LESSON MAKER PRO

Table Talk

Conditional probability and independence from two-category data

HIGH SCHOOL · AII-S.CP.4

AII-S.CP.4 "Interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and calculate conditional probabilities."

NAME ____________________ DATE ____________

USE THE CONDITION

For P(A|B), count outcomes in both A and B, then divide by the total in B. Events are independent when P(A|B) = P(A).

WORKED EXAMPLE

In a sample, 11 students play a sport and have a job, 17 play a sport only, 13 have a job only, and 19 do neither. Find P(job|sport). Are job and sport independent?

1. Sport total: 11 + 17 = 28.
2. P(job|sport) = 11/28.
3. Job total: 11 + 13 = 24, so P(job) = 24/60 = 2/5.
4. Since 11/28 is not 2/5, the events are not independent.

Answer: P(job|sport) = 11/28; job and sport are not independent.

PRACTICE 4 problems

1 In a sample, 9 artists use headphones, 3 artists do not, 8 nonartists use headphones, and 20 nonartists do not. Find P(headphones|artist).

ANSWER ____________________

2 Of 50 commuters, 20 bike to school, 15 listen to podcasts, and 6 do both. Are biking and listening to podcasts independent? Show the comparison.

ANSWER ____________________

3 Of 40 students, 18 juniors stream music, 6 juniors do not, 9 seniors stream music, and 7 seniors do not. Find P(not streaming|senior).

ANSWER ____________________

4 In a survey of 45 students, 15 have a driver license, 18 have a parking pass, and 9 have both. Are having a license and having a parking pass independent?

ANSWER ____________________

APPLY IT Show your work

1 The table shows whether students follow the school esports team and attend its matches. Find P(attend|follow). Then decide whether following the team and attending matches are independent.

ESPORTS SURVEY

	Attend	Do Not Attend	Total
Follow team	12	8	20
Do not follow	6	10	16
Total	18	18	36

ANSWER ______________________

2 At a student film festival, 30 students who submitted a portfolio received an interview and 10 did not. Of students without a portfolio, 12 received an interview and 28 did not. Find P(portfolio|interview). Then decide whether submitting a portfolio and receiving an interview are independent.

WORK SPACE

ANSWER ______________________

CHALLENGE One step up

In a survey of 120 students, 45 have a part-time job and 40 play on a school team. The events are independent. How many students have both? Then find how many have only a job, only a team, and neither. Explain your reasoning.

WORK SPACE AND ANSWER

Table Talk

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	In a sample, 9 artists use headphones, 3 artists do not, 8 nonartists use headphones, and 20 nonartists do not. Find P(headphones|artist).	**3/4**
2	Of 50 commuters, 20 bike to school, 15 listen to podcasts, and 6 do both. Are biking and listening to podcasts independent? Show the comparison.	**Yes. P(bike and podcast) = 6/50 = 3/25, and P(bike)P(podcast) = (20/50)(15/50) = 3/25.**
3	Of 40 students, 18 juniors stream music, 6 juniors do not, 9 seniors stream music, and 7 seniors do not. Find P(not streaming|senior).	**7/16**
4	In a survey of 45 students, 15 have a driver license, 18 have a parking pass, and 9 have both. Are having a license and having a parking pass independent?	**No. P(license and pass) = 9/45 = 1/5, but P(license)P(pass) = (15/45)(18/45) = 2/15.**

PART 2 · APPLY IT

1. **P(attend|follow) = 3/5. The events are not independent.** Among the 20 students who follow the team, 12 attend, so 12/20 = 3/5. Since P(attend) = 18/36 = 1/2, the probabilities are not equal.
2. **P(portfolio|interview) = 5/7. The events are not independent.** There were 42 interviews, and 30 were for students with portfolios, so 30/42 = 5/7. Since P(portfolio) = 40/80 = 1/2, the events are not independent.

CHALLENGE

Both: 15. Only a job: 30. Only a team: 25. Neither: 50. Since the events are independent, P(job and team) = (45/120)(40/120) = 1/8, so 120(1/8) = 15 have both.

Accept equivalent fractions and valid independence comparisons using either conditional probability or the product rule.