Lab 5

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September 22, 2017

Section: 91973 Friday 9am

Question 1

Script

```
#calculate the following values:
numplants <- 24
p_wrinkled <- 1/4

#a. The probability that exactly 8 plants will have wrinkled peas.
dbinom(8, numplants, p_wrinkled)

#b. The probability that 8 or fewer plants will have wrinkled peas.
pbinom(8, numplants, p_wrinkled)

#c. The probability that 12 or more plants will have wrinkled peas.
pbinom(11, numplants, p_wrinkled, lower.tail = FALSE)

#d. The 0.025 quantile of the number of plants with wrinkled peas.
qbinom(.025, numplants, p_wrinkled)
```

Output

```
#calculate the following values:
#a. The probability that exactly 8 plants will have wrinkled peas.
```

```
## [1] 0.1124775
```

```
#b. The probability that 8 or fewer plants will have wrinkled peas.
```

```
## [1] 0.8786817
```

```
#c. The probability that 12 or more plants will have wrinkled peas.
```

```
## [1] 0.00719965
```

```
#d. The 0.025 quantile of the number of plants with wrinkled peas.
```

```
## [1] 2
```

Answers

Question 2

Script

```
#experiment parameters
total <- 25
nfemales <- 15
nmales <- 10

# a. Use the data to estimate the probability p that a reproductive offspring is female.
(phat <- nfemales / total)

# b. Use the Agresti-Coull method to calculate the 95% confidence interval for p.
p_prime <- (nfemales + 2)/(total + 4)
s_pp <- sqrt((p_prime * (1 - p_prime))/(total + 4))
c(p_prime - 2 * s_pp, p_prime + 2 * s_pp)

# c. Based on the confidence interval you calculated, briefly explain whether it is plausible that the
# It is plausible that the true sex ratio is 1:1, as the confidence interval includes .5 .

# d. Now carry out a formal test of the hypothesis that the sex ratio is 1:1. Perform this test by hand
# 1) State the null and alternative hypotheses.
# H0: The sex ratio is .5
# Ha: The sex ratio is not equal to .5

# 2) State the significance level.
# alpha = 0.05

# 3) Define the test statistic.
#  The test stastistic is X, the number of females in a sample of 25 offspring
p_null <- 0.5

# 4) Calculate the test statistic from the data.
nfemales

# 5) Calculate the P-value and use it to make a decision about the hypothesis under test.
pbinom(nfemales - 1, total, 0.5, lower.tail = FALSE) * 2
#We fail to reject the null hypothesis that the sex ratio is .5 at a significance level of .05 (Binomia

# e. Perform the same test using the R command binom.test. Show the complete output of the test.
binom.test(nfemales, total)

# f. Explain whether the result of your hypothesis test consistent with the confidence interval that yo
#The result of the hypothesis test is consistent with the confidence interval.
#The confidence interval includes .5, which we are not able to reject with the hypothesis test.
```

Output

```
# a. Use the data to estimate the probability p that a reproductive offspring is female.
```

```
## [1] 0.6
```

```
# b. Use the Agresti-Coull method to calculate the 95% confidence interval for p.
```

```
## [1] 0.4032924 0.7691214
```

```
# c. Based on the confidence interval you calculated, briefly explain whether it is plausible that the
# It is plausible that the true sex ratio is 1:1, as the confidence interval includes .5 .
# d. Now carry out a formal test of the hypothesis that the sex ratio is 1:1. Perform this test by hand
# 1) State the null and alternative hypotheses.
# H0: The sex ratio is .5
# Ha: The sex ratio is not equal to .5
# 2) State the significance level.
# alpha = 0.05
# 3) Define the test statistic.
#  The test stastistic is X, the number of females in a sample of 25 offspring
# 4) Calculate the test statistic from the data.
```

```
## [1] 15
```

```
# 5) Calculate the P-value and use it to make a decision about the hypothesis under test.
```

```
## [1] 0.4243562
```

```
#We fail to reject the null hypothesis that the sex ratio is .5 at a significance level of .05 (Binomia
# e. Perform the same test using the R command binom.test. Show the complete output of the test.
```

```
##
##  Exact binomial test
##
## data:  nfemales and total
## number of successes = 15, number of trials = 25, p-value = 0.4244
## alternative hypothesis: true probability of success is not equal to 0.5
## 95 percent confidence interval:
##  0.3866535 0.7887452
## sample estimates:
## probability of success
##                    0.6
```

```
# f. Explain whether the result of your hypothesis test consistent with the confidence interval that yo
#The result of the hypothesis test is consistent with the confidence interval.
#The confidence interval includes .5, which we are not able to reject with the hypothesis test.
```

Answers

Question 3

Script

```
total <- 18
dog_food <- 2
people_food <- total - dog_food
# a. What proportion of participants chose dog food as their favorite?
dog_food / total

# What proportion are expected to choose dog food, assuming no preference among the five items (i.e., t
```

```r
(p_null <- 1/5)

# b. Use binom.test to test the hypothesis that people have a preference between human food and dog foo
binom.test(dog_food,total,p_null)

#Include a complete statement of your conclusions
#We do not reject the null hypothesis that people have a preference between human food and dog food, at

# c. binom.test reports a confidence interval. Briefly describe what this interval means, and state whe
#The confidence interval has a 95% chance of including the true mean of the number of people who chose
```

Output

```r
# a. What proportion of participants chose dog food as their favorite?
```

```
## [1] 0.1111111
```

```r
# What proportion are expected to choose dog food, assuming no preference among the five items (i.e., t
```

```
## [1] 0.2
```

```r
# b. Use binom.test to test the hypothesis that people have a preference between human food and dog foo
```

```
##
##  Exact binomial test
##
## data:  dog_food and total
## number of successes = 2, number of trials = 18, p-value = 0.555
## alternative hypothesis: true probability of success is not equal to 0.2
## 95 percent confidence interval:
##  0.01375122 0.34712044
## sample estimates:
## probability of success
##              0.1111111
```

```r
#Include a complete statement of your conclusions
#We do not reject the null hypothesis that people have a preference between human food and dog food, at
# c. binom.test reports a confidence interval. Briefly describe what this interval means, and state whe
#The confidence interval has a 95% chance of including the true mean of the number of people who chose
```

Answers

Question 4

Script

```r
total <- 24
on_x_chr <- 11
p_null <- 1/4

# a. Use these data and binom.test to test the theory that spermatogenesis genes are found disproportio
binom.test(on_x_chr, total, p_null)
```

```r
# Report your results as described for exercise 3b.
#We reject the null hypothesis that the spermatogenesis genes are distributed proportionally on the X c

# b. Briefly explain whether the confidence interval reported by binom.test is consistent with the resu
#The confidence interval reported by binom.test is consistent with the results of the hypothesis test b
```

Output

```r
# a. Use these data and binom.test to test the theory that spermatogenesis genes are found disproportio
```

```
##
##  Exact binomial test
##
## data:  on_x_chr and total
## number of successes = 11, number of trials = 24, p-value = 0.03037
## alternative hypothesis: true probability of success is not equal to 0.25
## 95 percent confidence interval:
##  0.2555302 0.6717919
## sample estimates:
## probability of success
##              0.4583333
```

```r
# Report your results as described for exercise 3b.
#We reject the null hypothesis that the spermatogenesis genes are distributed proportionally on the X c
# b. Briefly explain whether the confidence interval reported by binom.test is consistent with the resu
#The confidence interval reported by binom.test is consistent with the results of the hypothesis test b
```

Answers