Question 1.2. State the null hypothesis. It should reflect the position of either Dr. DeNero or Dr. Sahai. **(4 points)**

Note: Check out 11.3 for a refresher on hypotheses.

Type your answer here, replacing this text.

SOLUTION:

The assignment of vaccines is like tossing a coin that lands heads with chance 3/5.

Question 1.3. State the alternative hypothesis. It should reflect the position of the doctor you did not choose to represent in Question 1.2. **(4 points)**

Note: Check out for a refresher on hypotheses.

Type your answer here, replacing this text.

SOLUTION:

The assignment to vaccines is not like tossing a coin.

Question 1.7. Simulate 20,000 values of the test statistic under the assumption you picked in Question 1.6. **(4 points)**

As usual, start by defining a function that simulates one value of the statistic. Your function should use `sample_proportions`. (You may find a variable defined in Question 1.1 useful here!) Then, write a `for` loop to simulate multiple values and collect them in the array `simulated_statistics`.

Use as many lines of code as you need. We have included the code that visualizes the distribution of the simulated values. The red dot represents the observed statistic you found in Question 1.5.

```
In [21]: """ # BEGIN PROMPT
         def one_simulated_statistic():
             ...

         num_simulations = 20000

         simulated_statistics = ...
         for ... in ...:
             ...
         """; # END PROMPT
         # BEGIN SOLUTION NO PROMPT
         #SOLUTION
         def one_simulated_statistic():
             percent_heads = 100 * sample_proportions(sample_size, make_array(0.6, 0.4)).item(0)
             return abs(percent_heads - 60)

         num_simulations = 20000

         simulated_statistics = make_array()
         for i in np.arange(num_simulations):
             simulated_statistics = np.append(simulated_statistics, one_simulated_statistic())
         # END SOLUTION

         # Run the this cell a few times to see how the simulated statistic changes
         one_simulated_statistic()
```

```
Out[21]: 3.3962264150943398
```

Question 2.1. Suppose we want to test whether or not each factor contributes the same amount to the overall Happiness Score. Define the null hypothesis, alternative hypothesis, and test statistic in the cell below. Feel free to check your work with another student or course staff. **(4 points)**

Note: Please format your answer as follows: - Null Hypothesis: …
- Alternative Hypothesis: …
- Test Statistic: …

Type your answer here, replacing this text.

SOLUTION:

- *Null Hypothesis:* Each factor contributes an equal amount to the happiness score. Any deviation is due to random chance.

- *Alternative Hypothesis:* Some factors contribute more to the happiness score than other factors.

- *Test Statistic:* the total variation distance (TVD) between the observed score proportions and the expected score proportions under the null.

Question 2.5. What can you conclude about how each factor contributes to the overall happiness score in the US? Explain your answer using the results of your hypothesis test. Assume a p-value cutoff of 5%. **(4 points)**

Type your answer here, replacing this text.

SOLUTION: The p-value is less than our cutoff, so the data is more consistent with the alternative hypothesis. The factors do not equally contribute to the overall happiness score of a country.