Two-Way Tables for Categorical Data

Apply the skill to decisions and designs

Name _____ **Date** _____ **Score** _____ / 10

QUICK REVIEW

Two-way tables help compare participation or transportation choices. Build each row total by adding its two nonoverlapping cells, and check that row totals and column totals give the same grand total. For "A or B, add their counts and subtract their overlap. Conditional rates describe the surveyed groups; a difference does not by itself establish causation.

Worked example

Example for form 3: among club members, what fraction ride the bus? Give percentages to the nearest tenth of a percent.

1. Restrict to row "Club": its total is $8 + 4 = 12$. Of these, 8 are in column "Bus".

2. The conditional fraction and percentage are $8/12 = \frac{2}{3} \approx 66.7\%$. The percentage is rounded to the nearest tenth of a percent.

Answer: $\frac{2}{3} \approx 66.7\%$

	Bus	Walk	Total
Club	8	4	12
No club	3	8	11
Total	11	12	23

Practice Problems

Show your thinking.

1. A school plans transport. What percentage of club members use the bus? Give percentages to the nearest tenth of a percent.

	Bus	Walk	Total
Club	21	9	30
No club	14	16	30
Total	35	25	60

2. The bus team surveys its riders. What fraction belong to the club? Give percentages to the nearest tenth of a percent.

	Bus	Walk	Total
Club	18	12	30
No club	12	18	30
Total	30	30	60

3. An organizer needs seats for anyone in club or on the bus. How many students qualify?

	Bus	Walk	Total
Club	16	14	30
No club	10	20	30
Total	26	34	60

4. A planner reserves outreach places for neither club nor bus. How many places are needed?

	Bus	Walk	Total
Club	12	18	30
No club	15	15	30
Total	27	33	60

5. A report is missing the number of club members walking. Reconstruct it.

	Bus	Walk	Total
Club	19	?	30
No club	13	17	30
Total	32	28	60

6. Which membership group has the greater bus-use proportion for planning purposes? Give percentages to the nearest tenth of a percent.

	Bus	Walk	Total
Club	24	16	40
No club	9	21	30
Total	33	37	70

7. A student is chosen uniformly from everyone. What is the probability of club membership and bus use? Give percentages to the nearest tenth of a percent.

	Bus	Walk	Total
Club	20	10	30
No club	15	25	40
Total	35	35	70

8. How many survey forms must the data team account for altogether?

	Bus	Walk	Total
Club	23	7	30
No club	11	19	30
Total	34	26	60

9. A designer wrongly uses the entire sample to report bus use within club. Correct the report fraction.

	Bus	Walk	Total
Club	18	27	45
No club	12	18	30
Total	30	45	75

10. A committee compares group bus rates before assigning representatives. Which rate is greater? Give percentages to the nearest tenth of a percent.

	Bus	Walk	Total
Club	15	10	25
No club	18	12	30
Total	33	22	55

Answer Key

1. $\frac{7}{10} = 70.0\%$
2. $\frac{3}{5} = 60.0\%$
3. 40
4. 15
5. 11
6. Club; 60.0% versus 30.0%.
7. $\frac{2}{7} \approx 28.6\%$
8. 60
9. Use $18/45 = \frac{2}{5}$, not $18/75$.
10. Neither; 60.0% versus 60.0%.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Restrict to row “Club”: its total is $21 + 9 = 30$. Of these, 21 are in column “Bus”.

2. The conditional fraction and percentage are $21/30 = \frac{7}{10} = 70.0\%$. The percentage is rounded to the nearest tenth of a percent.

Problem 2

1. Restrict to column “Bus”: its total is $18 + 12 = 30$. Within it, row “Club” contributes 18.

2. The conditional fraction and percentage are $18/30 = \frac{3}{5} = 60.0\%$, to the nearest tenth of a percent. Do not divide by the grand total 60.

Problem 3

1. Row “Club” contains 30, column “Bus” contains 26, and their overlap contains 16.

2. For either category, add and subtract the overlap: $30 + 26 - 16 = 40$. Equivalently, exclude only the opposite cell: $60 - 20 = 40$.

Problem 4

1. Neither row “Club” nor column “Bus” means the opposite row and opposite column. Their intersection contains 15.

2. Check by subtracting the union: $60 - (12 + 18 + 15) = 15$. So 15 observations meet neither of the two named categories.

Problem 5

1. Row “Club” totals 30, and its known cell is 19. Subtract: missing count $= 30 - 19 = 11$.

2. Check the column: $11 + 17 = 28$, matching its total. Thus the missing joint count is 11, not the whole row or column total.

Problem 6

1. For “Club”, the column-“Bus” fraction and percentage are $24/40 = \frac{3}{5} = 60.0\%$.

2. For “No club”, they are $9/30 = \frac{3}{10} = 30.0\%$. Compare the exact fractions: Club has the higher rate.

Problem 7

1. The requested joint category contains 20 people out of all 70. The denominator is the grand total because the selection is unrestricted.

2. The relative frequency and percentage are $20/70 = \frac{2}{7} \approx 28.6\%$. The percentage is rounded to the nearest tenth of a percent.

Problem 8

1. Add the first row: $23 + 7 = 30$. Add the second row: $11 + 19 = 30$.

2. The grand total is $30 + 30 = 60$. The column check, $34 + 26 = 60$, gives the same count without counting anyone twice.

Problem 9

1. The condition limits the group to row “Club”, with $18 + 27 = 45$ members. The favorable intersection has 18 members.

2. Divide by this restricted total: $18/45 = \frac{2}{5}$. Using denominator 75 would answer a different question about the entire sample.

Problem 10

1. For “Club”, the column-“Bus” fraction and percentage are $15/25 = \frac{3}{5} = 60.0\%$.

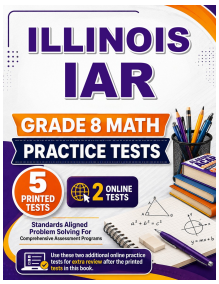
2. For “No club”, they are $18/30 = \frac{3}{5} = 60.0\%$. Compare the exact fractions: the rates are equal.

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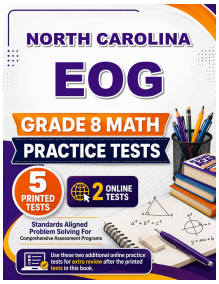
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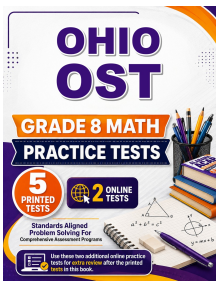
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