Sets and Dictionaries

A set is a group of things of the same kind. A dictionary is a set of key-value pairs. Sets and dictionaries are useful in programming, because they can store and look up unique values.

Manager: Recorder:

Presenter: Reflector:

Content Learning Objectives

After completing this activity, students should be able to:

- Describe operations that can be applied to a set of strings.
- Create a dictionary of strings and look up values by key.
- Represent complex data using nested dictionaries and lists.

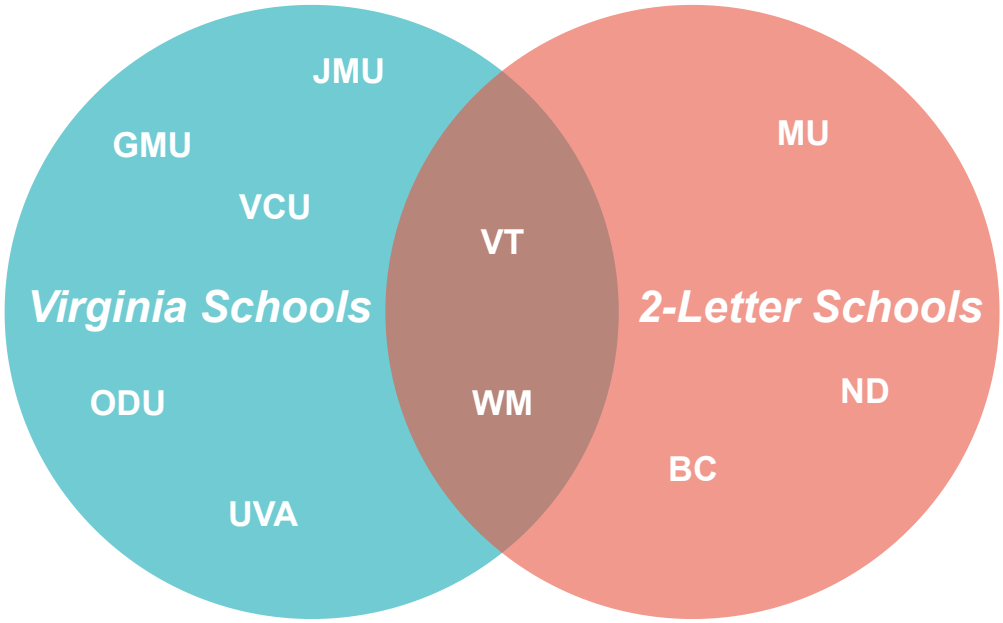
Process Skill Goals

During the activity, students should make progress toward:

- Developing an algorithm for traversing a real data set. (Problem Solving)

Model 1 School Acronyms

Venn Diagram:



Python Code:

```
va_schools = {"JMU", "GMU", "VCU", "VT", "ODU", "WM", "UVA"}
two_letter = {"MU", "VT", "ND", "WM", "BC"}
```

Questions (15 min) Start time:

1. As a team, predict the value of each expression. Then run each expression in a Python Shell, and record the actual value. Discuss any differences between the predicted and actual values.

Python code	Predicted value	Actual value
`type(va_schools)`		
`len(two_letter)`		
`"ND" in va_schools`		
`"JMU" not in two_letter`		
`len(va_schools.union(two_letter))`		
`va_schools.intersection(two_letter)`		
`two_letter.difference(va_schools)`		

2. Identify the following operations used in the previous question.

a) Built-in functions:

b) Built-in operators:

c) Methods of a `set`:

3. Predict the result of the following code. Then run the code in a Python Shell, and compare with your prediction.

```
va_schools.remove("GMU")
va_schools.remove("ODU")
va_schools.remove("VCU")
print(va_schools)
```

4. Predict the result of the following code, based on the result of the previous question. Then run the code in a Python Shell, and compare with your prediction.

```
va_schools.add("JMU")
va_schools.add("JMU")
va_schools.add("JMU")
print(va_schools)
```

5. Summarize the properties of a `set` object. For each answer, explain why.

a) Is a `set` mutable or immutable?

b) Can a `set` contain duplicate values?

c) Is the order of `set` values predictable?

6. Identify differences between a `set` and a `list` in Python.

Model 2 Keys and Values

In Python, a ***dictionary*** stores `key: value` pairs. In the following example, the `key: value` pairs are separated by commas and wrapped in curly braces.

```
elements = {'C': 'carbon', 'H': 'hydrogen', 'O': 'oxygen', 'N': 'nitrogen'}
```

Key	Value
'C'	'carbon'
'H'	'hydrogen'
'O'	'oxygen'
'N'	'nitrogen'

In contrast to lists and tuples, a dictionary is a ***mapping*** type. Values are referenced by ***keys***, rather than by integer indexes.

Python code	Shell output
`type(elements)`	<class 'dict'>
`elements.keys()`	dict_keys(['C', 'H', 'O', 'N'])
`elements.values()`	dict_values(['carbon', 'hydrogen', 'oxygen', 'nitrogen'])
`elements['C']`	'carbon'
`atom = 'N'`	
`elements[atom]`	'nitrogen'
`elements[N]`	NameError: name 'N' is not defined
`elements['nitrogen']`	KeyError: 'nitrogen'
`elements[1]`	KeyError: 1
`len(elements)`	4
`elements['B'] = 'boron'`	
`elements.items()`	dict_items([('C', 'carbon'), ('H', 'hydrogen'), ...])

Questions (15 min) Start time:

7. What is the data type of the keys in the `elements` dictionary?

8. List all the keys stored in the `elements` dictionary at the end of the table.

9. Explain the reason for the error after entering each of the following lines:

a) `elements[N]`

b) `elements['nitrogen']`

c) `elements[1]`

10. Ignoring the "dict_items()" part, describe the contents and type of data returned by the `items()` method.

11. Write a Python expression that creates a dictionary for the seven days of the week: Sun=1, Mon=2, Tue=3, etc. Assign the dictionary to the variable `dow`.

12. If you assign two different values to the same key (i.e., two assignment statements with one value each), which value is stored in the dictionary? Justify your answer with an example.

13. Another way to store the data in Model 2 is to use two lists:

```
keys = ['C', 'H', 'O', 'N']
vals = ['carbon', 'hydrogen', 'oxygen', 'nitrogen']
```

What is a disadvantage of this approach? Explain your reasoning.