# Practice Quiz 10

Statistics 200
Dr. Nancy Pfenning

1. (4 pts.) Some shoppers were observed in supermarket bakery departments that provided tongs and others were observed in departments that provided tissues. A researcher recorded how many people used their hands to withdraw baked goods instead of the tongs or tissues provided:

| | Hands | No Hands | Total |
|---|---|---|---|
| Tongs | 97 | 11 | 108 |
| Tissues | 83 | 49 | 132 |
| Total | 180 | 60 | 240 |

   (a) Which *two* of these are correct formulations of the null hypothesis?
      i. Use of hands, and whether tongs or tissues are provided, are not related.
      ii. Use of hands, and whether tongs or tissues are provided, are related.
      iii. Proportions who use their hands are the same for all shoppers in stores that provide tongs and stores that provide tissues.
      iv. Proportions who use their hands are different for all shoppers in stores that provide tongs and stores that provide tissues.

   (b) Explain how the study's results may be biased if observations were made in the morning for stores with tongs and in the evening for stores with tissues.

   (c) Explain how the study's results may be biased if stores with tongs tended to be located in areas with a large student population.

   (d) If proportions using their hands were actually equal for shoppers in stores providing tongs and tissues, then the proportions would both be _____.

   (e) Complete this table of counts expected under the null hypothesis.

| | Hands | No Hands | Total |
|---|---|---|---|
| Tongs | | | 108 |
| Tissues | | | 132 |
| Total | 180 | 60 | 240 |

   (f) Calculate the chi-square statistic; its size is
   (i) large (ii) not large (iii) borderline

   (g) The $P$-value is (i) small (ii) not small (iii) borderline

   (h) Draw your conclusions, first in terms of a relationship, then in terms of population proportions using their hands.

2. (6 pts.) Is there a significant difference in mean ages of students who identify themselves as vegetarians, non-vegetarians, or sometimes-vegetarians? Analysis of variance was carried out on survey data from several hundred Pitt students:

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Analysis of Variance for Age
Source     DF        SS        MS        F        P
Veg?        2     14.23      7.11     0.84    0.434
Error     440   3742.07      8.50
Total     442   3756.30
                                  Individual 95% CIs For Mean
                                  Based on Pooled StDev
Level       N      Mean     StDev  ------+---------+---------+---------+
no        383    20.312     2.872        (---*---)
some       35    20.548     2.908   (-----------*-----------)
yes        25    21.058     3.554       (-------------*-------------)
                                  ------+---------+---------+---------+
Pooled StDev =    2.916               20.00     20.80     21.60     22.40
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(a) What are the total sample size $N$ and the number of groups $I$?

(b) As far as the sample means are concerned, _____were the youngest and _____were the oldest.

(c) Sample standard deviations are

i. close enough that it is reasonable to assume population standard deviations to be equal.

ii. different enough to suggest that population standard deviations are not equal.

(d) Two of these express the correct conclusions to draw, given the size of the $P$-value; which two are they?

i. There is a relationship between students' age and their being vegetarian, non-vegetarian, or sometimes-vegetarian.

ii. There is no evidence of a relationship between students' age and their being vegetarian, non-vegetarian, or sometimes-vegetarian.

iii. Mean age may be equal for populations of students in the three categories (vegetarian, non-vegetarian, sometimes-vegetarian).

iv. Mean age differs for populations of students in all three categories (vegetarian, non-vegetarian, sometimes-vegetarian).

v. Mean age differs for populations of students in at least two of the three categories (vegetarian, non-vegetarian, sometimes-vegetarian).

(e) The $F$ statistic can be considered (i) large (ii) not large (iii) borderline

(f) Explain why it is not a problem that the distributions of ages are somewhat skewed.