Quiz 1 Review

Jul 22, 2022

True or False

- A coffee shop serves an average of 75 customers per hour during the morning rush. The number of customers per hour during the morning rush can be modeled with binomial distribution.

True or False

- A coffee shop serves an average of 75 customers per hour during the morning rush. The number of customers per hour during the morning rush can be modeled with binomial distribution.

  Poisson: The number of occurrence in a given unit of time

  Normal: When the rate of occurrence is large enough, poisson distribution can be approximated by normal distribution.

Multiple Choice

- Which of the following is **TRUE** regarding the standard deviation?

  (a) Standard deviation is a measure of central tendency.

  (b) In the presence of skew, the standard deviation represents an observation's typical distance from the median rather than mean.

  (c) It is possible to have a standard deviation of zero.

  (d) It is possible to have a negative standard deviation.

Multiple Choice

- Which of the following is **TRUE** regarding the standard deviation?

  (a) Standard deviation is a ~~measure of central tendency.~~measure of spread

  (b) ~~In the presence of skew, the standard deviation represents an observation's typical distance from the median rather than mean.~~always the distance from the "mean"

  (c) It is possible to have a standard deviation of zero.

  (d) ~~It is possible to have a negative standard deviation.~~always positive

Case Study: Heart Transplant

- ***Goal:*** to determine heart transplant program increases lifespan.

	Alive	Dead	Total
Treatment	24	45	**69**
Control	4	30	**34**
Total	**28**	**75**	**103**

- Death rate of treatment group(patients ***with*** heart transplant) = 45/69 = 65.2%
- Death rate of control group(patients ***without*** heart transplant) = 30/34 = 88.2%

Case Study: Heart Transplant

- *Goal:* to determine heart transplant program increases lifespan.
- Hypothesis
  - H_0**(status quo)**
    - There is no effectiveness in heart transplant. OR
    - Heart transplant does not increase the lifespan. OR
    - The death rates of two groups are identical.
  - H_1: Heart transplant does increase the lifespan.

Case Study: Heart Transplant

- *Goal:* to determine heart transplant program increases lifespan.
- Null Hypothesis: The death rates of two groups are identical.
  - Unless we have "enough" evidence to reject the null hypothesis, our analysis should assume H_0
  - If two groups have the same death rates, then what would be that value?
    - 75(Total number of deaths) / 103(Total number of Participants)= 72%

Case Study: Heart Transplant

- *Goal:* to determine heart transplant program increases lifespan.
- To reject H_0
  - First, we assume H_0 to be true — same death rates for both group.
  - Simulate the difference of death rates between the group. (A)
  - If our observed differences 65%-88%=23%p is “usual” point of (A), then the this large difference occurs just by chance.
  - If 23%p is “unusual” or “rare” point of (A), then this difference is not just by chance, but indicating the real significance.

Case Study: Heart Transplant

```
nexp = 5000
res = matrix(0, nrow = nexp, ncol = 3)
colnames(res) = c("trt", "control","diff")
for (i in 1:nexp){
   set.seed(1234+i)
# randomly select the deads out of all participants
   dead = sample(1:103,size = 75)
   trt = sample(1:103,69)
# identify how many deals are from trt group
   n = sum(dead %in% trt)
   res[i,1] = n/69
   res[i,2] = (75-n)/34
   res[i,3] = res[i,1]-res[i,2]
}

observed = (45/69)-(30/34)
hist(res[,3], xlab = "% diff", main = "Difference in death rates",
breaks = 22)
abline(v = observed, col="red", lty = 2)
```

Case Study: Heart Transplant