AP® STATISTICS
2010 SCORING GUIDELINES (Form B)

Question 1

Intent of Question

The primary goals of this question were to assess students' ability to (1) compare three distributions of a quantitative variable; (2) construct a stemplot; (3) recognize that different graphical displays of the same data can reveal different characteristics of a distribution.

Solution

Part (a):

Comparing the medians reveals that the concentration of aldrin tends to be highest for River X and lowest for River Z. About 50 percent of the concentrations of aldrin for Rivers X and Y are higher than all of the concentrations for River Z. River X also displays the most variability in aldrin concentrations, as seen by the largest range and largest IQR, and River Z has the least variability, as judged by both IQR and range. The shapes of the three distributions differ, in that the distribution appears to be skewed to the right for River X, roughly symmetric for River Y and slightly skewed to the left for River Z.

Part (b):

Aldrin concentrations (in ppm) for River X
Leaf unit = 0.1 (for example, 3 | 4 represents 3.4 ppm)

3	47
4	0236678
5	13356
6	
7	35
8	0267

Part (c):

The stemplot shows a gap in the distribution of aldrin concentrations for River X between the values of 5.6 and 7.3 ppm of aldrin. This gap is not apparent in the boxplot.

Scoring

Parts (a), (b) and (c) are each scored as essentially correct (E), partially correct (P) or incorrect (I).

Part (a) is scored as follows:

Essentially correct (E) if the response correctly describes, in context, the center, spread and shape (all three characteristics) of the three distributions *AND* makes a *comparative* statement involving all three distributions for at least one characteristic. Specific numerical values are not required.

Question 1 (continued)

Partially correct (P) if the response does not warrant an E, but it includes all three of the following components:

1. Mentions all three distributions
2. Correctly describes at least two of the characteristics (center, spread, shape) of at least two distributions
3. Includes a correct comparison of at least two distributions for at least one characteristic

OR
if the response describes all three characteristics of the three distributions but does not make a *comparison* across distributions.

Incorrect (I) otherwise.

Note: Context is required to earn an E but not to earn a P.

Part (b) is scored as follows:

Essentially correct (E) if a reasonable stemplot that includes a leaf unit key is provided. It is *not* necessary for the key to include measurement units (ppm).

Partially correct (P) if a reasonable stemplot without a leaf unit key is provided.

Incorrect (I) if an unreasonable stemplot or a graph other than a stemplot is provided.

Part (c) is scored as follows:

Essentially correct (E) if the response includes a recognition of the gap in the stemplot *AND* gives an indication of where the gap occurs, *OR* if the response comments on bimodality *AND* specifies where the modes/clusters occur.

Partially correct (P) if the response indicates there is a gap or bimodality in the stemplot but does not give an indication of where the gap occurs.

Incorrect (I) otherwise. For example, the response might indicate that the numerical values can be seen in the stemplot but not the boxplot, or that the mean and standard deviation can be computed with the stemplot but not the boxplot, or only that the distribution is skewed to the right.

Note: The scoring system counts part (a) at *double weight*. In other words, an E counts as 2 points in part (a) and as 1 point in each of parts (b) and (c). Similarly, a P counts as 1 point in part (a) and as ½ point in parts (b) and (c).

AP® STATISTICS
2010 SCORING GUIDELINES (Form B)

Question 1 (continued)

4 **Complete Response**

3 **Substantial Response**

2 **Developing Response**

1 **Minimal Response**

If a response is between two scores (for example, 2½ points), use a holistic approach to determine whether to score up or down, depending on the overall strength of the response and communication.

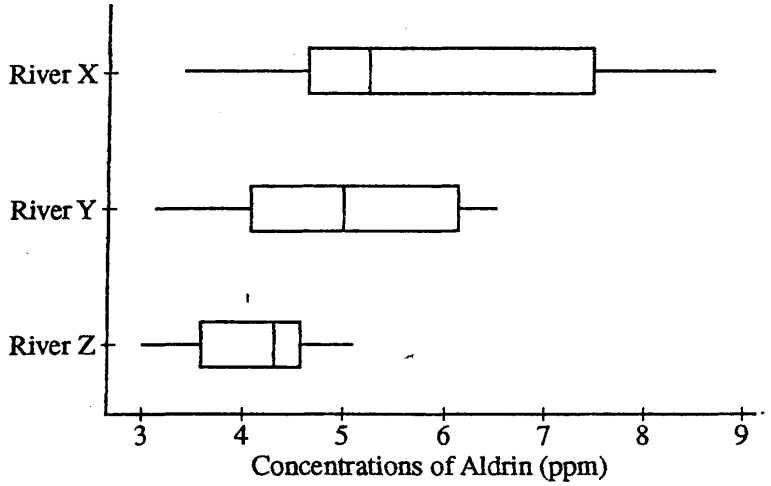
1A1

STATISTICS
SECTION II
Part A
Questions 1-5
Spend about 65 minutes on this part of the exam.
Percent of Section II score—75

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. As a part of the United States Department of Agriculture's Super Dump cleanup efforts in the early 1990s, various sites in the country were targeted for cleanup. Three of the targeted sites—River X, River Y, and River Z—had become contaminated with pesticides because they were located near abandoned pesticide dump sites. Measurements of the concentration of aldrin (a commonly used pesticide) were taken at twenty randomly selected locations in each river near the dump sites.

   The boxplots shown below display the five-number summaries for the concentrations, in parts per million (ppm) of aldrin, for the twenty locations that were sampled in each of the three rivers.



(a) Compare the distributions of the concentration of aldrin among the three rivers.

The river X has the largest median, and Y the second. The range of X is larger than Y's and larger than two times Z's. the IQR of X is larger than the range of Z. X is skewed to the right, Y is roughly symmetric, and Z is skewed to left. There is no outlier in each of the three rivers.

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1A2

(b) The twenty concentrations of aldrin for River X are given below.

3.4	4.0	5.6	3.7	8.0	5.5	5.3	4.2	4.3	7.3
8.6	5.1	8.7	4.6	7.5	5.3	8.2	4.7	4.8	4.6

Construct a stemplot that displays the concentrations of aldrin for River X.

concentration of aldrin for River X (ppm)

3	4 7
4	0 2 3 6 6 7
5	1 3 3 5 6
6	
7	3 3 5
8	0 2 6 7

* 3 | 4 7

means there are two data started with 3 : 3.4 and 3.7

(c) Describe a characteristic of the distribution of aldrin concentrations in River X that can be seen in the stemplot but cannot be seen in the boxplot.

There is a gap during 5.6 to 7.3, and we can see it in the stemplot, but not in boxplot.

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STATISTICS
SECTION II
Part A
Questions 1-5

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1. As a part of the United States Department of Agriculture's Super Dump cleanup efforts in the early 1990s, various sites in the country were targeted for cleanup. Three of the targeted sites—River X, River Y, and River Z—had become contaminated with pesticides because they were located near abandoned pesticide dump sites. Measurements of the concentration of aldrin (a commonly used pesticide) were taken at twenty randomly selected locations in each river near the dump sites.

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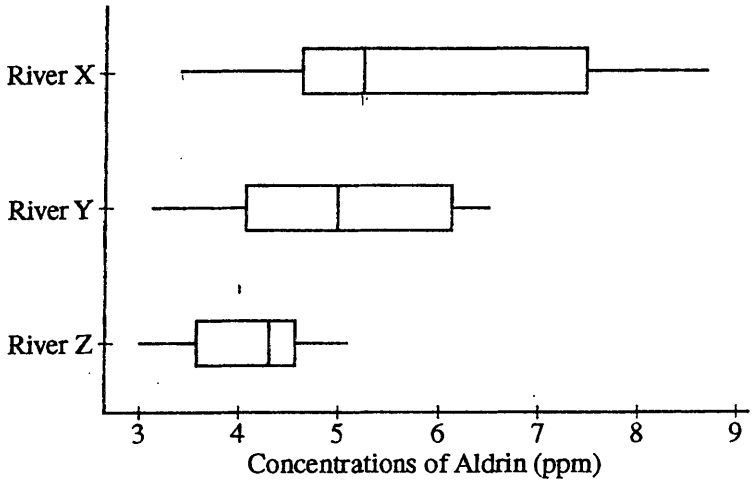

(a) Compare the distributions of the concentration of aldrin among the three rivers.

shape: Shape of distribution of river X is ~~was~~ skewed to the right while river Y show a roughly symmetric distributions. River Z shows a distribution that is slightly skewed to the left. none of the ~~rivers~~ distributions has outliers

center: River X has the ~~largest~~ ~~mean~~ median, which is ~~about~~ approximately 5.2 ppm and River Z has the smallest median which is ~~as~~ approximately 4.4 ppm. River Y has a median of 5 ppm. River

range: The river X, Y and Z has range of approximately 5.2, 3.4, and 2.1 respectively. ~~&~~ The river X Y and Z has interquartile range of approximately 2.8 2 and 1 respectively. This indicates the river ~~&~~ X has widest range and river Z has the narrowest range.

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1B2

(b) The twenty concentrations of aldrin for River X are given below.

3.4 4.0 5.6 3.7 8.0 5.5 5.3 4.2 4.3 7.3
8.6 5.1 8.7 4.6 7.5 5.3 8.2 4.7 4.8 4.6

Construct a stemplot that displays the concentrations of aldrin for River X.

concentration of aldrin for River X

3	4 7
4	0 2 3 6 6 7 8
5	1 3 3 5 6
6	
7	3 5
8	0 2 6 7

(c) Describe a characteristic of the distribution of aldrin concentrations in River X that can be seen in the stemplot but cannot be seen in the boxplot.

We can see a clear gap and two cluster in the stemplot but not in the boxplot.

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IC 1

STATISTICS
SECTION II
Part A
Questions 1-5
Spend about 65 minutes on this part of the exam.
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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.

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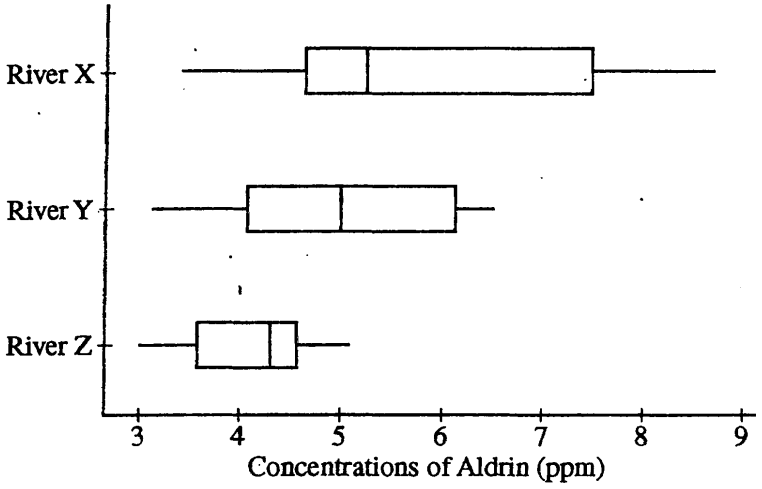

   (a) Compare the distributions of the concentration of aldrin among the three rivers.

From the boxplots shown above we can conclude that the distribution of the concentration of Aldrin for River X has the greatest Range = max − min, it also has the greatest median and IQR. What about the distribution of concentration of Aldrin in River Z, it has the lowest median and IQR and it also has the lowest Range.
The boxplot of River Y distribution is between River Z's and River X' boxplot's of the distribution by it's characteristics

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1C2

(b) The twenty concentrations of aldrin for River X are given below.

3.4 4.0 5.6 3.7 8.0 5.5 5.3 4.2 4.3 7.3
8.6 5.1 8.7 4.6 7.5 5.3 8.2 4.7 4.8 4.6

Construct a stemplot that displays the concentrations of aldrin for River X.

Units	One tenth's
3	4, 7
4	0, 2, 3, 6, 6, 7, 8
5	1, 3, 3, 5, 6
6	
7	3, 5
8	0, 2, 6, 7

(c) Describe a characteristic of the distribution of aldrin concentrations in River X that can be seen in the stemplot but cannot be seen in the boxplot.

From our stemplot we can see that the graph of the distribution of the concentration of aldrin for River X is bell shape, has approximately normal distribution and it's also symmetric.

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AP® STATISTICS
2010 SCORING COMMENTARY (Form B)

Question 1

Sample: 1A
Score: 4

Part (a) of this response includes comparative statements about center, spread and shape for all three rivers. The response refers twice to rivers, providing minimal context; it would be stronger if it also referred to concentrations of aldrin. Part (a) was scored as essentially correct. The response in part (b) includes a reasonable stemplot with a clear leaf unit key. Despite two minor errors in entering leaves in the stemplot, part (b) was scored as essentially correct. Part (c) is answered concisely and correctly and was scored as essentially correct. The entire answer, based on all three parts, was judged a complete response and earned a score of 4.

Sample: 1B
Score: 3

Part (a) of this response includes comparative statements, in context, involving all three rivers for center, spread and shape; thus part (a) was scored as essentially correct. The response in part (b) includes a correct stemplot but no leaf unit key, so part (b) was scored as partially correct. The response in part (c) comments on the gap and the existence of two clusters but does not indicate where the gap occurs. Part (c) was therefore scored as partially correct. The entire answer, based on all three parts, was judged a substantial response and earned a score of 3.

Sample: 1C
Score: 2

Part (a) of this response includes comparative statements, in context, involving all three rivers for medians, ranges and IQRs. Because the response describes and compares center and spread, but not shape, part (a) was scored as partially correct. The response in part (b) includes a reasonable stemplot with an adequate leaf unit key. The commas included in the stemplot are unnecessary, but they are not incorrect. Part (b) was scored as essentially correct. The response in part (c) does not include a recognition of the gap in the stemplot. Furthermore, the characterizations of the distribution as "bell-shape," "approximately normal" and "symmetric" are incorrect. Thus part (c) was scored as incorrect. The entire answer, based on all three parts, was judged a developing response and earned a score of 2.