

From Subgroups to the Whole

Build relative-frequency tables from marginal and conditional information.

HIGH SCHOOL • MA.912.DP.3.2

MA.912.DP.3.2 "Given marginal and conditional relative frequencies, construct a two-way relative frequency table summarizing categorical bivariate data."

NAME _____

DATE _____

Name the denominator

A joint relative frequency is a fraction of everyone. To find it from a conditional rate, multiply the subgroup's share of everyone by the rate within that subgroup. Use complements and margins to complete the table; its four joint cells must total 100%.

Worked example

In a simulated picnic survey, 40% packed lunch; among them, 50% brought fruit. How much of the whole sample packed lunch and brought fruit?

Practice picnic choices (% of all respondents)

Lunch	Fruit	No fruit	Total
Packed	20%	20%	40%
Bought	15%	45%	60%
Total	35%	65%	100%

1. Use the packed-lunch subgroup's share of the whole: 40%.
2. Multiply by the fruit rate within that group: $0.40 \times 0.50 = 0.20$.

20% of all respondents packed lunch and brought fruit. The conditional 50% and the joint 20% use different denominators.

Every scenario is simulated. In each table, every numeric cell is a percent of ALL respondents, including row and column margins. Complete every blank cell. Tasks 3, 4 and 6 refer to your concert table from task 1.

1. Construct from row information

Use the given marginal and conditional percentages to construct the whole-sample table. Show one multiplication below it.

Shares of all respondents: Snack 60%; No snack 40%.

Within Snack: 70% Early.

Within No snack: 45% Early.

Concert arrival (% of all respondents)

Snack choice	Early	Not early	Total
Snack			
No snack			
Total			

2. Construct a second table

Build the whole-sample table from this separate survey. Show one multiplication and check the overall attendance percentage.

Shares of all respondents: Bus 40%; Other travel 60%.

Within Bus: 75% Attend.

Within Other travel: 50% Attend.

Event attendance (% of all respondents)

Travel	Attend	Do not attend	Total
Bus			
Other travel			
Total			

3. Explain the two percentages

In the concert survey, explain why 70% is not the joint percentage for Snack and Early. Give the joint percentage and name both denominators.

4. Recover a reversed conditional

Among early arrivals in the concert survey, what percent did not buy snacks? Use your completed table and show the numerator and denominator.

5. Construct from column information

Here the given groups are travel columns, not team-status rows. Construct the whole-sample table and show how you obtained Team and Bus.

- Shares of all respondents: Walk 25%; Bus 75%.
- Within Walk: 80% Team.
- Within Bus: 40% Team.

Team and travel (% of all respondents)

Team status	Walk	Bus	Total
Team			
No team			
Total			

6. Check whether the information can agree

A second report says 65% of the concert respondents arrived early, while all percentages supplied in task 1 remain exact. Can both reports be correct? Use the joint cells to justify your answer.

7. Distinguish one table from the only table

Use the incomplete information below to construct ONE possible whole-sample table. No volunteering rate is given for nonmembers. Explain which entries can vary and give a different possible No club/Volunteer percentage.

- Shares of all respondents: Club 50%; No club 50%.
- Within Club: 40% Volunteer.

One possible club survey (% of all respondents)

Club status	Volunteer	No volunteer	Total
Club			
No club			
Total			

TEACHER NOTES

All scenarios are simulated classroom data. Accept equivalent exact fractions and percentages, but require the named denominator and an interpretation in context. Whole-sample relative-frequency tables have grand total 100%; row-conditional tables and each segmented bar instead represent 100% of their own group. Equal-length bars do not imply equal group sizes. Association does not establish causation. Keep solutions off student workspaces.

TASK 1

Snack/Early 42%, Snack/Not early 18%, No snack/Early 18%, No snack/Not early 22%. For example, $0.60 \times 0.70 = 0.42$.

Concert arrival (% of all respondents)

SNACK CHOICE	EARLY	NOT EARLY	TOTAL
SNACK	42%	18%	60%
NO SNACK	18%	22%	40%
TOTAL	60%	40%	100%

TASK 2

Joint cells are 30%, 10%, 30%, 30%; overall attendance is 60%. For example, $0.40 \times 0.75 = 0.30$.

Event attendance (% of all respondents)

TRAVEL	ATTEND	DO NOT ATTEND	TOTAL
BUS	30%	10%	40%
OTHER TRAVEL	30%	30%	60%
TOTAL	60%	40%	100%

TASK 3

70% uses only snack buyers as its denominator. The joint percentage is 42% of all respondents: $60\% \times 70\% = 42\%$.

TASK 4

18% of all respondents are Early and No snack; 60% are Early. Thus $18/60 = 30\%$ of early arrivals did not buy snacks.

TASK 5

Joint cells are 20%, 30%, 5%, 45%; team and no-team totals are each 50%. Team and Bus is $0.75 \times 0.40 = 0.30$, or 30% of all respondents. Use the stated reference group and check all totals against that denominator.

Team and travel (% of all respondents)

TEAM STATUS	WALK	BUS	TOTAL
TEAM	20%	30%	50%
NO TEAM	5%	45%	50%
TOTAL	25%	75%	100%

TASK 6

No. The early column must total $42\% + 18\% = 60\%$, not 65%. At least one reported percentage would need to change. Use the stated reference group and check all totals against that denominator.

TASK 7

One valid table is shown. No club/Volunteer could instead be 40%, with No club/No volunteer 10%; the Club row remains 20%, 30%, 50%. More generally, the unknown joint percentage can range from 0% to 50%, with its row partner completing 50%.

One possible club survey (% of all respondents)

CLUB STATUS	VOLUNTEER	NO VOLUNTEER	TOTAL
CLUB	20%	30%	50%
NO CLUB	10%	40%	50%
TOTAL	30%	70%	100%