LIST PROCESSING

COMP130 – INTRODUCTION TO COMPUTING

DICKINSON COLLEGE

LIST PROCESSING PATTERNS

- Three common ***patterns*** found in `List` processing are:
  - ***Map***: applies (i.e. *maps*) an operation(s) to every element of the `List`.
    - Add a curve to all exam scores in a class.
    - Strip spaces and uppercase all words in a text.
  - ***Filter***: selects (i.e. *filters*) elements from the `List` that meet some criterion.
    - Get all sales records for the month of May.
    - Find all small farms with less than 100 acres.
  - ***Reduce*** (or *Aggregate*): computes (i.e. *reduces* the list to) an aggregate value.
    - Compute a student's overall GPA.
    - Compute the average monthly sales for a store.

MAP PATTERN

- ***Map***: applies (i.e. *maps*) an operation(s) to every element of the `List`.
- The common elements of the map pattern are:
  - Create a new `List`
  - Visit each element in the `List`
  - Apply the operation(s) to the current element and add it to the new `List`.
  - Return the new `List`

```
def curve_grades(scores, curve):
    """ Apply the curve to each score
        in the list scores. """

    new_scores = []
    for score in scores:
        new_scores.append(score + curve)

    return new_scores
```

```
def add_interest(balances, rate):
    """ Add interest at the given rate to
        each balance in the list balances. """

    new_balances = []
    for balance in balances:
        interest = balance * rate
        new_bal = balance + interest
        new_balances.append(new_bal)

    return new_balances
```

FILTER PATTERN

- ***Filter***: selects (i.e. *filters*) elements from the `List` that meet some criterion.
- The common elements of the filter pattern are:
  - Create a new `List`
  - Visit each element in the `List`
  - Filter the element, adding it to the new `List` if it meets the criterion.
  - Return the new `List`

```
def comes_before(names, cutoff):
    """ Get all of the names in the list
        names that come before cutoff in
        the alphabet """

    names_before = []
    for name in names:
        if name.upper() < cutoff.upper():
            names_before.append(name)

    return names_before
```

REDUCE (AGGREGATE) PATTERN

- ***Reduce*** (or *Aggregate*): computes (i.e. *reduces* the list to) an aggregate value.
- The common elements of the reduce pattern are:
  - Initialize the aggregate value.
  - Visit each element in the `List`
  - Update the aggregate value based on the current element of the `List`.
  - Return the aggregate value.

```
def count_e(words):
    """ Count the number of e's that
        appear in the strings in the
        list words. """

    total_e = 0
    for word in words:
        up = word.upper()
        total_e = total_e + up.count('E')

    return total_e
```

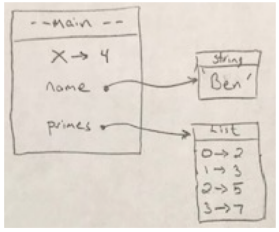
AUGMENTED ASSIGNMENT

- Programmers are lazy…
  - `x += 1` → `x = x + 1`
  - `x -= 4` → `x = x - 4`
  - `x *= 2` → `x = x * 2`
  - `x /= 3` → `x = x / 3`

OBJECTS AND OBJECT REFERENCES

- Variables that name an object do not hold the object, instead they hold a ***reference*** to the object.

```
x = 4
name = 'Ben'
primes = [2, 3, 5, 7]
```

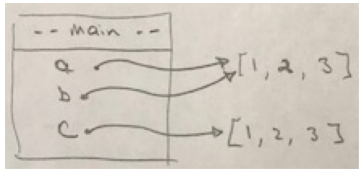


OBJECT REFERENCES AND ALIASES

- When two variables refer to the same object they are ***aliases*** for the object.

```
a = [1, 2, 3]
b = a

c = [1, 2, 3]
```



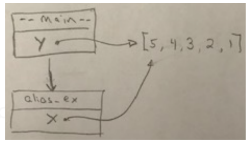
FUNCTION PARAMETERS AND ALIASES

- If an argument passed to a function is an object reference the parameter becomes an alias to the object.

```
def alias_ex(x):
    print(x[2])

y = [5, 4, 3, 2, 1]
alias_ex(y)
```

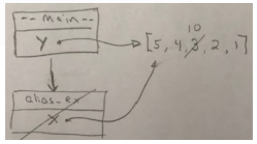
```
3
```




```
def alias_change(x):
    x[2] = 10

y = [5, 4, 3, 2, 1]
print(y[2])
alias_change(y)
print(y[2])
```

```
3
10
```



FUNCTION PARAMETERS AND VALUES

- By contrast, if the argument passed to a function is a value (not an object reference), the parameter is a copy of the value.

```
def not_today(x):
    x = 7

y = 3
not_today(y)
print(y)
```

```
3
```