Map

What if we want to take a recipe and make it vegan?

Sorry, meat-lovers!

Let's think about what the input and output should be. We're starting with the list of ingredients,

```
[list: "egg", "butter", "flour",
  "sugar", "salt", "baking powder",
  "blueberries"]
```

and it should become, say,

```
[list: "flax", "margarine", "flour",
  "sugar", "salt", "baking powder",
  "blueberries"]
```

We need an operation that produces a list, where some of the items are different than in the input list.

We can't do this with **`member`**, **`distinct`**, or **`filter`**.

`L.map` is similar to the **`transform-column`** function we used with tables.

It takes a function and a list as input and produces a list where each item is the result of running the function on the corresponding item of the input list.

```
fun veganize-ingredient(ingredient :: String) -> String:
  doc: "Change a non-vegan ingredient to its vegan
equivalent"
  if ingredient == "egg":
    "flax"
  else if ingredient == "pork":
    "mushroom"
  else if ingredient == "beef":
    "tofu"
  else if ingredient == "chicken":
    "chick'n"
  else if ingredient == "butter":
    "margarine"
  else:
    ingredient
  end
end
```

```
fun veganize-recipe(recipe :: List<String>) -> List<String>:
  doc: "Update a recipe to be vegan"
  L.map(veganize-ingredient, recipe)
where:
  veganize-recipe(pasta) is pasta
  veganize-recipe(dumplings) is
  [list: "flax", "wonton wrappers",
    "mushroom", "garlic", "salt", "soy sauce"]
end
```

Because **veganize-ingredient** is just a helper function for **veganize-recipe**, we might prefer to define it inside **veganize-recipe**:

```
fun veganize-recipe(recipe :: List<String>) -> List<String>:
  fun veganize-ingredient(ingredient :: String) -> String:
    if ingredient == "egg": "flax"
    else if ingredient == "pork": "mushroom"
    else if ingredient == "beef": "tofu"
    else if ingredient == "chicken": "chick'n"
    else if ingredient == "butter": "margarine"
    else: ingredient
    end
  end
  L.map(veganize-ingredient, recipe)
where:
  veganize-recipe(pasta) is pasta
  veganize-recipe(dumplings) is [list: "flax", "wonton wrappers",
    "mushroom", "garlic", "salt", "soy sauce"]
end
```

Operation signatures

What operations have we seen so far?

`L.member`

`List, ⟨item⟩ -> Boolean`

Indicates whether the item is in the list

`L.distinct`

`List -> List`

Returns the unique values from input list

`L.filter`

`Function, List -> List`

Returns list of items from input list on which function returns true
(in the same order as in the input list)

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Can we get more specific?

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`(a -> Boolean), List -> List`

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…

A function that takes an input of some type – call it ***a*** *– and returns a Boolean.*

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`L.member`

`List, ⟨item⟩ -> Boolean`

Indicates whether the item is in the list

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`List -> List`

Returns the unique values from input list

`L.filter`

`(a -> Boolean), List<a> -> List<a>`

Returns list of items from input list on which function returns true
(in the same order as in the input list)

…

*The items in the input and output lists will be of the same type **a**, otherwise we couldn't run the predicate function on them.*

What about **`map`**?

```
Function, List -> List
```

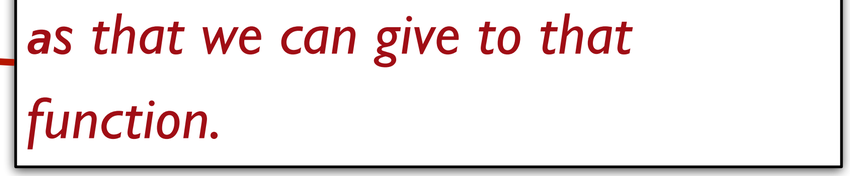
What about **`map`**?

```
(a -> b), List -> List
```

A function that takes an input of some type – call it ***`a`*** *– and returns an output of type* ***`b`****, which might be the same as* ***`a`*** *or might not. E.g., we might be taking a Number and converting it to a String.*

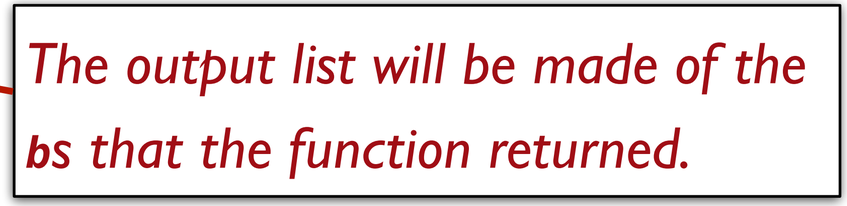
What about **map**?

```
(a -> b), List<a> -> List
```



What about **`map`**?

```
(a -> b), List<a> -> List<b>
```



For a full list of operations and their signatures, see the Pyret lists documentation.

Lists and tables

We've seen one way of describing a set of recipes – as a set of hardcoded lists.

This makes sense when we have a small set of recipes that doesn't change often, but we might want something better.

Another possibility would be to use a table with one column per ingredient:

```
recipes1 = table:
  name :: String, spaghetti :: Boolean, milk :: Boolean,
  tomatoes :: Boolean, onions :: Boolean, blueberries :: Boolean,
  garlic :: Boolean, salt :: Boolean
  row: "pasta", true, false, true, true, false, true, true
end
```

name	spaghetti	milk	tomatoes	onions	blueberries	garlic	salt
"pasta"	true	false	true	true	false	true	true

The table would let us make plots and charts using the operations we know in Pyret

The lists are easier to write and modify

The tables could become sparse if we add more categories and ingredients

Whether you use tables or lists depends on the data you have and how you plan to use it.

For the programs we've written today, the lists were sufficient and lightweight, so they were the better choice.

Other programs might have benefitted from the table-shaped data.

Another possibility we'll return to later is combining lists and tables, e.g.,

```
recipes2 = table:
  name :: String, ingredients :: List<String>
  row: "pasta", [list: "spaghetti", "tomatoes", "garlic", "onion", "salt"]
end
```

name	ingredients
"pasta"	[list: "spaghetti", "tomatoes", "garlic", "onion", "salt"]

Lecture code:

https://code.pyret.org/editor#share=1j8jQBfC7dt04L6wqwddliK8O0AJzeP2a&v=1904b2c