The Beauty and Joy of Computing

Beyond Blocks Python

Session 2: Data Structures

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(photo: http://www.nationaljournal.com/tech/bill-to-legalize-cell-phone-unlocking-heads-to-obama-s-desk-20140725)

Unlocking Phones Legally

The House passed a bill allowing phones to be unlocked legally. Environmentally, this can help phone reuse. Economically this could stall new phone production and sales. Thoughts?

http://www.npr.org/blogs/thetwo-way/2014/07/25/335351105/bill-allowing-americans-to-unlock-cellphones-passes-house-heads-to-obama

(thanks to Glenn Sugden for the first version of these slides)

Data Structures (Overview)

- Review (and some new introductions)
- Sequences
  - Operators
- Sets
  - Operators
- Dictionaries
- Higher-Order Functions

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Review

- Typing, Build-In Types
  - Int, function, string, list, etc
- Variables
- Looping and Conditionals
  - For loops,
  - While loops
- Functions
  - Recursion
- This week's content
  - Sequences, APIs

Sequences

- Contain an ORDERED set of data
- `str` – short for a “string of text”
- `list` - [‘a’, ‘group’ , ‘of’, ‘items’]
- `range(start, stop, step)`
- `tuple` – a list that can’t be modified
- Supports very easy iteration:
- ```
  for item in sequence:
      print(item)
  ```


  ```

Sequence (General) Operators

- elem `in` & `not in` sequence
- `+` & `*`
- slice `[START:END:`*`STEP=1`*`]`
- `len()`
- `min()` & `max()`
- Even `map()` `filter()` & `reduce()`!
- `count(item)`
- Many, many more: http://docs.python.org/library/stdtypes.html#typesseq

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Strings and String Operators

- Sequence (or “list” or “array”) of chars
- Quoting
  - Single Quotes, Double Quotes
  - Triple Quotes (this keeps formatting and line breaks)
- Concatenation, finding length, etc.
  - `help(“string”)`
- Slicing Supported `[START:END:STEP]`
- http://docs.python.org/library/stdtypes.html#string-methods

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Lists

- Collection of any type
  - Including itself!
- Indexing `list[item]`
  - Indexed from 0, **NOT** 1, unlike S*nap!*
- Modifying `list[item] = new_item`
- Slicing and slicing notation `i.e. [::]`
  - Exactly the same as string notation!
- Operators
  - append(x), insert(i,x), count(x), sort(), etc.
- http://docs.python.org/library/stdtypes.html#mutable-sequence-types

Dictionaries

- Very fast access (by *key*, not number)
- "Map" from a key to a value
- Syntax
  - `{ key1 : value1, key2 : value2, … }`
- Adding elements
  - `dict[key] = value`
- Accessing elements; `dict[key]`
- Keys
  - Looking for specific keys (has_key() & "in")
  - Iterating over (iterkeys())

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API (Application Programming Interface)

- Set of agreements for sharing information
- Programming APIs:
  - “Building Blocks” for common elements such as Open or Save prompts
- Web APIs
  - “Special” URLs for accessing data directly
- Example: Open Weather Map API
  - Map: http://openweathermap.org/Maps
  - Raw data:http://api.openweathermap.org/data/2.5/weather?q=Berkeley,CA

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Demo (reference)

- Code files are all on the website
- fractals.py
  - Some fractals in Turtle Graphics
- ttt.py
  - Tic-Tac-Toe in Python
  - Uses the Games Crafters API for getting information about best moves

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More Information

- Sequences & Methods
  - http://docs.python.org/library/stdtypes.html
- Coding Bat (***Great*** practice!)
  - http://codingbat.com/python
- Google's Python Class
  - http://code.google.com/edu/languages/google-python-class/
- Exercises (More practice!)
  - http://code.google.com/edu/languages/google-python-class/exercises/basic.html

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