lab02

March 11, 2020

0.1 Lab 2

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0.1.1 Release Date: Friday, February 7

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0.1.2 Due Date: Monday, February 10 at 12:00PM

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Question	Points
1.1	1
1.2	1
1.3	1
2.1	1
2.2	1
2.3	1
3.1	2
Total	8

Rubric

0.1.3 Background

Below is a probability table for the gender in a Hospital Bedlam's birth records database:

Sex	Male	Female
Probability	0.525	0.475

Sex	Male	Female
Number of births	2,100	1,900

0.1.4 Question 1

Suppose we take a simple random sample of $n = 100$ births from the 4000 births in Bedlam.

- What is the expected number of male births?
- What is the expected number of female births?

To answer these questions, let T_1 be 1 if the first child chosen is male and 0 if female. Let T_2 be 1 if the second child chosen is male and 0 if female, and so on.

Let's start by finding:

$$P(T_5 = 1)$$

$$P(T_5 = 0)$$

$$\mathbb{E}(T_{11})$$

Part 1 $P(T_5 = 1)$:

[ ]:
```
q1a_answer = 0.525

# YOUR CODE HERE
raise NotImplementedError()
```

[ ]:
```
# TEST
0 <= q1a_answer <= 1
```

Part 2 $P(T_5 = 0)$:

[ ]:
```
q1b_answer = 0.475

# YOUR CODE HERE
raise NotImplementedError()
```

[ ]:
```
# TEST
0 <= q1b_answer <= 1
```

Part 3 $E(T_{11})$:

```
[ ]: q1c_answer = 1*0.525 +0*0.475

# YOUR CODE HERE
raise NotImplementedError()
```

```
[ ]: # TEST
0 <= q1c_answer <= 1
```

0.1.5 Question 2

For each birth chosen for the sample, let's keep track of whether it is male or female.

We can do this with the tuple (M_i, F_i, O_i), $i = 1, 2, \ldots, 1500$, where

- $M_i = 1$ if the ith birth sampled is male and 0 otherwise (this is the same random variable as in Question 1),
- $F_i = 1$ if the ith birth sampled is female and 0 otherwise, and

Part 1 Find

$$M_{11} + F_{11} = ?$$

```
[ ]: q2a_answer = 1

# YOUR CODE HERE
raise NotImplementedError()
```

```
[ ]: # TEST
0 <= q2a_answer <= 1
```

Part 2 Define $N_M = \sum_{i=1}^{100} M_i$ and $N_F = \sum_{i=1}^{100} F_i$

Notice that because they are sums of random variables, N_M and N_F are random variables, too.

Find the expected value of N_M, i.e.,

$$\mathbb{E}(N_M)$$

In other words, find the expected number of male births in our simple random sample of 100 births from Bedlam.

```
[ ]: q2b_answer = 52.5

# YOUR CODE HERE
raise NotImplementedError()
```

[ ]:
```
# TEST
0 <= q2b_answer <= 100
```

Part 3 Find

$$N_M + N_F = ?$$

[ ]:
```
q2c_answer = 100

# YOUR CODE HERE
raise NotImplementedError()
```

[ ]:
```
# TEST
0 <= q2c_answer <= 100
```

0.1.6 Question 3

Given our population of births in Bedlam, every possible SRS has a certain well defined probability of occurring. For example, if we collected a SRS of only 2 births with replacement (instead of 100), the chance of each SRS is given in the probability distribution table below:

N_M	N_F	p
0	2	0.225
1	1	0.49875
2	0	0.275

As an exercise in probability, we will have you compute similar probabilities for a simple random sample of 3 births with replacement.

Part 1 Find the following probability.

$$P(N_M = 3, N_F = 0)$$

Hint: It is a product of three fractions.

[ ]:
```
q3a_answer = 0.145

# YOUR CODE HERE
raise NotImplementedError()
```

[ ]:
```
# TEST
0 <= q3a_answer <= 1
```

0.2 Lab 2 Complete! Congratulations

Ensure you submit this on JupyterHub after validating all the visible tests.