Warmup (L10)

- You have files named, e.g., `"2023-04-13_finances.txt"`. Write functions that take a filename as argument to extract info:
  - `fileYear(filename)` returns the year as an int
  - `fileMonth(filename)` returns the month as an int
  - `fileDay(filename)` returns the day of the month as an int
  - `fileSubject(filename)` returns the subject (“finances” above) as a string

Sorting and Dictionaries

M5

in order? put things Why

CS114 L10 (M5)

Sorting

- Lists can be in any order (whatever order you put things in it)
- Some things would be easier if they were in order: What's the least value? The most? The biggest gap?
- So, in some cases it's useful to put things in order

Sorting a list

- Lists have a method to do this!

```
lst = [2, 4, 6, 0, 1]
lst.sort()
print(lst) # [0, 1, 2, 4, 6]
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```
lst = [2, 4, 6, 0, 1]
x = lst
lst.sort()
print(x) # [0, 1, 2, 4, 6]
```

This sorts *in place*, so all references will see the same sorting.

It's just <

- Under the surface, it's just using < to sort
- < works on numbers and strings, but not *between* numbers and strings

```
lst = [99, "bottles of beer on the wall"]
lst.sort() # Error!
```

Surprising sorts!

- < can also compare lists, so `.sort()` can sort a list of lists!

```
x = [[3], [2, 1]]
x[0] < x[1] # False
x.sort()
print(x) # [[2, 1], [3]]
```

Non-mutating sort

- `.sort()` mutates the list
- It's a method of lists: doesn't work on strings, ranges, tuples
- Also a built-in function to sort any sequence, by duplicating it into a list:

```
x = sorted("hello, world!")
print(x) # [" ", "!", ",", "d", "e",
         #  "h", "l", "l", "l", "o",
         #  "o", "r", "w"]
```

Least, greatest, gap

- Let's solve exactly the question we started with: find the least, greatest, and greatest gap of a list

```
def lgg(lst: list[float]) -> tuple[float, float, float]:
    s = sorted(lst)
    greatestGap = 0.0
    for idx in range(0, len(lst)-1):
        gap = s[idx+1] - s[idx]
        if gap > greatestGap:
            greatestGap = gap
    return (s[0], s[-1], greatestGap)
```

Named parameters

CS114 L10 (M5)

RTFM

Read The Fuggers' Manual

The Fuggers were an influential merchant family in the Renaissance. Economists are encouraged to read the Fuggers' manuscripts (RTFM), and the same approbation encourages all of us to read manuals.

There is certainly no other expansion of RTFM.

Read The Fuggers' Manual

- Feeling a bit limited by `.sort()` and `sorted`? Remember that `help` can tell us how to use anything!

```
help([1, 2, 3].sort)
```

Help on built-in function sort:

sort(*, key=None, reverse=False) method of builtins.list instance
    Sort the list in ascending order and return None.

    The sort is in-place (i.e. the list itself is modified) and stable (i.e. the
    order of two equal elements is maintained).

    If a key function is given, apply it once to each list item and sort them,
    ascending or descending, according to their function values.

    The reverse flag can be set to sort in descending order.

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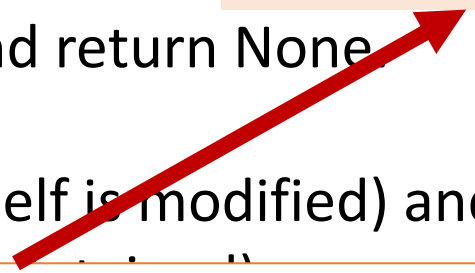

An “instance” is one thing from a type of things.
`[1, 2, 3]` is an instance of a list,
1 is an instance of an int

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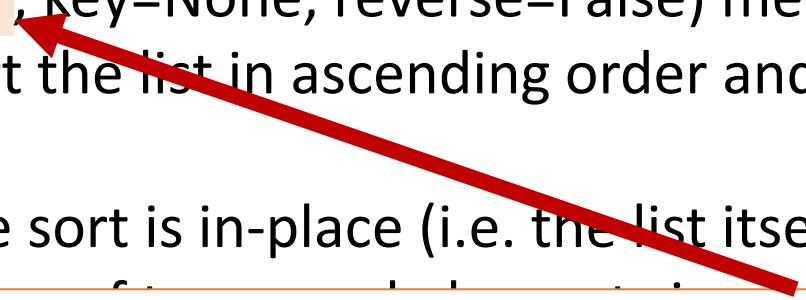

The asterisk (somewhat confusingly) says that there are no normal parameters. We can't do `x.sort(42)`, because what would the 42 mean?

The reverse flag can be set to sort in descending order.

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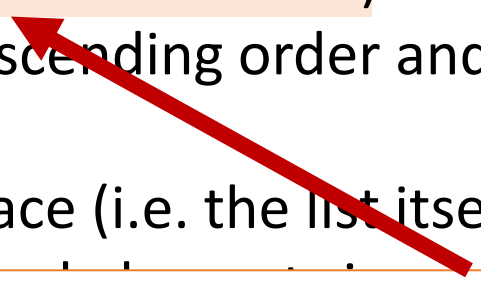

But what are these things???

If a key function is given, apply it once to each list item and sort them, ascending or descending, according to their function values.

The reverse flag can be set to sort in descending order.

Reverse sort

- What if we want things backwards? .sort has a parameter for reversing, but it doesn't look like a normal parameter…
- It's a *named parameter* (or *keyword argument*). To pass it in, you have to name it:

```
x = [2, 4, 6, 0, 1]
x.sort(reverse=True)
print(x) # [6, 4, 2, 1, 0]
```

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OK, we saw “reverse”, but what does this mean?

Key sort

- Sorting normally uses <
- This only works on things you can compare with <, but it's also pretty limited
- What if I wanted to sort strings by their *length*?
- .sort() provides a way to change the sorting criteria: a *key function*

Sort strings by length

```
x = ["an", "excellent", "list", "of", "strings"]
x.sort(key=len)
print(x) # ["an", "of", "list", "strings", "excellent"]
```

Sort strings even/odd

```
def parity(val: int) -> int:
    return val%2
lst = [8, 6, 7, 5, 3, 0, 9]
s = sorted(lst, key=parity)
print("After sorted, lst is", lst)
print("Sorted:", s)
lst.sort(key=parity)
print("After .sort, lst is", lst)

# [8, 6, 0, 7, 5, 3, 9]
```

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def parity(val: int) -> int:
    return val%2
lst = [8, 6, 7, 5, 3, 0, 9]
s = sorted(lst, key=parity)
print("After sort, lst is", lst)

# [8, 6, 0, 7, 5, 3, 9]
```

NOTE: Sorting is “stable”. This means that if two distinct values could go in either order (such as 8 and 0 here) it won’t swap them.

Sort strings by vowel count

```
VOWELS = "aeiou"

def vowels(s: str) -> int:
    r = 0
    for ch in s:
        if ch in VOWELS:
            r = r + 1
    return r

lst = ["these", "are", "just",
       "some", "of", "my",
       "favo[u]rite", "words"]
lst.sort(key=vowels)
print(lst)
```

There’s much more!

- Let’s use `help` to learn about
  - `list.reverse`
  - `list.index`
  - `str.join`
  - `str.split`
  - `str.find`