
Exercise Set 13

1 Refresher on probabilities [basic-normal]

Give your results with 2 significant digits precision e.g. 95% or 0.15%.

When Mr Schmitt has a cold, he always wears his red jumper. When he does not have a cold, there is a 6% chance he will wear his red jumper. On average, Mr Schmitt has a cold on 15 days in one year.

- Draw a probability tree diagram and fill in the probabilities that are given.
- What is the overall probability for Mr Schmitt to wear his red jumper?
- You see Mr. Schmitt *not* wearing his red jumper. What is the probability that he has a cold?
- Mr. Schmitt is wearing his red jumper. What is the probability that he has a cold?
- Are the probabilities for "Mr Schmitt has a cold" and "Mr Schmitt wears his red jumper" independent? Prove your statement.

2 Finishing the two-factor ANOVA from Exercise Set 12 [normal]

We follow up from Exercise Set 12, question 3. You can use the following results:

$$SS_E = \sum_{i=1}^2 \sum_{j=1}^2 SS_{i,j} = 127.11$$

$$SS_T = \sum_{i=1}^2 \sum_{j=1}^2 \sum_{k=1}^9 (X_{i,j,k} - \bar{X}_{\bullet,\bullet,\bullet})^2 = 181.56$$

$$SS_{B,skiing} = 9 * 2 * ((\bar{X}_{0,\bullet,\bullet} - \bar{X}_{\bullet,\bullet,\bullet})^2 + (\bar{X}_{1,\bullet,\bullet} - \bar{X}_{\bullet,\bullet,\bullet})^2) = 28.44$$

$$SS_{B,fondue} = 9 * 2 * ((\bar{X}_{\bullet,0,\bullet} - \bar{X}_{\bullet,\bullet,\bullet})^2 + (\bar{X}_{\bullet,1,\bullet} - \bar{X}_{\bullet,\bullet,\bullet})^2) = 25$$

- Test if people who went skiing and ate fondue on the same day gained significantly more enjoyment from this combined action than just the sum of the individual actions (i.e. test if there is an interaction between the factors "skiing" and "fondue". Use a level of significance of $\alpha = 0.05$.

3 The tuna-nutella sandwich [normal]

A new chef at a large convenience store wants to explore fusion cuisine. Her newest idea is a tuna-nutella sandwich. Before market launch, they hire a marketing company to conduct a field study. They find 36 volunteers to sample sandwiches and divide them into 4 equally sized groups. One group receives only bread, one bread with nutella, one bread with tuna, and one with nutella and tuna. The marketing company gives you the aggregated statistical results shown below. Would you recommend the company to launch the product? Use $\alpha = 0.05$.

Mean taste scores in each group:		
	no tuna	tuna
no nutella	4.89	5.89
nutella	5.68	4.89

Sum of square of errors within each group		
	no tuna	tuna
no nutella	2.89	2.89
nutella	4	4.89

The total values are $\bar{X}_{\bullet,\bullet,\bullet} = 5.33$ and $SS_T = 22$.

4 More exam-style Python questions [normal-advanced]

- a) Which output will the following code give?

```
import numpy as np

myArray = np.array([3,4,2])

for i in range(3):
    val = myArray[i]-np.mean(myArray)
    print(val)
```

- b) Which output will the following code give?

```
import numpy as np
def myFilter(a):
    if a<0:
        return 0
    else:
        return a

myNumber = -1
print(myFilter(myNumber))
```

- c) Continuing in the code above you write:

```
myArray = np.array([1,2,-1])
print(myFilter(myArray))
```

and you receive the error message:

```
ValueError: The truth value of an array with more than one element is ambiguous.  
Use a.any() or a.all()
```

What went wrong? How could you solve it so that you get an array `[1,2,0]` in the end? There are several possible solutions. *You can write code, without paying attention to exact syntax, or describe the approach in words*