nums[i])
        if locate == nums[i]:
            found = True
        else:
            i = i+1
    return(found)

nums= [1,4,10,6,5,42,9,8,12]
if search(nums,6):
    print('Found it! 6 is in the list!')
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    print('Did not find 6 in the list.')
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Python Tutor

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(Demo with `pythonTutor`)

Design Pattern: Linear Search

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- Start at the beginning of the list.
- Look at each item, one-by-one.
- Stop when found, or the end of list is reached.

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- Design Patterns: Searching
- **Python Recap**
- Machine Language
- Machine Language: Jumps & Loops
- Binary & Hex Arithmetic

Python & Circuits Review: 10 Weeks in 10 Minutes

A whirlwind tour of the semester, so far...

Week 1: print(), loops, comments, & turtles

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- Introduced comments & print():

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#Name:  Thomas Hunter
#Date:  September 1, 2017
#This program prints:  Hello, World!

print("Hello, World!")
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← These lines are comments
← (for us, not computer to read)
← (this one also)

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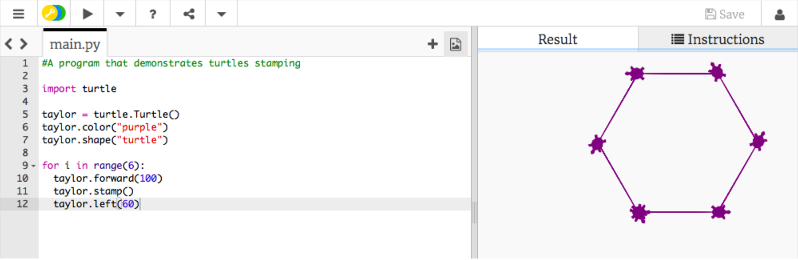
- As well as definite loops & the turtle package:



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  - **class variables**: for complex objects, like turtles.
- More on loops & ranges:

```
#Predict what will be printed:

for num in [2,4,6,8,10]:
    print(num)

sum = 0
for x in range(0,12,2):
    print(x)
    sum = sum + x

print(sum)

for c in "ABCD":
    print(c)
```

Week 3: colors, hex, slices, numpy & images

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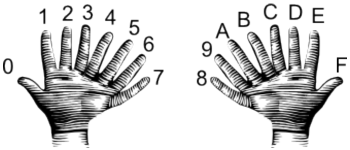
Navy	#000080	
DarkBlue	#00008B	
MediumBlue	#0000CD	
Blue	#0000FF	



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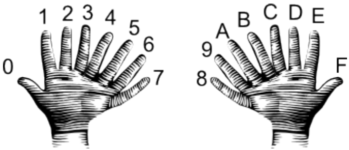

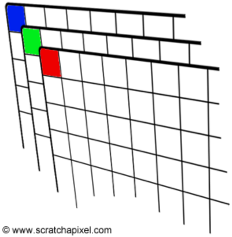

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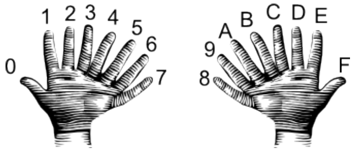
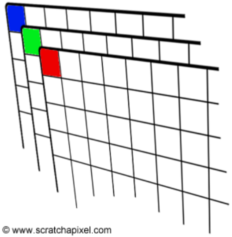




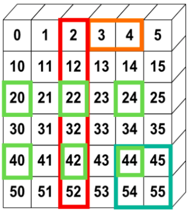
© www.scratchapixel.com

```
>>> a[0,3:5]
array([3,4])

>>> a[4:,4:]
array([[44, 45],
       [54, 55]])

>>> a[:,2]
array([2,12,22,32,42,52])

>>> a[2::2,::2]
array([[20,22,24]
       [40,42,44]])
```



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- Next: write pseudocode.
  1. Import numpy and pyplot.
  2. Ask user for file names and dimensions for cropping.
  3. Save input file to an array.
  4. Copy the cropped portion to a new array.
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- Next: translate to Python.

Week 4: design problem (cropping images) & decisions

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yearBorn = int(input('Enter year born: '))
if yearBorn < 1946:
    print("Greatest Generation")
elif yearBorn <= 1964:
    print("Baby Boomer")
elif yearBorn <= 1984:
    print("Generation X")
elif yearBorn <= 2004:
    print("Millennial")
else:
    print("TBD")

x = int(input('Enter number: '))
if x % 2 == 0:
    print('Even number')
else:
    print('Odd number')
```

Week 5: logical operators, truth tables & logical circuits

```python
origin = "Indian Ocean"
winds = 100
if (winds > 74):
    print("Major storm, called a ", end="")
    if origin == "Indian Ocean" or origin == "South Pacific":
        print("cyclone.")
    elif origin == "North Pacific":
        print("typhoon.")
    else:
        print("hurricane.")

visibility = 0.2
winds = 40
conditions = "blowing snow"
if (winds > 35) and (visibility < 0.25) and \
      (conditions == "blowing snow" or conditions == "heavy snow"):
    print("Blizzard!")
```

Week 5: logical operators, truth tables & logical circuits

in1		in2	*returns:*
False	and	False	False
False	and	True	False
True	and	False	False
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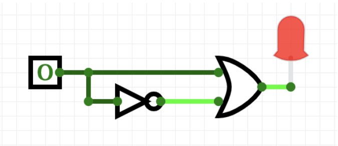

Week 6: structured data, pandas, & more design

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All population figures are consistent with present-day boundaries.,,,,,,
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1698,4937,2017,,,727,7681
1771,21863,3623,,,2847,28423
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1950,1960101,2738175,1550849,1451277,191555,7891957
1960,1698281,2627319,1809578,1424815,221991,7781984
1970,1539233,2602012,1986473,1471701,295443,7894862
1980,1428285,2230936,1891325,1168972,352121,7071639
1990,1487536,2300664,1951598,1203789,378977,7322564
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`nycHistPop.csv`

In Lab 6

Week 6: structured data, pandas, & more design

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import matplotlib.pyplot as plt
import pandas as pd
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`nycHistPop.csv`

In Lab 6

Week 6: structured data, pandas, & more design

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import matplotlib.pyplot as plt
import pandas as pd

pop = pd.read_csv('nycHistPop.csv',skiprows=5)
```

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nycHistPop.csv

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pop = pd.read_csv('nycHistPop.csv',skiprows=5)

pop.plot(x="Year")
plt.show()
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1830,202589,20535,9049,3023,7082,242278
1840,312710,47613,14480,5346,10965,391114
1850,515547,138882,18593,8032,15061,696115
1860,813669,279122,32903,23593,25492,1174779
1870,942292,419921,45468,37393,33029,1478103
1880,1164673,599495,56559,51980,38991,1911698
1890,1441216,838547,87050,88908,51693,2507414
1900,1850093,1166582,152999,200507,67021,3437202
1910,2331542,1634351,284041,430980,85969,4766883
1920,2284103,2018356,469042,732016,116531,5620048
1930,1867312,2560401,1079129,1265258,158346,6930446
1940,1889924,2698285,1297634,1394711,174441,7454995
1950,1960101,2738175,1550849,1451277,191555,7891957
1960,1698281,2627319,1809578,1424815,221991,7781984
1970,1539233,2602012,1986473,1471701,295443,7894862
1980,1428285,2230936,1891325,1168972,352121,7071639
1990,1487536,2300664,1951598,1203789,378977,7322564
2000,1537195,2465326,2229379,1332650,443728,8008278
2010,1585873,2504700,2230722,1385108,468730,8175133
2015,1644518,2636735,2339150,1455444,474558,8550405
```

`nycHistPop.csv`

In Lab 6

Week 6: structured data, pandas, & more design

```
import matplotlib.pyplot as plt
import pandas as pd

pop = pd.read_csv('nycHistPop.csv',skiprows=5)

pop.plot(x="Year")
plt.show()
```

```
Source:  https://en.wikipedia.org/wiki/Demographics_of_New_York_City,,,,,,
All population figures are consistent with present-day boundaries.,,,,,,
First census after the consolidation of the five boroughs,,,,,,
,,,,,,
,,,,,,
Year,Manhattan,Brooklyn,Queens,Bronx,Staten Island,Total
1698,4937,2017,,,727,7681
1771,21863,3623,,,2847,28423
1790,33131,4549,6159,1781,3827,49447
1800,60515,5740,6642,1755,4563,79215
1810,96373,8303,7444,2267,5347,119734
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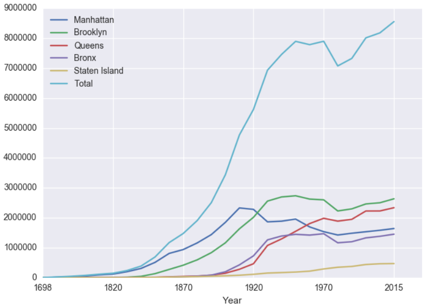
nycHistPop.csv

In Lab 6



Week 7: functions

```
#Name:  your name here
#Date:  October 2017
#This program, uses functions,
#     says hello to the world!

def main():
     print("Hello, World!")

if __name__ == "__main__":
     main()
```

- Functions are a way to break code into pieces, that can be easily reused.

Week 7: functions

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- You **call** or **invoke** a function by typing its name, followed by any inputs, surrounded by parenthesis:

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- You **call** or **invoke** a function by typing its name, followed by any inputs, surrounded by parenthesis: Example: `print("Hello", "World")`
- Can write, or **define** your own functions, which are stored, until invoked or called.

Week 8: function parameters, github

- Functions can have **input parameters**.

```
def totalWithTax(food,tip):
    total = 0
    tax = 0.0875
    total = food + food * tax
    total = total + tip
    return(total)

lunch = float(input('Enter lunch total: '))
lTip = float(input('Enter lunch tip:' ))
lTotal = totalWithTax(lunch, lTip)
print('Lunch total is', lTotal)

dinner= float(input('Enter dinner total: '))
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dTotal = totalWithTax(dinner, dTip)
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```

Week 8: function parameters, github

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- The “placeholders” in the function definition: **formal parameters**.

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- The ones in the function call: **actual parameters**

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- Functions can also **return values** to where it was called.

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Formal Parameters

Actual Parameters

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- The ones in the function call: **actual parameters**.
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Week 9: top-down design, folium, loops, and random()


```
def main():
    dataF = getData()
    latColName, lonColName = getColumnNames()
    lat, lon = getLocale()
    cityMap = folium.Map(location = [lat,lon], tiles = 'cartodbpositron',zoom_start=11)
    dotAllPoints(cityMap,dataF,latColName,lonColName)
    markAndFindClosest(cityMap,dataF,latColName,lonColName,lat,lon)
    writeMap(cityMap)
```

Week 10: more on loops, max design pattern, random()

```
dist = int(input('Enter distance: '))
while dist < 0:
    print('Distances cannot be negative.')
    dist = int(input('Enter distance: '))

print('The distance entered is', dist)
```

- Indefinite (while) loops allow you to repeat a block of code as long as a condition holds.

```
import turtle
import random

trey = turtle.Turtle()
trey.speed(10)

for i in range(100):
  trey.forward(10)
  a = random.randrange(0,360,90)
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- Very useful for checking user input for correctness.
- Python's built-in random package has useful methods for generating random whole numbers and real numbers.
- To use, must include: `import random`.
- The max design pattern provides a template for finding maximum value from a list.

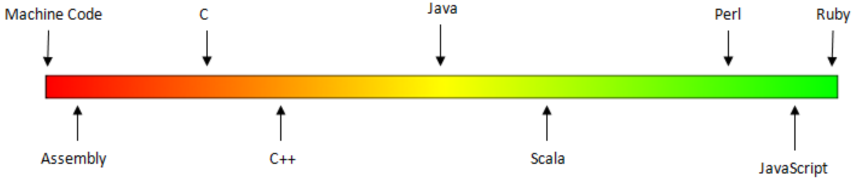
Python & Circuits Review: 10 Weeks in 10 Minutes

- Input/Output (I/O): `input()` and `print()`; pandas for CSV files
- Types:
  - Primitive: int, float, bool, string;
  - Container: lists (but not dictionaries/hashes or tuples)
- Objects: turtles (used but did not design our own)
- Loops: definite & indefinite
- Conditionals: if-elif-else
- Logical Expressions & Circuits
- Functions: parameters & returns
- Packages:
  - Built-in: turtle, math, random
  - Popular: numpy, matplotlib, pandas, folium

Today's Topics

- Design Patterns: Searching
- Python Recap
- **Machine Language**
- Machine Language: Jumps & Loops
- Binary & Hex Arithmetic

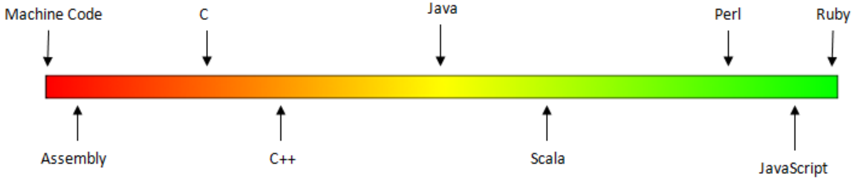
Low-Level vs. High-Level Languages



(codeCommit)

- Can view programming languages on a continuum.

Low-Level vs. High-Level Languages



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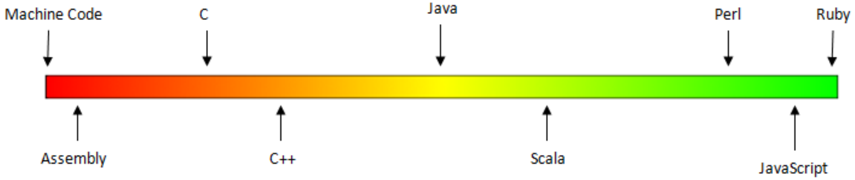
Low-Level vs. High-Level Languages



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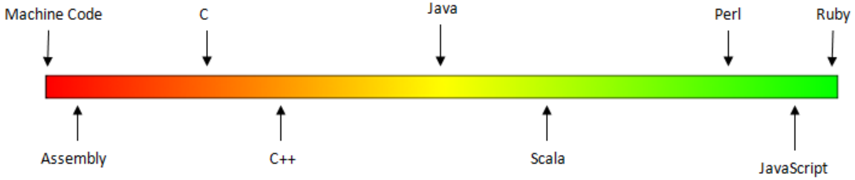

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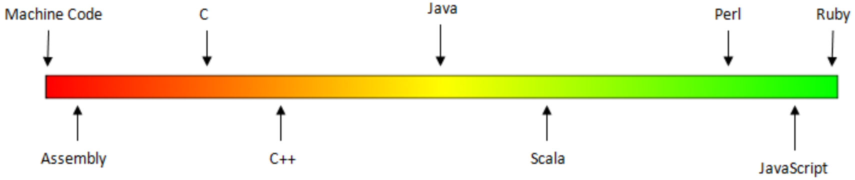

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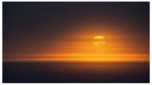
- Some languages, like C, are in between– allowing both low level access and high level data structures.

Processing



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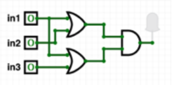
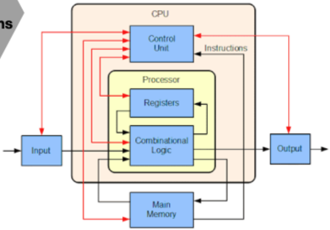
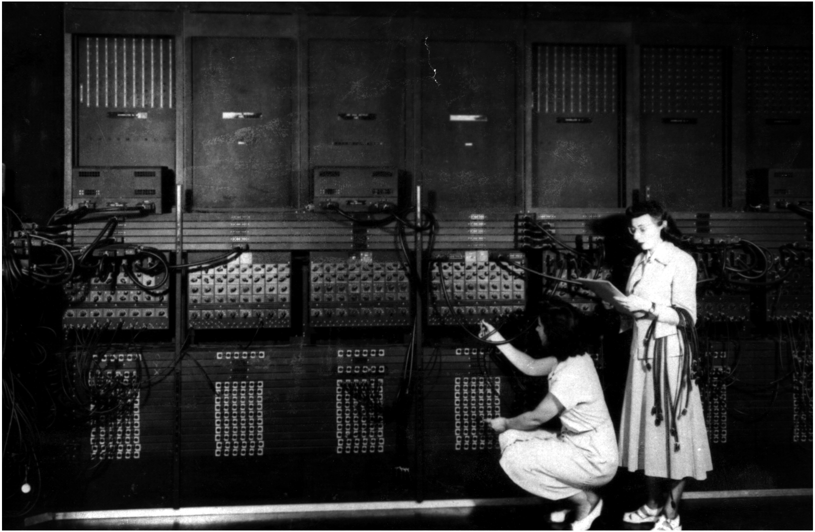


Circuits (switches)
On/Off 1/0 Logic
Billions of switches/bits

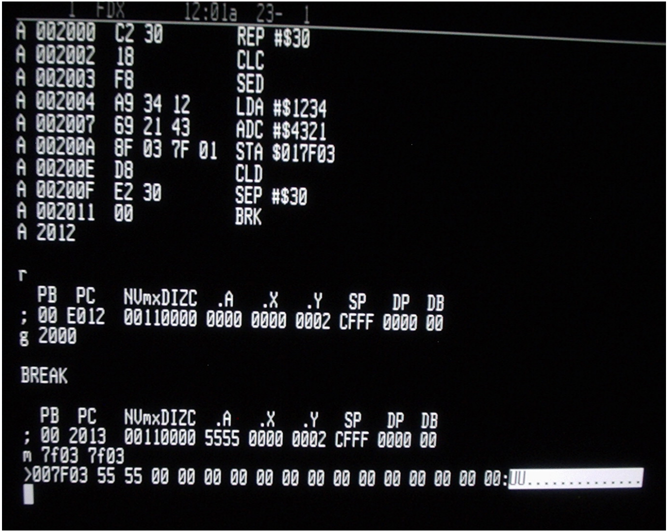


Machine Language



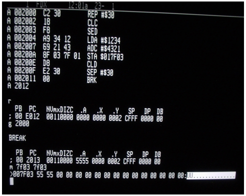
(Ruth Gordon & Ester Gerston programming the ENIAC, UPenn)

Machine Language



(wiki)

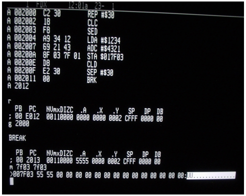
Machine Language



(wiki)

- We will be writing programs in a simplified machine language, WeMIPS.

Machine Language



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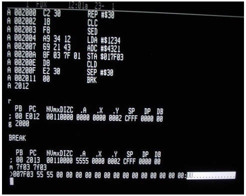

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- Due to its small set of commands, processors can be designed to run those commands very efficiently.

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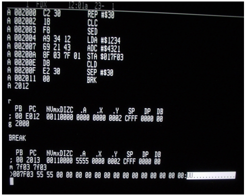

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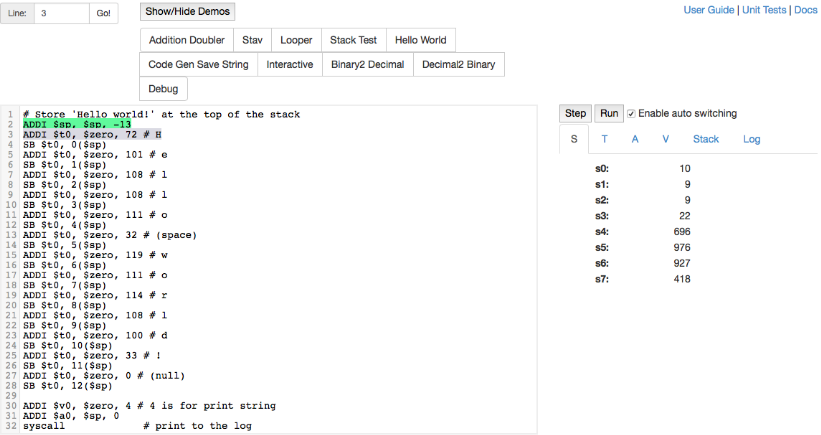
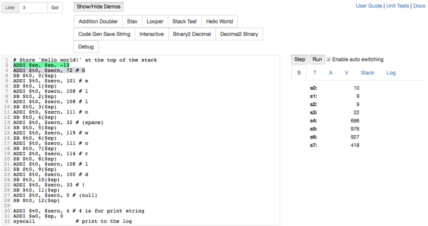
- Due to its small set of commands, processors can be designed to run those commands very efficiently.
- More in future architecture classes....

"Hello World!" in Simplified Machine Language



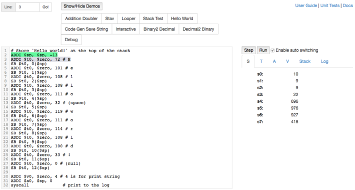
(WeMIPS)

WeMIPS



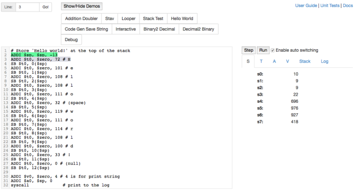
(Demo with `WeMIPS`)

MIPS Commands



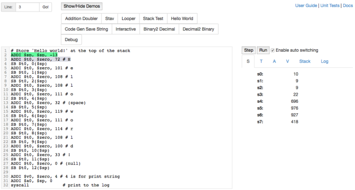
- **Registers:** locations for storing information that can be quickly accessed.

MIPS Commands



- **Registers:** locations for storing information that can be quickly accessed. Names start with '\$': `$s0`, `$s1`, `$t0`, `$t1`,...

MIPS Commands



- **Registers:** locations for storing information that can be quickly accessed. Names start with '$': `$s0`, `$s1`, `$t0`, `$t1`,...
- **R Instructions:** Commands that use data in the registers:

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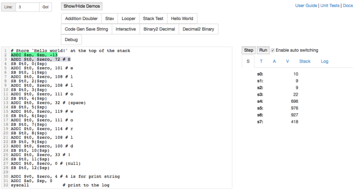

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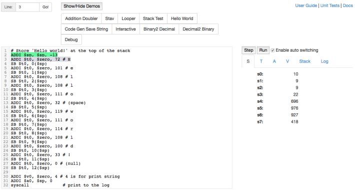

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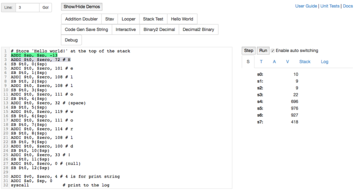

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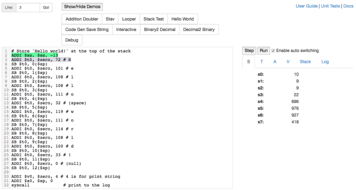

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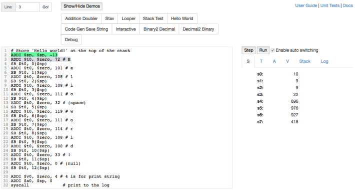

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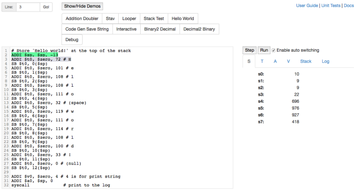
MIPS Commands



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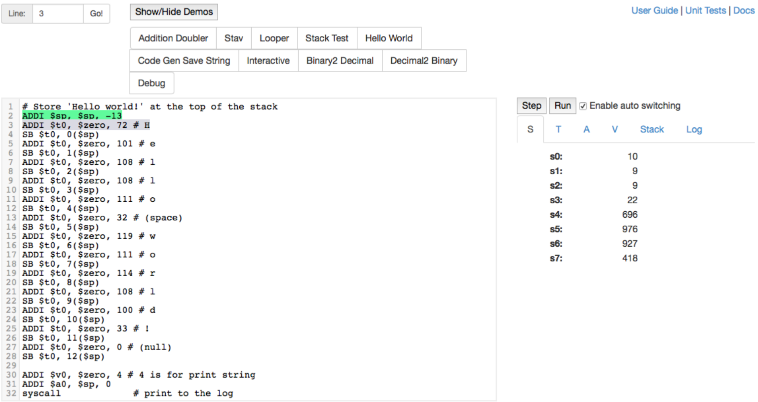
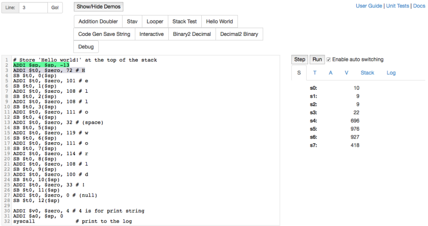
  `j done` (Basic form: `OP label`)

Challenge:



Write a program that prints out the alphabet: `a b c d ... x y z`

WeMIPS



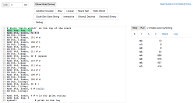
(Demo with `WeMIPS`)

Today's Topics

- Design Patterns: Searching
- Python Recap
- Machine Language
- **Machine Language: Jumps & Loops**
- Binary & Hex Arithmetic

Loops & Jumps in Machine Language

- Instead of built-in looping structures like `for` and `while`, you create your own loops by "jumping" to the location in the program.



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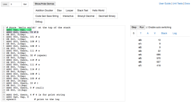
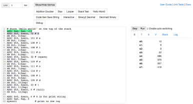


Loops & Jumps in Machine Language



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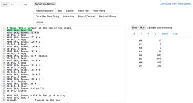

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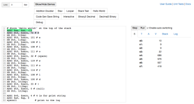

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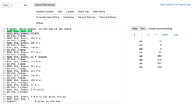

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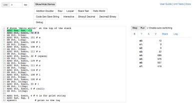
Loops & Jumps in Machine Language



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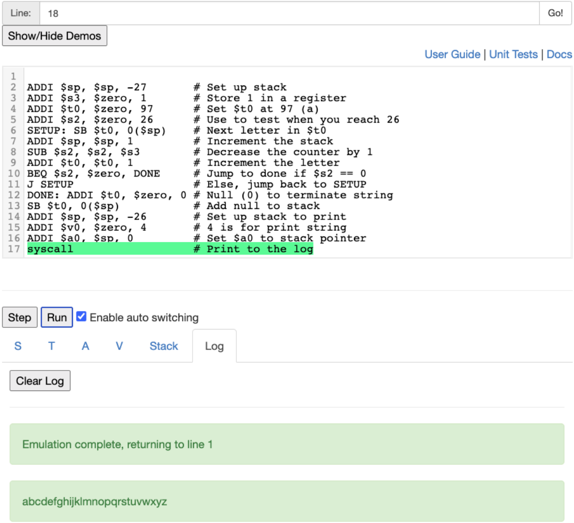
  - See reading for more variations.

Jump Demo



(Demo with WeMIPS)

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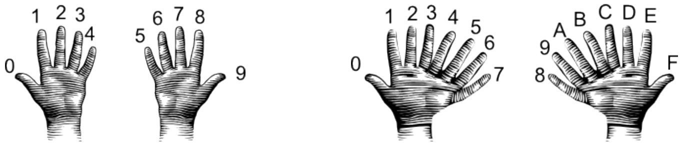
- **Binary & Hex Arithmetic**

Hexadecimal to Decimal: Converting Between Bases



(from i-programmer.info)

- From hexadecimal to decimal (assuming two-digit numbers):
  - Convert first digit to decimal and multiple by 16.

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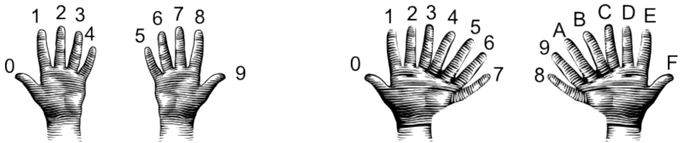

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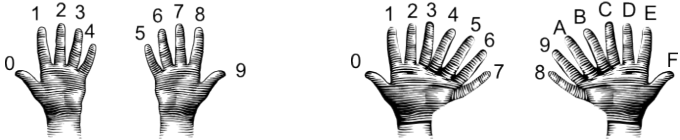

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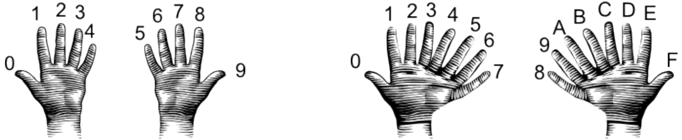

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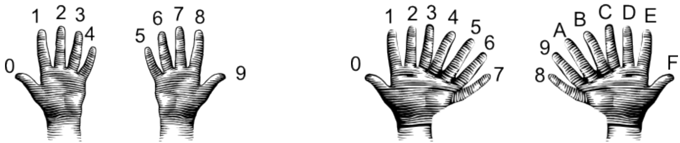

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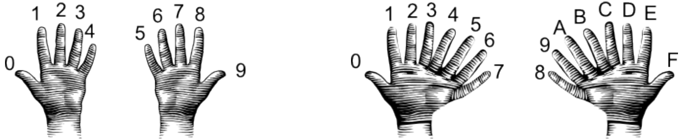

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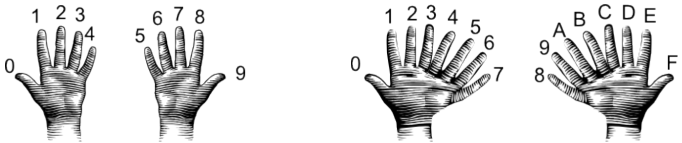

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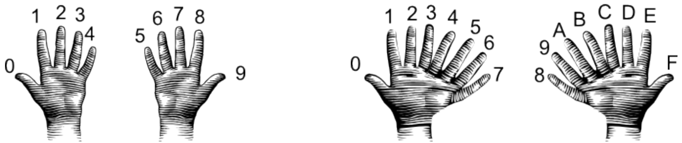

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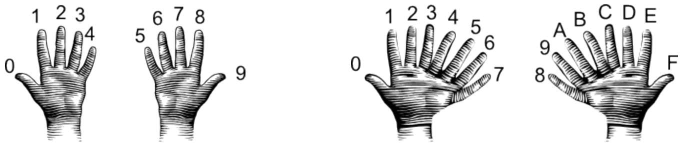

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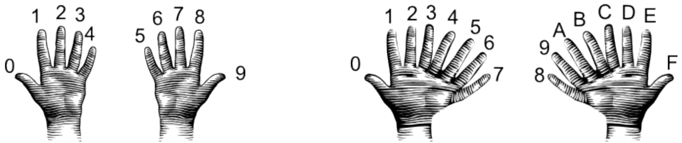

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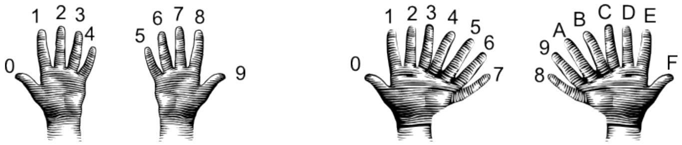

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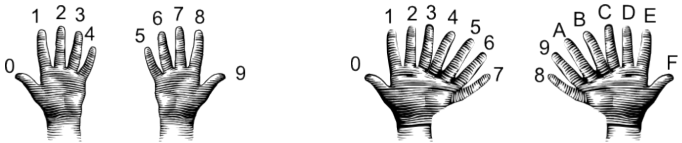

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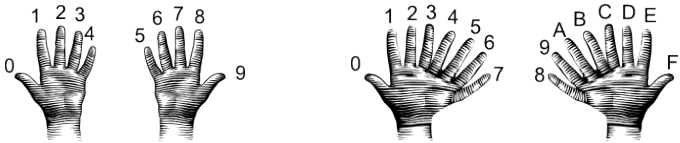

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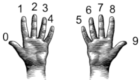
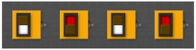
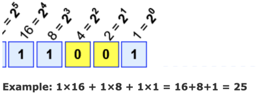
Decimal to Binary: Converting Between Bases







- From decimal to binary:
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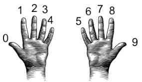

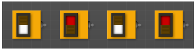

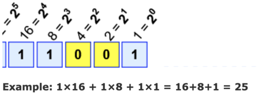

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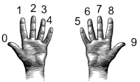

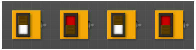

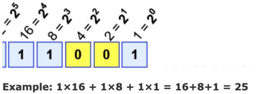

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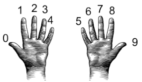

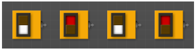

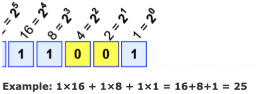

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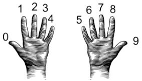
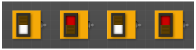
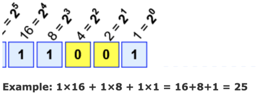
Decimal to Binary: Converting Between Bases







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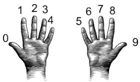

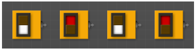

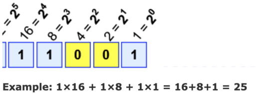

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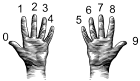

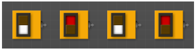

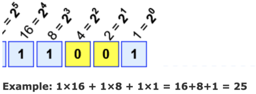

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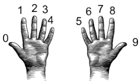

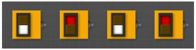

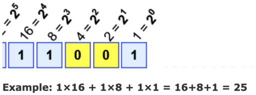

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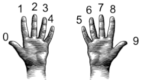

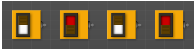

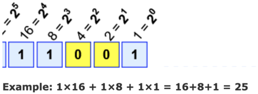

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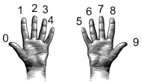

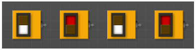

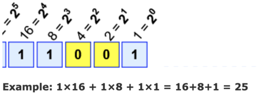

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    130/128 is 1 rem 2.
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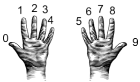

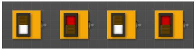

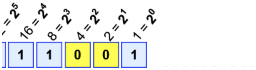

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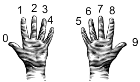

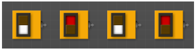

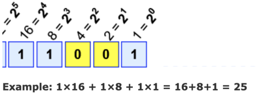

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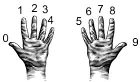

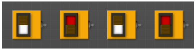

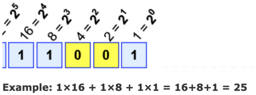

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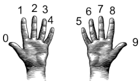

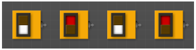

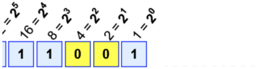

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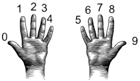

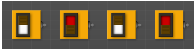

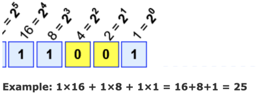

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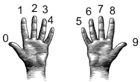

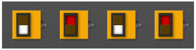

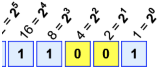

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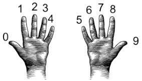

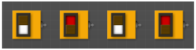

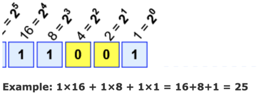

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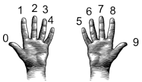

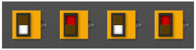

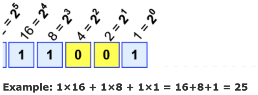

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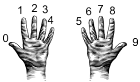

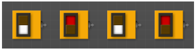

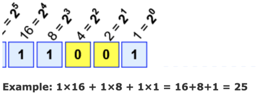

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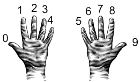

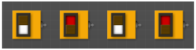

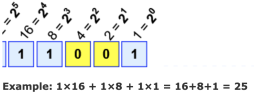

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  - Example: what is 130 in binary notation?

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130/128 is 1 rem 2. First digit is 1:    1...
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2/32 is 0 rem 2. Next digit is 0:        100...
2/16 is 0 rem 2. Next digit is 0:        1000...
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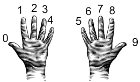

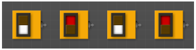

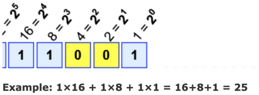

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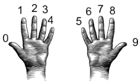

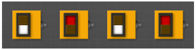

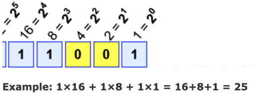

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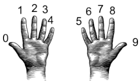

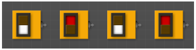

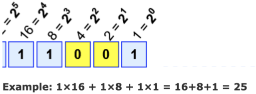

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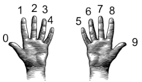

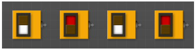

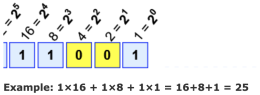

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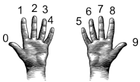

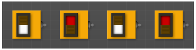

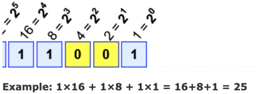

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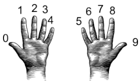

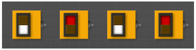

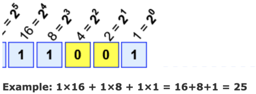

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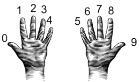

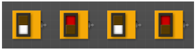

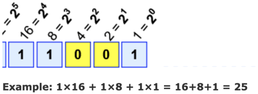

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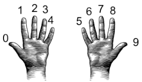

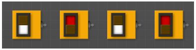

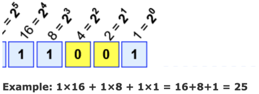

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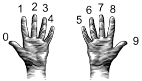

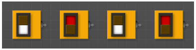

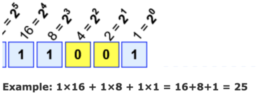

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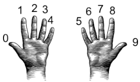

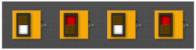

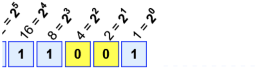

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Adding the last remainder:               10000010
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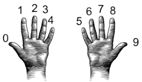

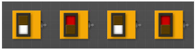

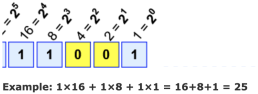

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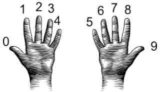

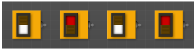

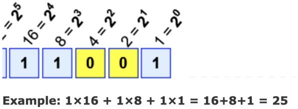

- Example: what is 99 in binary notation?

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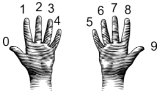
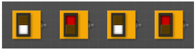
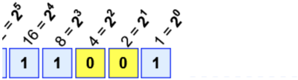
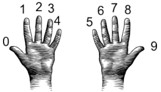


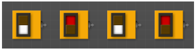


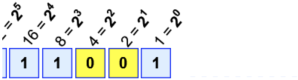


- Example: what is 99 in binary notation?
  `99/128 is 0 rem 99.`

Decimal to Binary: Converting Between Bases







- Example: what is 99 in binary notation?

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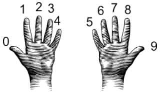
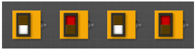
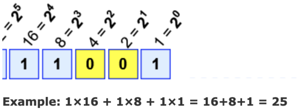
99/128 is 0 rem 99. First digit is 0:
```

Decimal to Binary: Converting Between Bases







- Example: what is 99 in binary notation?

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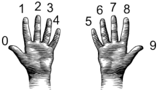
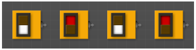
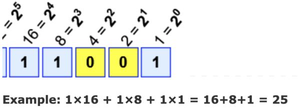
  `99/64 is 1 rem 35.`

Decimal to Binary: Converting Between Bases







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99/128 is 0 rem 99. First digit is 0:    0...
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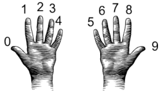
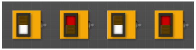
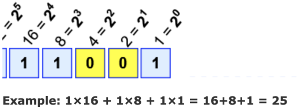
Decimal to Binary: Converting Between Bases







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99/128 is 0 rem 99. First digit is 0:    0...
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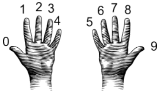
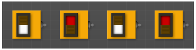
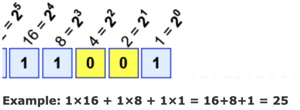
Decimal to Binary: Converting Between Bases







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99/128 is 0 rem 99. First digit is 0:    0...
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```
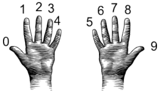
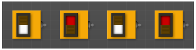
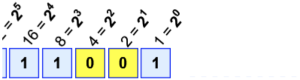

Decimal to Binary: Converting Between Bases







Example: 1×16 + 1×8 + 1×1 = 16+8+1 = 25

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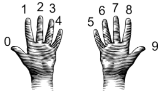

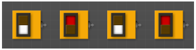

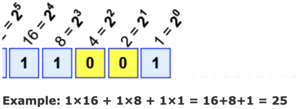

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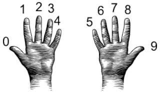

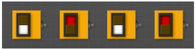

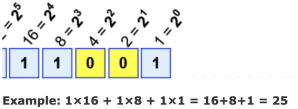

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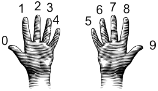

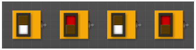

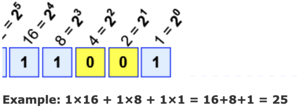

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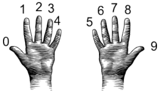

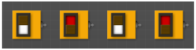

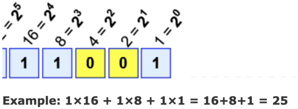

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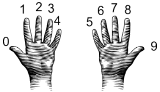

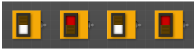

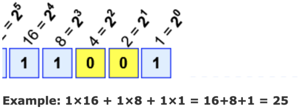

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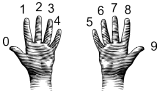

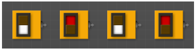

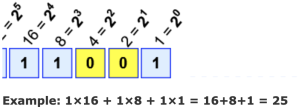

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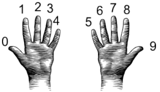

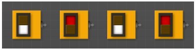

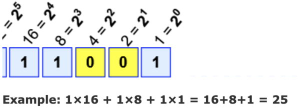

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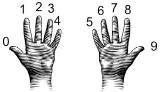

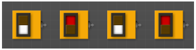

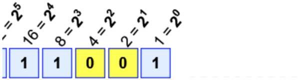

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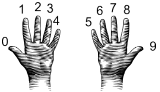

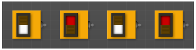

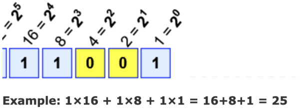

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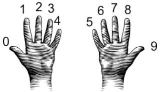

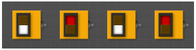

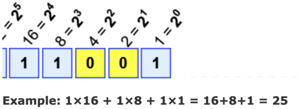

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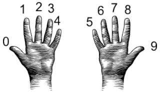
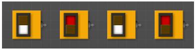
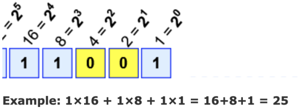
Decimal to Binary: Converting Between Bases







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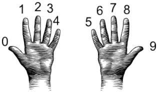

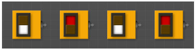

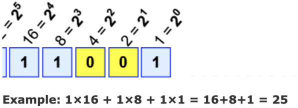

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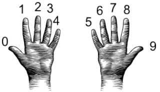

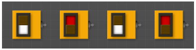

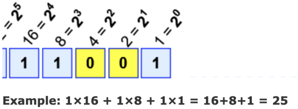

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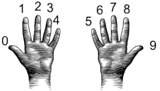
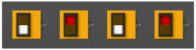
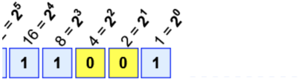
Decimal to Binary: Converting Between Bases







Example: 1×16 + 1×8 + 1×1 = 16+8+1 = 25

- Example: what is 99 in binary notation?

`99/128 is 0 rem 99. First digit is 0:`	0...
`99/64 is 1 rem 35. Next digit is 1:`	01...
`35/32 is 1 rem 3. Next digit is 1:`	011...
`3/16 is 0 rem 3. Next digit is 0:`	0110...
`3/8 is 0 rem 3. Next digit is 0:`	01100...
`3/4 is 0 remainder 3. Next digit is 0:`	011000...
`3/2 is 1 rem 1. Next digit is 1:`	0110001...
`Adding the last remainder:`	01100011

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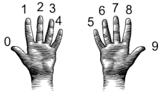
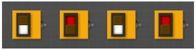
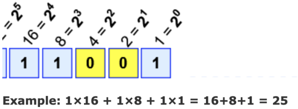




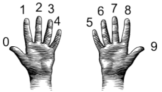


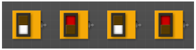
- Example: what is 99 in binary notation?

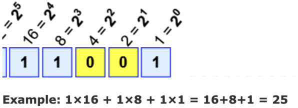
`99/128 is 0 rem 99. First digit is 0:`	0...
`99/64 is 1 rem 35. Next digit is 1:`	01...
`35/32 is 1 rem 3. Next digit is 1:`	011...
`3/16 is 0 rem 3. Next digit is 0:`	0110...
`3/8 is 0 rem 3. Next digit is 0:`	01100...
`3/4 is 0 remainder 3. Next digit is 0:`	011000...
`3/2 is 1 rem 1. Next digit is 1:`	0110001...
`Adding the last remainder:`	01100011

Answer is 1100011.

Binary to Decimal: Converting Between Bases

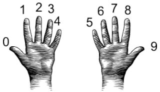


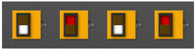


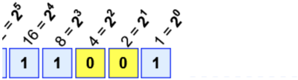


- From binary to decimal:
  - Set sum = last digit.

Binary to Decimal: Converting Between Bases



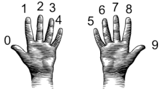


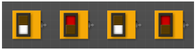


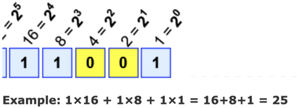
Example: 1×16 + 1×8 + 1×1 = 16+8+1 = 25

- From binary to decimal:
  - Set sum = last digit.
  - Multiply next digit by $2 = 2^1$. Add to sum.

Binary to Decimal: Converting Between Bases

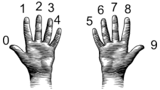


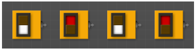


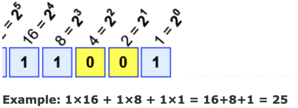


- From binary to decimal:
  - Set sum = last digit.
  - Multiply next digit by $2 = 2^1$. Add to sum.
  - Multiply next digit by $4 = 2^2$. Add to sum.

Binary to Decimal: Converting Between Bases







- From binary to decimal:
  - Set sum = last digit.
  - Multiply next digit by $2 = 2^1$. Add to sum.
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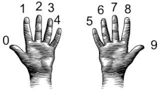
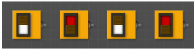
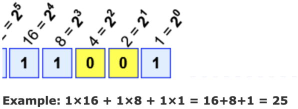
Binary to Decimal: Converting Between Bases







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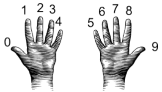
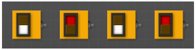
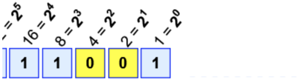
Binary to Decimal: Converting Between Bases







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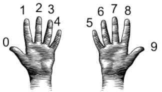
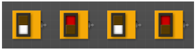
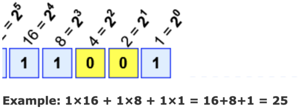
  - Multiply next digit by $16 = 2^4$. Add to sum.
  - Multiply next digit by $32 = 2^5$. Add to sum.

Binary to Decimal: Converting Between Bases







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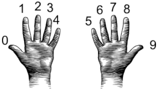
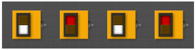
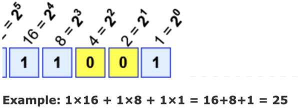
  - Multiply next digit by $64 = 2^6$. Add to sum.

Binary to Decimal: Converting Between Bases







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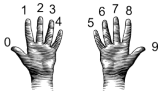
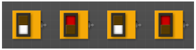
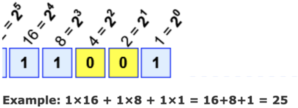
  - Multiply next digit by $128 = 2^7$. Add to sum.

Binary to Decimal: Converting Between Bases







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  - Sum is the decimal number.

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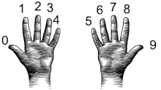

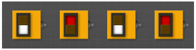

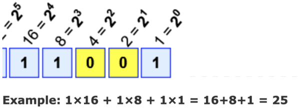

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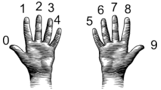
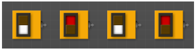
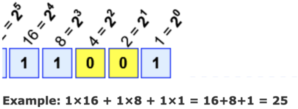
  - Multiply next digit by $128 = 2^7$. Add to sum.
  - Sum is the decimal number.
  - Example: What is 111101 in decimal?

```
Sum starts with:
```

Binary to Decimal: Converting Between Bases







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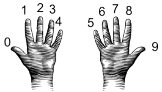
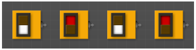
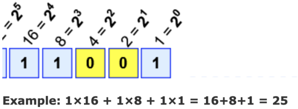
  - Sum is the decimal number.
  - Example: What is 111101 in decimal?

```
Sum starts with:            1
0*2 = 0.  Add 0 to sum:
```

Binary to Decimal: Converting Between Bases







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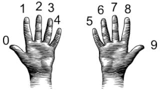
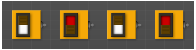
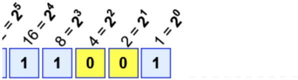
  - Sum is the decimal number.
  - Example: What is 111101 in decimal?

```
Sum starts with:          1
0*2 = 0.  Add 0 to sum:   1
```

Binary to Decimal: Converting Between Bases







Example: 1×16 + 1×8 + 1×1 = 16+8+1 = 25

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```
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```

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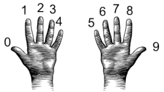

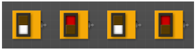

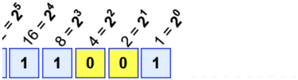

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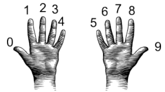
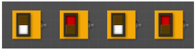
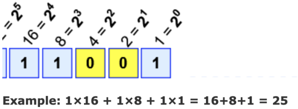
  - Multiply next digit by $128 = 2^7$. Add to sum.
  - Sum is the decimal number.
  - Example: What is 111101 in decimal?

```
Sum starts with:          1
0*2 = 0.  Add 0 to sum:   1
1*4 = 4.  Add 4 to sum:   5
```

Binary to Decimal: Converting Between Bases







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  - Example: What is 111101 in decimal?

```
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1*4 = 4.  Add 4 to sum:   5
1*8 = 8.  Add 8 to sum:
```
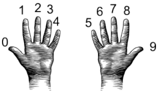
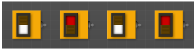
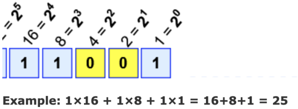

Binary to Decimal: Converting Between Bases







- From binary to decimal:
  - Set sum = last digit.
  - Multiply next digit by $2 = 2^1$. Add to sum.
  - Multiply next digit by $4 = 2^2$. Add to sum.
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  - Multiply next digit by $16 = 2^4$. Add to sum.
  - Multiply next digit by $32 = 2^5$. Add to sum.
  - Multiply next digit by $64 = 2^6$. Add to sum.
  - Multiply next digit by $128 = 2^7$. Add to sum.
  - Sum is the decimal number.
  - Example: What is 111101 in decimal?

```
Sum starts with:            1
0*2 = 0.  Add 0 to sum:     1
1*4 = 4.  Add 4 to sum:     5
1*8 = 8.  Add 8 to sum:     13
```

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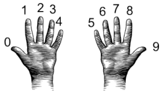

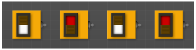

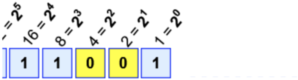

Example: 1×16 + 1×8 + 1×1 = 16+8+1 = 25

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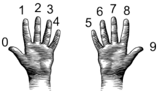

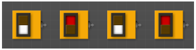

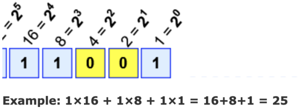

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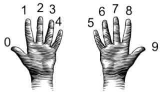
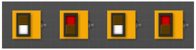
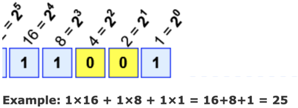
```

Binary to Decimal: Converting Between Bases







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```
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0*2 = 0.   Add 0 to sum:     1
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1*8 = 8.   Add 8 to sum:     13
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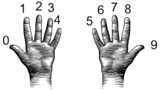
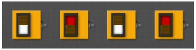
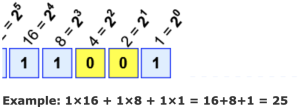
Binary to Decimal: Converting Between Bases







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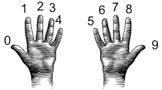
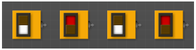
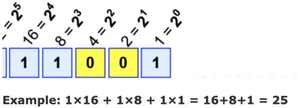
1*8 = 8.  Add 8 to sum:       13
1*16 = 16.  Add 16 to sum:    29
1*32 = 32.  Add 32 to sum:    61
```

Binary to Decimal: Converting Between Bases







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1*16 = 16.  Add 16 to sum:  29
1*32 = 32.  Add 32 to sum:  61
```
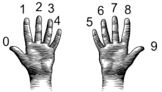
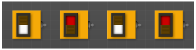
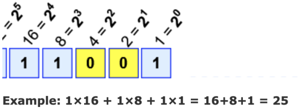

Binary to Decimal: Converting Between Bases



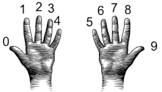


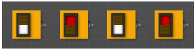


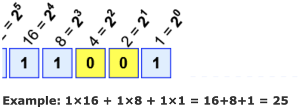
- Example: What is 10100100 in decimal?

  `Sum starts with:`

Binary to Decimal: Converting Between Bases



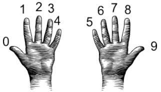


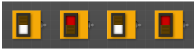


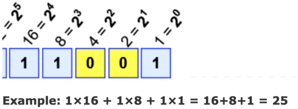
- Example: What is 10100100 in decimal?

```
Sum starts with:              0
0*2 = 0.  Add 0 to sum:
```

Binary to Decimal: Converting Between Bases







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Sum starts with:           0
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```

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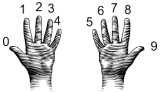
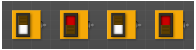
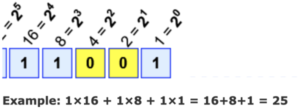


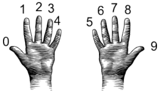


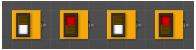


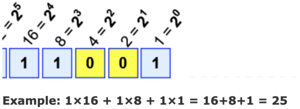
- Example: What is 10100100 in decimal?

```
Sum starts with:             0
0*2 = 0.   Add 0 to sum:     0
1*4 = 4.   Add 4 to sum:
```

Binary to Decimal: Converting Between Bases







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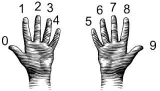

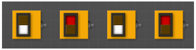

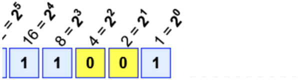

Example: 1×16 + 1×8 + 1×1 = 16+8+1 = 25

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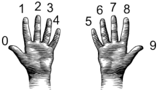

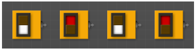

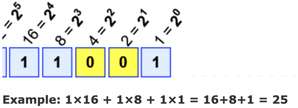

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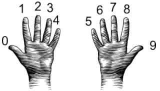

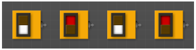

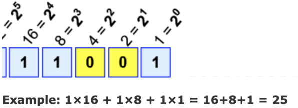

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0*16 = 0.   Add 0 to sum:
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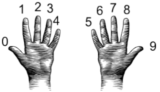

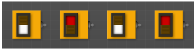

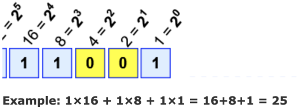

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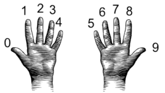

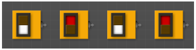

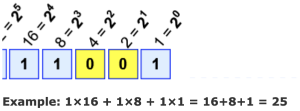

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Sum starts with:              0
0*2 = 0.  Add 0 to sum:       0
1*4 = 4.  Add 4 to sum:       4
0*8 = 0.  Add 0 to sum:       4
0*16 = 0.  Add 0 to sum:      4
1*32 = 32.  Add 32 to sum:
```

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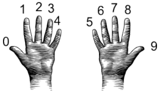

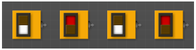

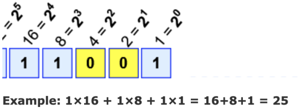

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```
Sum starts with:               0
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1*4 = 4.   Add 4 to sum:       4
0*8 = 0.   Add 0 to sum:       4
0*16 = 0.   Add 0 to sum:      4
1*32 = 32.   Add 32 to sum:    36
```
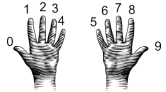
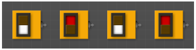
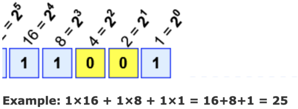

Binary to Decimal: Converting Between Bases



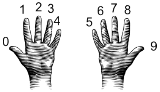


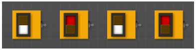


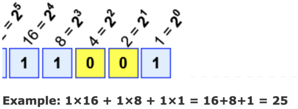
- Example: What is 10100100 in decimal?

```
Sum starts with:              0
0*2 = 0.   Add 0 to sum:      0
1*4 = 4.   Add 4 to sum:      4
0*8 = 0.   Add 0 to sum:      4
0*16 = 0.   Add 0 to sum:     4
1*32 = 32.   Add 32 to sum:   36
0*64 = 0.   Add 0 to sum:
```

Binary to Decimal: Converting Between Bases







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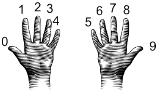

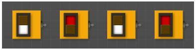

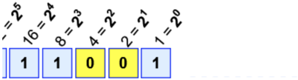

Example: 1×16 + 1×8 + 1×1 = 16+8+1 = 25

- Example: What is 10100100 in decimal?

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0*64 = 0.   Add 0 to sum:  36
1*128 = 0.   Add 128 to sum:
```

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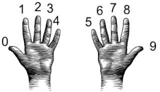

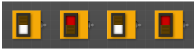

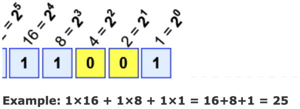

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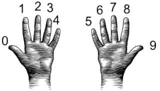

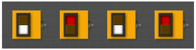

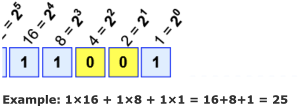

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0*64 = 0.   Add 0 to sum:   36
1*128 = 0.   Add 128 to sum: 164
```
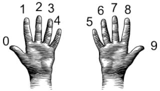
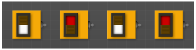
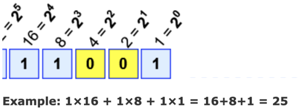

The answer is 164.

Design Challenge: Incrementers







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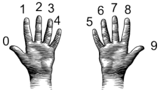
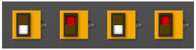
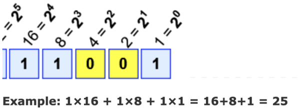
Design Challenge: Incrementers







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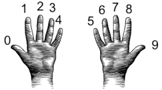

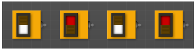

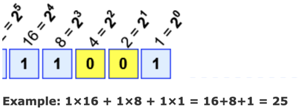

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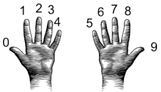

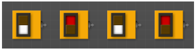

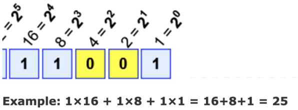

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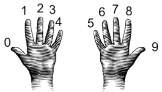

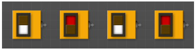

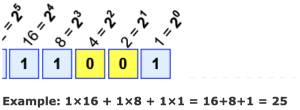

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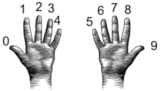

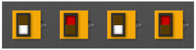

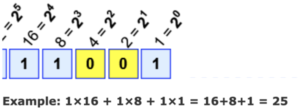

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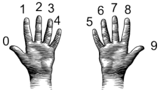

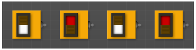

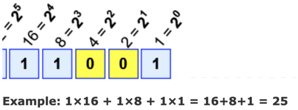

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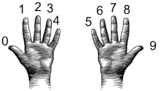

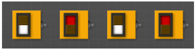

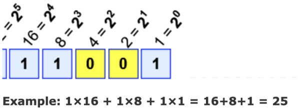

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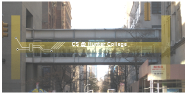
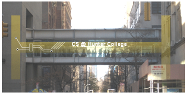
  Example: `"1001"` → `"1010"`

Recap



- Searching through data is a common task– built-in functions and standard design patterns for this.

Recap



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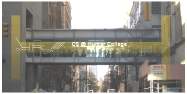

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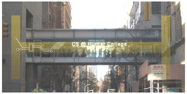

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- Converting between Bases

Final Overview: Format

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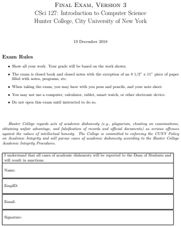
- Past exams available on the webpage (includes answer keys).

Exam Options

Exam Times:



FINAL EXAM, VERSION 3
CSci 127: Introduction to Computer Science
Hunter College, City University of New York

19 December 2018

Exam Rules

- Show all your work. Your grade will be based on the work shown.
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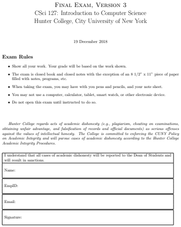
- When taking the exam, you may have with you pens and pencils, and your note sheet.
- You may not use a computer, calculator, tablet, smart watch, or other electronic device.
- Do not open this exam until instructed to do so.

Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The College is committed to enforcing the CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures.

I understand that all cases of academic dishonesty will be reported to the Dean of Students and will result in sanctions.
Name:
EmplID:
Email:
Signature:

Exam Options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- Regular Time: Monday, May 22 in Assembly Hall, 9-11 am.

Exam Options

FINAL EXAM, VERSION 3
CSci 127: Introduction to Computer Science
Hunter College, City University of New York

19 December 2018

Exam Rules

- Show all your work. Your grade will be based on the work shown.
- The exam is closed book and closed notes with the exception of an 8 1/2" x 11" piece of paper filled with notes, programs, etc.
- When taking the exam, you may have with you pens and pencils, and your note sheet.
- You may not use a computer, calculator, tablet, smart watch, or other electronic device.
- Do not open this exam until instructed to do so.

Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The College is committed to enforcing the CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures.

I understand that all cases of academic dishonesty will be reported to the Dean of Students and will result in sanctions.
Name:
EmpID:
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- Regular Time: Monday, May 22 in Assembly Hall, 9-11 am.
- Alternate Time: Wednesday, May 17 in 1001G Hunter North, (time TBD).

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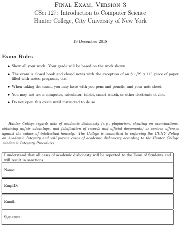
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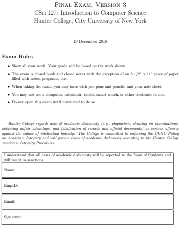
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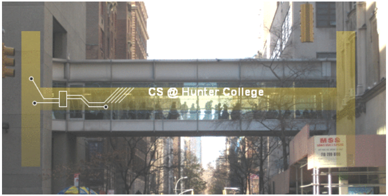
- If you choose to take the early date, you will not be given access to the exam on May 22, even if you miss the early exam.

Weekly Reminders!



Before the next lecture, don't forget to:

- Work on this week's Online Lab

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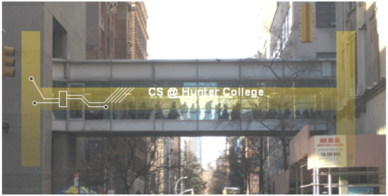

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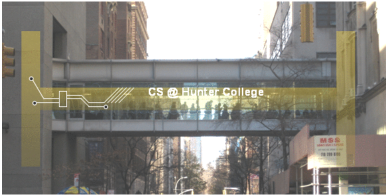

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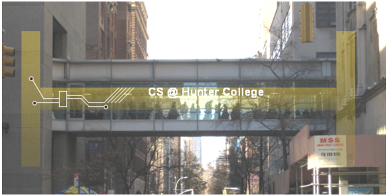

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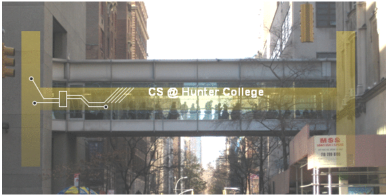
- Submit this week's programming assignments

Weekly Reminders!



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- If you need help, schedule an appointment for Tutoring

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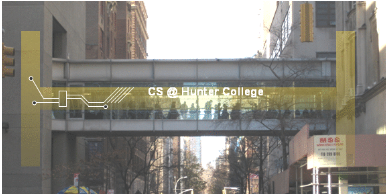

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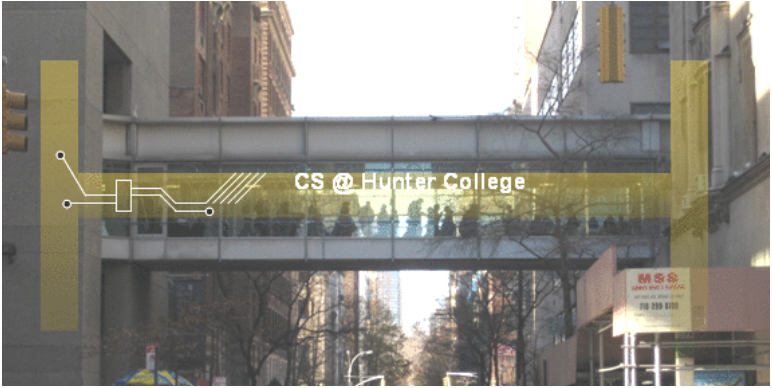
- If you need help, schedule an appointment for Tutoring
- Take the Lecture Preview on Blackboard

Lecture Slips & Writing Boards



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