MATH 10B with Prof. Stankova | Student:
DIS 106; TTh 9:30∼11:00 | SID:
GSI: Seewoo Lee | **Quiz 13** | Tue 4/30/19

True/False - No explanation needed. (2pts)

1. The Mendelian traits "color" and "height" in pea plants were shown in class to be independent using, among other things, the formula $M_{ij} = \frac{K_i L_j}{n}$ for the expected #occurences of the traits. True/**False**

   sol. We can't say that we *show* or *prove* something by using the hypothesis testing. We can only fail to reject the null hypothesis, or accept it.

2. All the students should finish course evaluations. **True**/False

   sol. You should!

Problems - Need justification. No justification means **zero**!

Thanos claims that the infinite gauntlet is biased so that the probability of disintegrating a creature is 2/3. He made an infinite-gauntlet-simulator to test his claim, and m of 300 creatures disintegrated when he snapped his finger. We want to test whether his claim is true or not by χ^2-test.

1. Set a null hypothesis H_0 and an alternative hypothesis H_1. (4pts)

   sol.
   $$\begin{cases} H_0: & \text{The disintegrating probability } p \text{ is } \frac{2}{3} \\ H_1: & \text{The disintegrating probability } p \text{ is not } \frac{2}{3} \end{cases}$$

2. By using χ^2-test, find the rejection region for H_0, i.e. find a region of m that we reject H_0 under $\alpha = 0.05$. You may use $\chi^2_{k=1}(r = 3.84) = 0.95$ or $\chi^2_{k=1}(r = 0.004) = 0.05$. Also, note that $256 = 16^2$. (6pts)

   sol. The expected number of disintegrated creatures (under the null hypothesis) is 200. Then the χ^2-statistic is
   $$\frac{(m-200)^2}{200} + \frac{((300-m)-100)^2}{100} = \frac{(m-200)^2}{200} + \frac{(200-m)^2}{100} = \frac{3(m-200)^2}{200}$$
   and we reject H_0 when this value is bigger than 3.84. So we have
   $$\begin{aligned} \frac{3(m-200)^2}{200} > 3.84 &\Leftrightarrow (m-200)^2 > \frac{3.84 \cdot 200}{3} = 256 \\ &\Leftrightarrow m - 200 > 16 \text{ or } m - 200 < -16 \\ &\Leftrightarrow m > 216 \text{ or } m < 184. \end{aligned}$$