Discussion 3: Domain, Range, Lists and HOFs
SOLUTIONS

Domain and Range

1. Determine the domain and range of the following Snap! blocks:

a. 

Domain: **First blank: list, second blank: any value**

Range: **Booleans (True/False)**

b. 

Domain of foo: **Numbers**

Range of foo: **Booleans (True/False)**

Data type of var: **Booleans (True/False), since the type of var is the same as the output type of foo**

2. Fill in the table with the domain and range of the following higher order functions:

Higher Order Function	Domain	Range	Notes
	First blank: reporter, with zero or more of its input slots left blank Second blank: list	List with same length as input list	~ The reporter must be able to take in all the data types in the input list without erroring. For example, if the input list to map has numbers and words, the input reporter must be able to handle numbers and words. ~ The output type of the reporter determines the data types of the values in the output list. For example, if the reporter outputs Booleans, then the output list will only have Boolean values.

	First blank: predicate, zero or more of its input slots left blank Second blank: list	List with length less than or equal to length of input list	~ The domain of the predicate must include ALL data types in the input list. For example, if the list contains booleans and numbers, the predicate must be able to handle both booleans and numbers. ~ Keep should never modify the items in the input list when creating its output list. Every item in the list outputted by keep MUST also be in the input list
	First blank: reporter with two input slots left blank Second blank: list	A single value of any data type	~The type of the output value is the same as the output type of the reporter. For example, if the reporter outputs numbers, combine will output a number. ~The input reporter must be able to handle all data types from the input list, as in map and keep.

Higher Order Function Practice

1. Fill in the blanks so the keep block returns a list of the numbers from MyList.

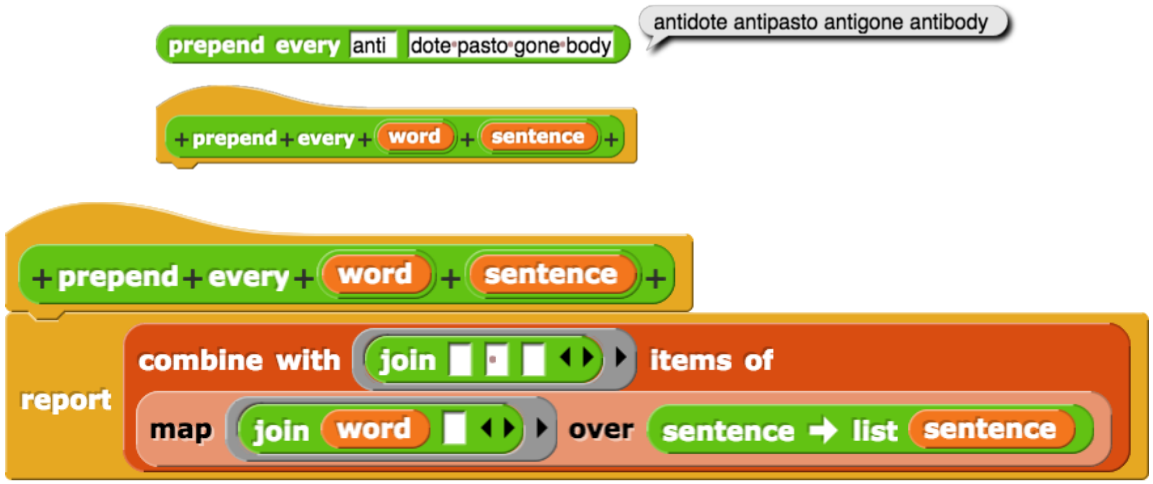
```
MyList = [3, hello, goodbye, 5, 6]
```

Keep items such that  from MyList

2. Write an expression that returns the sum of the squares of the numbers in YourList.

```
YourList = [1, 2, 3, 4]
```

3. Complete the following block so it works as described. Note: You may find the sentence -> list block helpful.



4. Describe (in words) what the following block outputs. Assume OurList is a list of words.

It outputs a word consisting of the last letter of each word from our list.

Challenge Problems

1. Determine the domain and range of the following blocks:

a. 

Domain of Foo: **Booleans, since the output of the equals block is passed in**
Range of Foo: **A list of numbers, since we know that the output of Foo is passed into the map block**

a. 

Domain of Bar: **Not enough information**

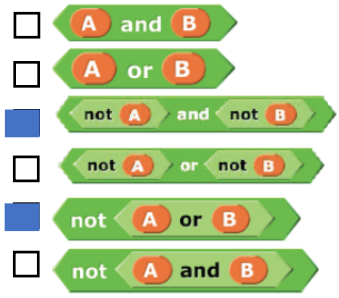
Range of Bar: **Numbers, since the output of Bar can be passed into the ">" block and can be compared with a number**

2. If the output of `Mystery` is true, which of the following can you say for sure?

☐	☐	■	■	☐
A must be true	B must be true	A must be false	B must be false	None of these

If Mystery outputs true, then it could not have gone into either of the if statements, so A and B must be false.

3. You realize you could replace the *entire* body of `Mystery` with a single report statement. What could we report instead so that `Mystery` would have the same exact behavior? (Select all that apply)



To get this answer, we test each of the blocks with every possible combination of A and B (TT, TF, FT, FF) and find the ones that match the behavior of Mystery.

4. Given the following expression, what does `NAMES` evaluate to?

a. 

b. 

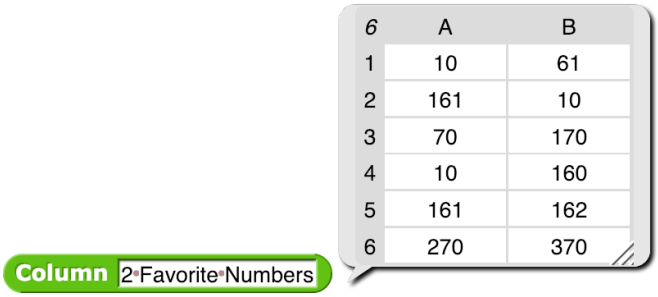
c. 

d. 

5. One of the most common data storage technologies is databases, think of them as Tables/Charts, with columns and rows. Let's say you're given a table that looks like the following:

ID	Name	Height(inches)	Year	2 Favorite Numbers
1	Dan	75	4	[10, 61]
2	Mansi	65	4	[161, 10]
3	Bob	70	3	[70, 170]
4	Alice	71	1	[10, 160]
5	Nick	68	3	[161, 162]
6	Eve	64	2	[270, 370]
:	:	:	:	:
:	:	:	:	:
...	...	...	...	...

Note: Each entry in "2 Favorite Numbers" is a list with exactly 2 numbers!



You're given a reporter block, Column [ ], that takes in the name of a column in the database and reports a list of all of the elements in that column in order. An example call is shown to the left.

For this problem, you can assume that you are only given the 3 HOFs, Column [ ], and any operators (green blocks) in Snap! For each of the subparts before, determine if the problem can be solved using only the given blocks.

a Report the total sum of heights **Yes** No

Yes, we can use combine on Column(height)

b Report a list of the names of people who are in year 4 Yes **No**

No, our higher order functions cannot take in multiple lists. It can tell which years are equal to 4, but not which rows those 4s came from

c Report the number you get when you multiply the squares of all of the heights above 70 inches together. **Yes** No

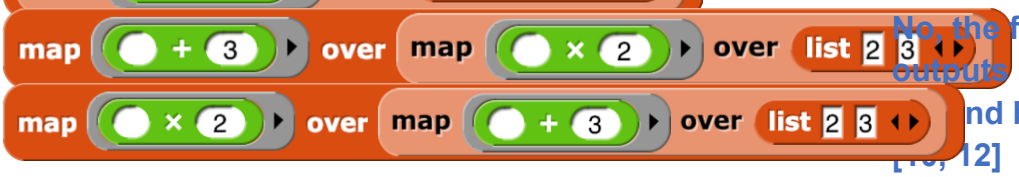
d Calculate the sum of all of the numbers in the "2 Favorite Numbers" column **Yes** No

6. Indicate whether each set of blocks below is equivalent:

a

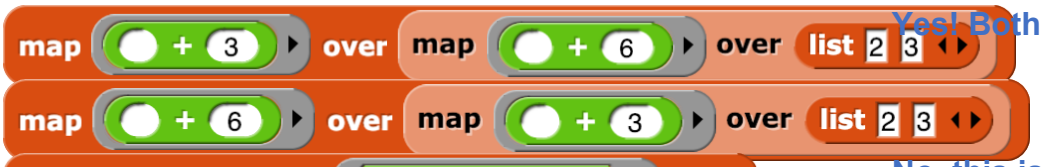
No, the first block outputs [6, 6], and the second block outputs [4, 5, 6, 6]

b



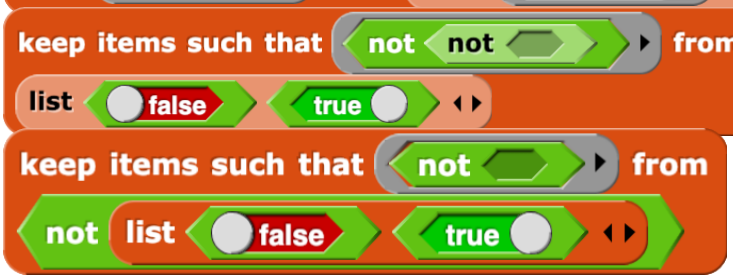
No, the first block outputs [7, 9], and the second block outputs [10, 12]

c



Yes! Both output [11, 12]

d



No, this is a trick question! The second block will cause an error, because not cannot take in a list.