Cartesian Join
SELECT [expression] as [name], ...
SELECT [columns] from [table] where [condition] ORDER BY [order]
SELECT [columns] from [table] GROUP BY [expressions] having [expr]

SQL and Final Review

COMPUTER SCIENCE MENTORS CS 61A

April 29 to May 1, 2019

1 Creating Tables, Querying Data

Examine the table, `mentors`, depicted below.

Name	Food	Color	Editor	Language
Jade	Thai	Purple	Notepad++	Java
Evan	Pie	Green	Sublime	Java
Jack	Sushi	Orange	Emacs	Ruby
Kevin	Tacos	Blue	Vim	Python
Jemmy	Ramen	Green	Vim	Python

1. Create a new table `mentors` that contains all the information above. (You only have to write out the first two rows.)

CREATE table mentors as
SELECT 'Jade' as Name, 'Thai' as Food, 'Purple' as Color, 'Notepad++' as Editor, 'Java' as Language UNION
SELECT 'Evan' as Name, 'Pie' as Food, 'Green' as Color, 'Sublime' as Editor, 'Java' as Language UNION
.
.
.

2. Write a query that lists all the mentors along with their favorite food if their favorite color is green.
   ```
   Evan|Pie
   Jemmy|Ramen
   ```

SELECT Name, food
from mentors
WHERE Color = 'Green';

SELECT m.name, m.food
from mentors as m
WHERE m.color = 'Green'
;

3. Write a query that lists the food and the color of every person whose favorite language is *not* Python.
   ```
   Thai|Purple
   Pie|Green
   Sushi|Orange
   ```

SELECT food, color
from mentors
WHERE Language != 'Python';

SELECT m.food, m.color
from mentors as m
WHERE m.language <> 'Python';

4. Write a query that lists all the pairs of mentors who like the same language. (How can we make sure to remove duplicates?)
   ```
   Evan|Jade
   Jemmy|Kevin
   ```

SELECT m1.name, m2.name
From mentors as m1, mentors as m2
WHERE m1.language = m2.language
and m1.name < m2.name;

2 Aggregation

CS 61A wants to start a fish hatchery, and we need your help to analyze the data we've collected for the fish populations! Running a hatchery is expensive – we'd like to make some money on the side by selling some seafood (only older fish of course) to make delicious sushi.

The table `fish` contains a subset of the data that has been collected. The SQL column names are listed in brackets.
Table name: `fish`*

Species [species]	Population [pop]	Breeding Rate [rate]	$/piece [price]	# of pieces per fish [pieces]
Salmon	500	3.3	4	30
Eel	100	1.3	4	15
Yellowtail	700	2.0	3	30
Tuna	600	1.1	3	20

*(This was made with fake data, do not actually sell fish at these rates)

Hint: The aggregate functions `MAX`, `MIN`, `COUNT`, and `SUM` return the maximum, minimum, number, and sum of the values in a column. The `GROUP BY` clause of a select statement is used to partition rows into groups.

1. Write a query to find the three most populated fish species.

   SELECT pop
   FROM fish
   ORDER BY -pop LIMIT 3;

2. Write a query to find the total number of fish in the ocean. Additionally, include the number of species we summed. Your output should have the number of species and the total population.

   SELECT count(species), sum(pop)
   FROM fish;

3. Profit is good, but more profit is better. Write a query to select the species that yields the most number of pieces for each price. Your output should include the species, price, and pieces.

   SELECT species, price, MAX(pieces)
   FROM fish
   GROUP BY price;

The table `competitor` contains the competitor's `price` for each `species`.

Species [species]	**$/piece [price]**
Salmon	2
Eel	3.4
Yellowtail	3.2
Tuna	2.6

4. Business is good, but a bunch of competition has sprung up! Through some cunning corporate espionage, we have determined one such competitor's selling prices.

   Write a query that returns, for each species, the difference between our hatchery's revenue versus the competitor's revenue for one whole fish.

   This is because we make 30 pieces at $4 a piece for $120, whereas the competitor will make 30 pieces at $2 a piece for $60. Therefore, the difference is 60.

```
SELECT species, (our.price * pieces) - (their.price * pieces)
FROM fish as our, competitor as their
WHERE our.species = their.species;
```

FINAL REVIEW

3 Environment Diagrams

1. Draw the environment diagram that results from running the following code.

```
def f(f):
    def h(x, y):
        z = 4
        return lambda z:  (x + y) * z

    def g(y):
        nonlocal g, h
        g = lambda y: y[:4]
        h = lambda x, y: lambda f: f(x + y)
        return y[3] + y[5:8]

    return h(g("sarcasm!"), g("why would you do this?"))

f = f("61a")(2)
```

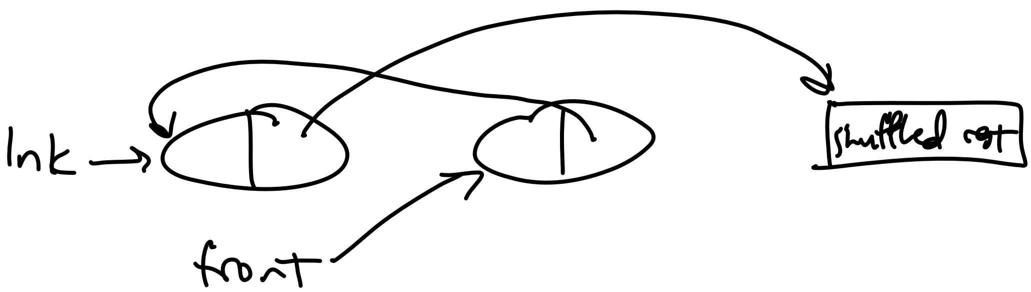
4 Recursive Data Structures

1. Fill in the implementation of `shuffle`.

```
def shuffle(lnk):
    """Swaps each pair of items in a linked list.

    >>> shuffle(Link(1, Link(2, Link(3, Link(4)))))
    Link(2, Link(1, Link(4, Link(3))))
    >>> shuffle(Link('s', Link('c', Link(1, Link(6,
       Link('a'))))))
    Link('c', Link('s', Link(6, Link(1, Link('a')))))
    """
    if lnk is Link.empty or lnk.rest is Link.empty:
        return lnk
    front = lnk.rest
    lnk.rest = shuffle(front.rest)
    front.rest = lnk
    return front
```

nothing to shuffle



5 Recursion

1. Imagine we have a game where there are multiple cards with numbers laid out in a straight line. Each turn, a player can take a card from the very left, or the very right. We want to write a function, `game`, that determines whether or not it is possible for a sequence of valid moves to result in both players getting an equal score once all cards are used.
   We represent the cards as a list. Say `lst = [0, 2, 2, 4]`. In this case, our function should return True. The current player (`curr`) can pick the last card (4) on their first turn. After that, the two players switch. On the next turn, the new current player (previously the opponent) can pick 2. Then the original player picks 0, and the other player picks 2.
   `Game` takes in the scores of both players (initially 0) and a list representing the cards.

```
def game(cards):
    """
    >>> game([1,2,3]) #1, then 3, then 2
    True
    >>> game([1, 1, 1])
    False
    >>> game([])
    True
    """
```

6 Scheme

1. Write a Scheme function `insert` that creates a new list that would result from inserting an item into an existing list at the given index. Assume that the given index is between 0 and the length of the original list, inclusive.

   Challenge: Write this as a tail recursive function. Assume append is tail recursive.

```
(define (insert lst item index)

)

; Tail recursive
(define (insert-tail lst item index)

)
```

7 Iterators, Generators, and Streams

1. Implement all_ways_gen, which takes in a list `lst` and integer `n` and returns a generator which yields all possible ways to add together non-consecutive elements of lst to sum up to n. You can assume all elements of lst are positive.

```
def all_ways_gen(lst, n):
    """
    >>> g = all_ways_gen([1, 6, 4, 7, 2, 3], 7)
    >>> sorted(g)
    [[1, 4, 2], [4, 3], [7]]
    >>> g2 = all_ways_gen([1], 2)
    >>> list(g2)
    []
    """
    if ______________________:
        __________________________
    elif _____________________:
        return
    else:
        first_el = lst[0]
        _____________________________________
        for s in ____________________________:
            yield _________________________
```

2. (a) You and your CS 61A friends are cons. You cdr'd just studied for the final, but instead you scheme to drive away across a stream in a car during dead week. Of course, you would like a variety of food to eat on your road trip.

Write an infinite stream that takes in a list of foods and loops back to the first food in the list when the list is exhausted.

```
;Doctests
scm> (define fruit (food-stream '(apple banana orange)))
fruit
scm> (car fruit)
apple
scm> (car (cdr-stream fruit))
banana
scm> (car (cdr-stream (cdr-stream (cdr-stream fruit))))
apple

(define (food-stream foods)







)
```

(b) We discover that some of our food is stale! Every other food that we go through is stale, so put it into a new stale food stream. Assume `is-stale` starts off as `#f`.

```
;Doctests
scm> (define cookies (stale-stream '(oatmeal chocolate
   sugar oreo)))
cookies
scm> (car cookies)
chocolate
scm> (car (cdr-stream cookies))
oreo


(define (stale-stream foods is-stale)
```