CCJS200 Friday Discussion Sessions

Week 11: 4/11/2025

Today's Agenda

- We will be going through practice problems 9.1-9.3 from your textbook
- Before we start, are there any questions?

Practice Problem 9.1

Local community leaders are concerned about the distribution of homicides in their small town. The local police department broke the city into six recognizable neighborhoods of the same size and discovered the following distribution of homicides. Community leaders would like to know whether the homicides are randomly distributed across these six neighborhoods.

Neighborhood	Number of Homicides
A	14
B	9
C	17
D	3
E	7
F	10

Practice Problem 9.1a

Use a 5% level of significance and outline each of the steps required in a test of statistical significance.

Practice Problem 9.1a Solution

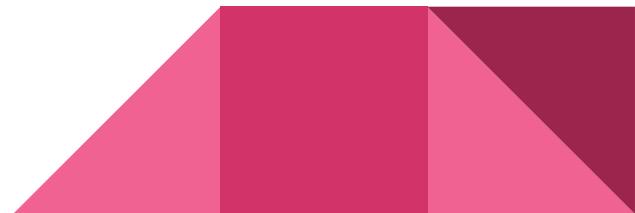Ho: **Cases are equally distributed across the neighborhoods**

Sampling distribution: **chi-square**

Degrees of freedom: **k-1 = 6-1 = 5**

Significance level: **0.05**

Critical chi-square value (Appendix 2): **11.070**

Expected values under Ho: **60/6 = 10**

Practice Problem 9.1a Solution

Calculate the test statistic

Neighborhood	O	E	O-E	(O-E)^2	[(O-E)^2]/E
A	14	10	4	16	16/10 = 1.6
B	9	10	-1	1	1/10 = 0.1
C	17	10	7	49	49/10 = 4.9
D	3	10	-7	49	49/10 = 4.9
E	7	10	-3	9	9/10 = 0.9
F	10	10	0	0	0/10 = 0
Total	60				**12.4**

Practice Problem 9.1b

What can you conclude about the distribution of homicides across these six neighborhoods?

Practice Problem 9.1b Solution

Since the test statistic (12.4) exceeds the critical value of the chi-square distribution, we reject Ho and conclude that the cases are not evenly distributed across the neighborhoods.

Practice Problem 9.2

Sergeant Bob is in charge of the duty roster at Gatley police station. Every week, it is his responsibility to randomly assign the five beat officers, including his son Bob Jr., to patrol in each of the five zones that make up the city of Gatley. Zones A and D are favored by all the officers because they are usually quiet. Of the others, Zone C is notoriously dangerous. The officers have recently begun to suspect Sergeant Bob of favoritism towards his son. In the last 30 weeks, Bob Jr. has been assigned to Zone A 12 times, Zone B and Zone C 2 times each, Zone D 9 times, and Zone E 5 times.

Practice Problem 9.2a

Do the other officers have reason to believe that Sergeant Bob is not assigning zones in a random manner? Use a 5% level of significance and outline each of the steps required in a test of statistical significance.

Practice Problem 9.2a Solution

Ho: **Bob Jr. is equally likely to work in all 5 zones**

Sampling distribution: **chi-square**

Degrees of freedom: **k-1 = 5-1 = 4**

Significance level: **part a: 0.05; part b: 0.01**

Critical chi-square value (Appendix 2): **part a: 9.488; part b: 13.277**

Expected values under Ho: **30/5 = 6**

Practice problem 9.2a Solution

Calculate the test statistic

Patrol Beat	O	E	O-E	(O-E)^2	[(O-E)^2]/E
A	12	6	6	36	36/6 = 6.000
B	2	6	-4	16	16/6 = 2.667
C	2	6	-4	16	16/6 = 2.667
D	9	6	3	9	9/6 = 1.500
E	5	6	-1	1	1/6 = 0.167
Total	30				**13.001**

Practice Problem 9.2a Solution

Since the test statistic (13.001) exceeds the critical value of the chi-square distribution (0.05 significance level), we reject Ho and conclude that Bob Jr. is not equally likely to work in all of the beats.

Practice Problem 9.2b

Would your answer be any different if a 1% level of significance were used?

Practice Problem 9.2b Solution

Since the test statistic (13.001) is less than the critical value of the chi-square distribution (0.01 significance level), we fail to reject Ho and conclude that the evidence is not strong enough to reject the hypothesis of equitable beat assignment.

Practice Problem 9.3

In the past 100 years, there have been more than 250 successful breakouts from Didsbury Prison. Mike is a researcher who has been hired by the prison governor to investigate the phenomenon. Details are available only for those breakouts that took place in the past ten years—a total of 30. Using the records of these 30 breakouts as a sample, Mike decides to break the figured down to see whether breakouts were more common in certain wings of the prison than in others. It transpires that of the 30 breakouts, 4 have been from A-Wing, 8 from B-Wing, 15 from C-Wing, and 3 from D-Wing.

Practice Problem 9.3a

Does Mike have enough evidence to conclude that, over the 100-year period, breakouts were more (or less) likely to occur from certain wings than from others? Use a 5% level of significance and outline each of the steps required in a test of statistical significance.

Practice Problem 9.3a Solution

Ho: **Breakouts are equally distributed across prison wings**

Sampling distribution: **chi-square**

Degrees of freedom: **k-1 = 4-1 = 3**

Significance level: **part a: 0.05; part b; 0.01**

Critical chi-square value (Appendix 2): **part a: 7.815; part b: 11.341**

Expected values under Ho: **30/4 = 7.5**

Practice Problem 9.3a Solution

Calculate the test statistic

Prison Wing	O	E	O-E	(O-E)^2	[(O-E)^2]/E
A	4	7.5	-3.5	12.25	12.5/7.5 = 1.633
B	8	7.5	0.5	0.25	0.25/7.5 = 0.033
C	15	7.5	7.5	56.25	56.25/7.5 = 7.500
D	3	7.5	-4.5	20.25	20.25/7.5 = 2.700
Total	30				**11.866**

Practice Problem 9.3a Solution

Since the test statistic (11.866) exceeds the critical value (7.815) of the chi-square distribution (0.05 significance level), we reject Ho and conclude that breakouts are not evenly distributed across the prison.

Practice Problem 9.3b

Would your answer be any different if a 1% level of significance were used?

Practice Problem 9.3b Solution

Our conclusion is the same since the test statistic (11.866) exceeds the critical value (11.341) of the chi-square distribution (0.01 significance level), we reject Ho and conclude that breakouts are not evenly distributed across the prison.

Practice Problem 9.3c

Are there any problems with Mike's choice of a sample? Explain your answer.

Practice Problem 9.3c Solution

The prison is old (100 years old) and there is a risk that the last 10 years are not representative of the entire period.

Reminders

- The second exam is scheduled for **TUESDAY 4/15**
  - Make sure you have a calculator

- Let us know if you have any questions and happy studying!