

- For full credit: *show/explain your work/calculations on every question.*
 - If you are using your calculator to compute something, write down the formula you are using.
 - Please write clearly — if I can't read it, I won't give you credit for it.
1. (6 pts) Data is collected for a (hypothetical) study of television viewing habits of children aged 6 - 10 in San Francisco. Identify the sample type (random, systematic, convenience, stratified, cluster), based on the descriptions below.

- (a) Twenty children are randomly selected from each elementary school (grades 1 - 5) in the city and surveyed.

Stratified: *The schools are the strata and a random sample is selected from each one.*

- (b) A list of all children aged 6 - 10 in the city is compiled and arranged alphabetically by last name. Every 20th child from the list is surveyed.

Systematic: *Every k^{th} child from a comprehensive list is selected.*

- (c) All the children aged 6 - 10 at the Exploratorium one Saturday morning are surveyed.

Convenience: *A sample of children is surveyed in a convenient way.*

2. (4 pts) Is any of the samples in the previous question a **random sample**? If you identified one of the samples as *random*, is it a **simple random sample**? Explain your answer(s) briefly.

*The stratified sample in (a) is potentially a random sample, because every child in the city is just as likely to be selected as any other. It is not a simple random sample, because samples that exclude **all** the children from some school will never be seen, for example.*

3. The following (*already sorted!*) data are a sample of measurements of *hemoglobin* (in grams/deciliter) taken from the blood of twelve healthy adults:

10.9, 11.5, 12.2, 12.5, 13.1, 13.5, 13.6, 13.9, 14.3, 15.6, 15.8, 15.9

- (a) (2 pts) Find the **mean**, \bar{x} , of the data.

$$\bar{x} = \frac{1}{12} \sum x_j = \frac{162.8}{12} \approx 13.57.$$

- (b) (2 pts) Find the **standard deviation**, s , of the data.

$$s = \sqrt{\frac{1}{11} \sum (x_j - \bar{x})^2} \approx 1.65$$

- (c) (2 pts) Find the **coefficient of variation** for this data.

$$CV = \frac{s}{\bar{x}} \cdot 100\% \approx 12.16\%$$

- (d) (2 pts) Using the statistics you computed above, convert the hemoglobin level $x = 10.2$ to **standard units** (a z -score). Based on the data, is this hemoglobin level **unusual**? Explain.

$$z = \frac{10.2 - 13.57}{1.65} \approx -2.042.$$

This level of hemoglobin is a little unusual according to the rule that says that if $|z| > 2$, then the value is unusual (because it lies more than two standard deviations away from the mean).

4. (2 pts) Find the first, second and third **quartiles** of the data in the previous problem.

$$Q_1 = \frac{12.2 + 12.5}{2} = 12.35, \quad Q_2 = \frac{13.5 + 13.6}{2} = 13.55, \quad Q_3 = \frac{14.3 + 15.6}{2} = 14.95$$