

Two Categorical Variables

AP Statistics | Unit 2 | two-way tables, bar graphs, mosaic plots

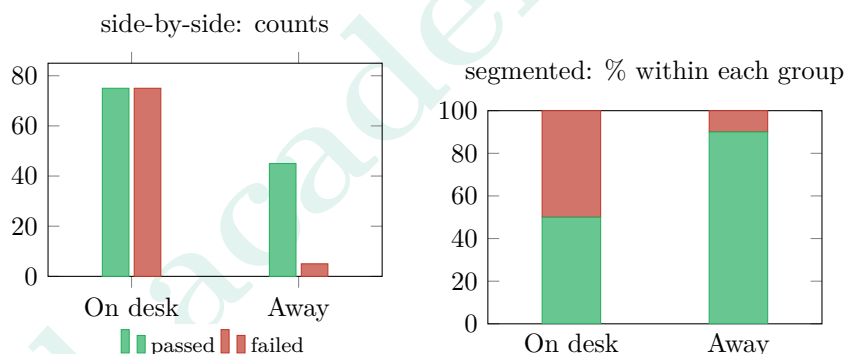
1. The two-way table

Two categorical variables measured on the same individuals go into a **two-way table**: one variable across the top, the other down the side. Each individual lands in exactly one cell; the totals around the edges are the **marginal totals**. Example (hypothetical): 200 students, where their phone was while studying, and whether they passed the test.

	Phone on desk	Phone away	Total
Passed	75	45	120
Failed	75	5	80
Total	150	50	200

“Among the students who passed, 75 had the phone on the desk and only 45 had put it away” is true — and misleading, because three times as many students kept the phone on the desk.

2. Three graphs



- **Side-by-side bar graph**: bar heights are **counts**. Fine when groups are the same size; otherwise the bigger group simply has bigger bars.
- **Segmented bar graph**: one bar per group, every bar **100%**, split by the other variable. It compares **proportions within each group**: $75/150 = 50\%$ passed with the phone on the desk, $45/50 = 90\%$ with the phone away.
- **Mosaic plot**: a segmented bar graph whose bar **widths** are proportional to the group sizes. Width = size of the group, height = proportion within the group, area = count in the cell.

The rule

When groups differ in size, compare **proportions**, not counts.

A caution. The students chose where to put their phone; the ones who put it away may have been more motivated anyway. The graphs show an association, not proof that the phone is the cause.

Where students lose points

1. Comparing raw counts between groups of different sizes.
2. Segmented bars that do not all reach 100%.
3. Reading a mosaic plot by height only and ignoring the widths.
4. Graphs with no labels, no legend, no context.
5. Claiming cause and effect from survey data.

Remember

- Two-way table: one variable across, one down, totals in the margins.
- Side-by-side bars show counts.
- Segmented bars show proportions within each group (every bar = 100%).
- Mosaic plot: widths show the group sizes too.

Now practise it

Theory sticks once you use it. On **sad-academy.com** you'll find practice questions for this exact subtopic in the AP format, and an AI that grades your free-response answers against the scoring guidelines, the way an AP reader would.

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