AP Statistics
**AP Test Prep Problem #2: Public school teachers and students**

RNB-KEY

Directions: *Show all your work. Indicate clearly the methods you use, because you will be scored on the correctness of your methods as well as on the accuracy and completeness of your results and explanations.*

1) Records are kept by each state in the United States on the number of pupils enrolled in public schools and the number of teachers employed by public schools for each school year. From these records, the ratio of the number of pupils to the number of teachers (P-T ratio) can be calculated for each state. The histograms below show the P-T ratio for every state during the 2001–2002 school year. The histogram on the left displays the ratios for the 24 states that are west of the Mississippi River, and the histogram on the right displays the ratios for the 26 states that are east of the Mississippi River.
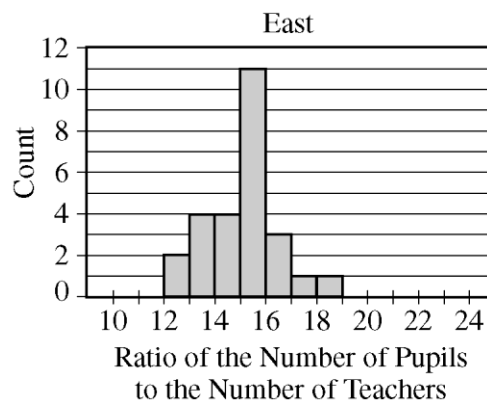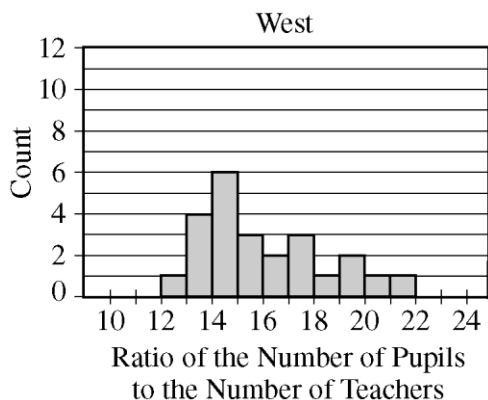
(a) Describe how you would use the histograms to estimate the median P-T ratio for each group (west and east) of states. Then use this procedure to estimate the median of the west group and the median of the east group.

The median is the value with half of the P-T ratios at or below it and half of the values at or above it.

For n observations in a group, use $\dfrac{n+1}{2}$ to find the position of the median in the ordered list of observations.

For states west of the Mississippi (n = 24) the median falls between the 12th and 13th value in the ordered list, and both the 12th and 13th values fall in the interval 15–16. For states east of the Mississippi (n = 26) the median falls between the 13th and 14th value in the ordered list, and both of these values also fall in the interval 15–16.

From the histogram, cumulative frequencies for the two groups are shown in the table below.

Interval	West	East
12–13	1	2
13–14	1+4=5	2+4=6
14–15	1+4+6=11	2+4+4=10
15–16	1+4+6+3=14	2+4+4+11=21

Thus, the median P-T ratio for both groups is at least 15 students per teacher and at most 16 students per teacher.

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(b) Write a few sentences comparing the distributions of P-T ratios for states in the two groups (west and east) during the 2001–2002 school year.

The shapes of the two histograms are different. The histogram for states that are west of the Mississippi River is unimodal and skewed to the right, whereas the histogram for states that are east of the Mississippi River is unimodal and nearly symmetric.

As noted in part (a), the medians of the two distributions are about the same, between 15 and 16 for both distributions.

The histograms also show that there is more variability in the P-T ratios for states that are west of the Mississippi River. Although the greatest and least values for each group are not known, the range can be approximated. The range for the west is at most 22 - 12 = 10, and the range for the east is at most 19 - 12 = 7.

(c) Using your answers in parts (a) and (b), explain how you think the mean P-T ratio during the 2001–2002 school year will compare for the two groups (west and east).

The medians of the two distributions are about the same, as determined in part (a). The distribution of P-T ratios for states that are west of the Mississippi River is skewed to the right, indicating that the mean will probably be higher than the median. The rough symmetry for the east group indicates that the mean will be close to the median. Thus, the mean for the west group will probably be greater than the mean for the east group.