

Solutions

2.1

Population: all 600 students. Sample: the 60 selected and surveyed students.

2.2

Route label is categorical, even if routes use numeral names. Travel time is quantitative.

2.3

The sample excludes students outside the club. Club members may have different preferences, so results need not represent the entire school. Select randomly from the full student list, or use a specified representative stratified design including club and non-club students. A better design still needs honest handling of nonresponse.

2.4

Width is 10 minutes.

$$D = f/w = 15/10 = 1.5 \text{ observations per minute}$$

Density 1.5. The bar area represents 15 observations.

3.1

(a) Total count $N = 12 + 18 + 20 = 50$.

(b) Divide frequency by the corresponding class width.

$$D_1 = f_1/w_1 = 12/10 = 1.2$$

$$D_2 = f_2/w_2 = 18/10 = 1.8$$

$$D_3 = f_3/w_3 = 20/20 = 1.0$$

All three densities correct.

(c) Combine the first two counts.

$$p = \frac{12 + 18}{50} = 0.60$$

Proportion 0.60, or 60%. Frequency-height bars would give the wider class too much area; density ensures area represents frequency.

3.2

(a) Divide replies by invited students.

$$r = \frac{60}{200} \times 100\% = 30\%$$

Response rate.

$$p_{respondents} = \frac{45}{60} \times 100\% = 75\%$$

Respondent preference percentage.

(b) The 140 nonrespondents' preferences are unknown, and voluntary responders may differ. The 75% describes respondents rather than all students. A stated preference does not measure a causal effect on attendance.

(c) Use an accessible, clearly worded survey with a specified selection method and follow-up on nonresponse. For a permitted change, record attendance using the same definition over comparable periods and account for competing events or group differences. Describe remaining limitations or, where feasible and approved, use a suitable comparison design rather than announcing causality from a simple before-after total.