Simulation Practice

- Based on sales, frozen yogurt flavors have the following relative frequencies:
- 38% chocolate
- 42% vanilla
- 20% strawberry

Suppose a group of 5 customers comes into the store to purchase yogurt. What is the probability that at least two of them choose chocolate?

Simulating a single customer

- Generate a random integer between 1 and 100 to simulate their ice cream choice
- #'s 1-38 represent purchasing chocolate
    - 38% chance
- #'s 39-80 represent purchasing vanilla
    - 42% chance
- #'s 81-100 represent purchasing Strawberry
    - 20% chance

In [54]:

```
# import the numpy package
import numpy

# Generate random number between 1-100
single_customer = numpy.random.randint(1,101)

# Test the percentage ranges
if single_customer <= 38:
    print("Chocolate")
elif single_customer <= 80:
    print("Vanilla")
else:
    print("Strawberry")
```

```
Chocolate
```

Copy and paste code into a function

- Return a String of the ice cream chosen
- Abstraction!

In [55]:

```
# Create function to simulate a single customer
def single_customer_trial():
    # Generate random number between 1-100
    single_customer = numpy.random.randint(1,101)

    # Test the percentage ranges
    if single_customer <= 38:
        return "Chocolate"
    elif single_customer <= 80:
        return "Vanilla"
    else:
        return "Strawberry"
```

In [56]:

```
# Call the function and print its return value to verify it works!
print(single_customer_trial())
```

```
Chocolate
```

Simulate a single trail of 5 customers

- Create three variables for Chocolate, Vanilla, and Strawberry counts
- Repeat 5 times
  - Execute a single trial
  - Check which ice cream was chosen
  - Update variable appropriately
- Return "true" if chocolate's count is 2 or higher, false otherwise

In [57]:

```
# Create variables
chocolate = 0
vanilla = 0
strawberry= 0

# For loop
for i in range(5):
    customer_choice = single_customer_trial()
    if customer_choice == "Chocolate":
        chocolate += 1
    elif customer_choice == "Vanilla":
        vanilla += 1
    else:
        strawberry += 1

# Print the end result of ice cream choices
# print(chocolate, vanilla, strawberry)

# Print whether chocolate was chosen at least twice
if chocolate >=2:
    print(True)
else:
    print(False)
```

```
True
```

Copy and paste code into a function

- Return true/false whether chocolate was chosen at least twice
- Abstraction!

In [58]:

```
# Create function to simulate 5 customers
def five_customer_trial():
    # Create variables
    chocolate = 0
    vanilla = 0
    strawberry= 0

    # For loop
    for i in range(5):
        customer_choice = single_customer_trial()
        if customer_choice == "Chocolate":
            chocolate += 1
        elif customer_choice == "Vanilla":
            vanilla += 1
        else:
            strawberry += 1

    # Print the end result of ice cream choices
    # print(chocolate, vanilla, strawberry)

    # Print whether chocolate was chosen at least twice
    if chocolate >=2:
        return True
    else:
        return False
```

In [59]:

```
# Call the function and print its return value to verify it works!
print(five_customer_trial())
```

```
False
```

Finding the probabilty that if 5 customers come in, at least two of them purchase chocolate

- Create an array to hold your results
- Create a loop to run 10000 times
  - Add result of each 5-customer trial to the array

In [60]:

```
# Create variables
ice_cream_results = []

# Create a loop that repeats a large number of trials (5 customers), in this ca
for i in range(10000):
    result = five_customer_trial()
    ice_cream_results.append(result)

# Print the results
print(ice_cream_results)
```

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```

Analyze the results

Find the total number of successes (true)

In [61]:

```
# Create variables
num_true = 0
num_false = 0

# Loop through each entry, updating the number of successful trials (true)
for trial in ice_cream_results:
    if trial == True:
        num_true += 1
    else:
        num_false += 1


# Print the results
print(num_true, num_false)
```

```
6260 3740
```

Calculate the probability

- Probability = (successes/total # trials)

In [62]:

```
# Calculate probability
prob = num_true / 10000

# Print results
print(prob)
```

```
0.626
```

Graph the results

In [65]:

```
# Import the library
import matplotlib.pyplot as plot
%matplotlib inline
# Magic to allow the graph to display directly in this notebook

# Create an array of labels
labels = ["2 or More Chocolate", "0 or 1 Chocolate"]

# Create an array of your results
results = [num_true, num_false]

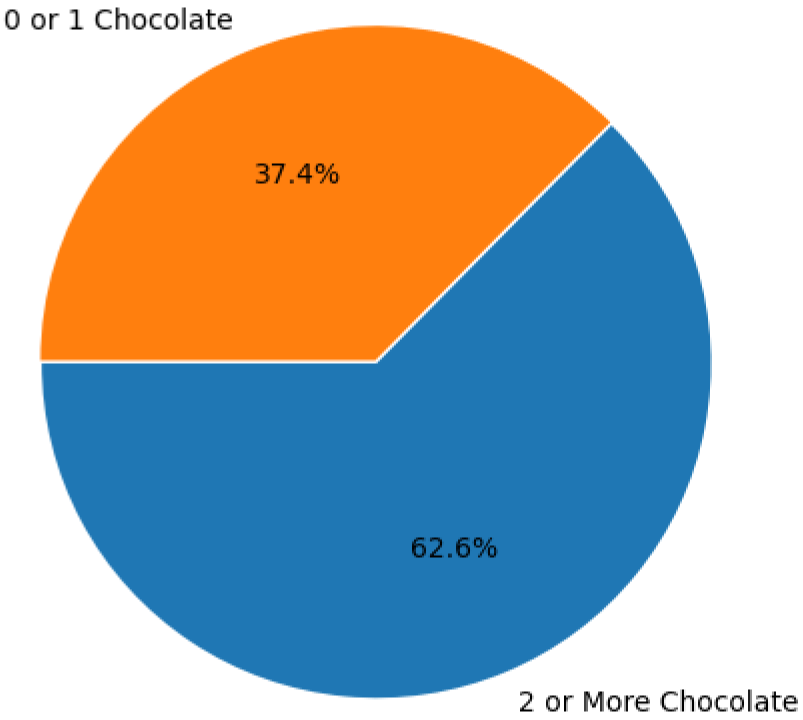
# Explode option
    # 'Slices' appear distanced from the center
        # Larger numbers = further explosion
    # Explode array should be same size as labels
explode = (0.01, 0)

# Use matplotlib module subplots() to get data for various charts
    # Returns a tuple in the form (figure,axes)
fig1,ax1 = plot.subplots()

# Use axes to create a pie chart
    # ax1.pie(data array, explode array, labels array, starting angle)
ax1.pie(results, explode, labels, autopct='%1.1f%%', startangle=180)

# Equal aspect ratio ensures that pie is drawn as a circle.
ax1.axis('equal')

plot.show()
```



Don't forget to answer the original question!

- Answer should be in the form of a complete sentence

Based on my simulation, I predict that if 5 people walk into my ice cream store that there is a 62.6% chance that 2 or more customers will purchase chocolate

Type *Markdown* and LaTeX: α^2