Functions and Excel

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Announcements

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- Practice quiz is up
- Don't forget to register for the quiz Thursday
- Homework 5 is up and homework 4 has entered it's 70% grace period
- Topic 8 and post reading 8 are both due tommorow

More on Functions

Dynamic Typing

Python is a dynamically typed language

- The + does several different things:
  1. Integer addition
  2. Floating point addition
  3. String concatenation
- At **runtime** Python looks at the + operator and determines the correct behaviours based on the types or it's operands.
- **Polymorphism** →A single piece of code can do several things depending on the type of data it's working with.
  1. You can write less code.
  2. Can be harder to find bugs.

Poll Question: Polymorphic Functions

Which function produces an error?

```
1 def print_all(collection):
2   for item in collection:
3     print(item)
4
5 print_all([1, 2, 3, 4])
6 print_all({ 'k': 'v', 'CS': '105' }) #A
7 print_all(7)                         #B
8 print_all('a string')                #C
```

- A A error
- B B error
- C C error
- D A & B error
- E A & C error
- F B & C error

Poll Question: Function Scoping

What is produced by the following code?

```
1 my_var = 11
2 def my_print(my_var):
3   print(my_var)
4
5 my_print(22)
6 print(my_var)
```

- A) 11
  11
- B) 11
  22
- C) 22
  11
- D) 22
  22
- E) NameError

Scoping

- Every function is given a clean slate.
- Any variables written in a function are defined in the function's scope.
- The scope is destroyed when the function returns.
- If a name is read that doesn't exist in the function's scope, it tries the scope the function was defined in.

Excel Polls

Poll Question: Excel Cell Range

How many cells in region `A1:B10`

A. 9
B. 10
C. 18
D. 20

Poll Question: Excel Cell Range

How many cells in region `A1:B10`

A. 9
B. 10
C. 18
D. 20

Answer: Colon-separated pair follows the form `upper-left:lower-right`.

Poll Question: Excel

If cell A1 contains `Champaign`

1. `=A1="CHAMPAIGN"`
2. `=A1>"Boston"`
3. `=A1="*ham*"`

A. 1
B. 2
C. 3
D. Both 1 & 2
E. Both 1 & 3
F. Both 2 & 3

Excel Review

Excel: SUM

For a 1-D Structure

```
def SUM(selected_range):
  total = 0
  for cell in selected_range:
    total += cell
  return total
```

For a 2-D Structure

```
def SUM(selected_range):
  total = 0
  for row in selected_range:
    for column in row:
      total += cell
  return total
```

Excel: COUNTIF

```
def COUNTIF(selected_range, criteria):
  count = 0
  for cell in selected_range:
    if meets_criteria(cell, criteria):
      count += 1
  return count
```

Criteria should be:

- A single value: `7` or `"Illinois"`
- A comparison: `">7"` or `">" & B2`
- A string with wildcards: `"*BADM*"` or `"CS 10?"`

Excel: COUNTIF cont'd

A. `COUNTIFS(range1, criteria1, range2, criteria2)`
B. Ranges 1 and 2 must be of equal # of rows and columns.
C. Counts each time the nth value of each range meets that range's criteria.

Poll Question: COUNTIF

How many rows are selected as a result of the following query?

```
=COUNTIFS(A1:A7, ">10", B1:B7, "empty")
```

A. 1
B. 2
C. 3
D. 4
E. 5

	A	B
1	12	empty
2	8	full
3	-10	empty
4	22	full
5	10	empty
6	15	empty
7	0	empty

Excel: INDEX

1. 1-dimensional lookup:
   - `=INDEX(cellrange, rowindex)`
   - `=INDEX(B3:B11, 4)` $\rightarrow$C6
2. 2-dimensional lookup:
   - `=INDEX(cellrange, rowindex, colindex)`
   - `=INDEX(B3:D11, 4, 2)` $\rightarrow$C6

Poll Question: INDEX

Which cell does `=INDEX(C10:F20, 3, 2)` read from?

A. D12
B. E11
C. E12
D. E13
E. F12

Excel: MATCH

`=MATCH(value, cellrange, matchtype)`

- **value** is the value we're looking for
- **cell-range** is a row or a column
- match type is:
  - 0 = exact match
  - 1 = Largest less than or equal, values must be sorted in increasing order
  - -1 = Smallest value greater than or equal, values must be sorted in descending order
- returns 1-based index into the cell range for a cell containing the value
- return #N/A if no match

Poll Question: MATCH

What does this call to the MATCH function return:
`=MATCH("Craig", A2:A8, 0)`.

A. 2
B. 3
C. 4
D. A3
E. A4
F. #NA

	A	B
1	Andrew	40
2	Max	20
3	David	25
4	Craig	17
5	Rachel	55
6	Akul	37
7	Kathleen	48
8	Austin	29

Excel: VLOOKUP - Combining INDEX and MATCH

- Handles a common case of INDEX + MATCH
- `=VLOOKUP(value, table, col_index, [range_lookup])`
  - **value** →Value to look for in the first column of table.
  - **table** →Table from which to retrieve a value.
  - **col_index** →The column in the table from which to retrieve a value.
  - **range_lookup** →TRUE for approximate match and FALSE for exact match.
- Value searched for must be to the left of value to return.
- HLOOKUP does for rows, what VLOOKUP does for cols.

Docstrings!

Off to Repl.it we go. . .