

AP[®] STATISTICS

2015 SCORING GUIDELINES

Question 1

Intent of Question

The primary goals of this question were to assess a student's ability to (1) compare features of two distributions of data displayed in boxplots and (2) identify statistical measures that are important in making decisions based on data sets.

Solution

Part (a):

The median salary is approximately the same for both corporations. The range and interquartile range of the salaries are greater for Corporation A than for Corporation B. The two highest salaries at Corporation A are outliers while Corporation B has no outliers.

Part (b):

- (i) Five years after starting, at least 3 out of 30 (10%) of the salaries at Corporation A are greater than the maximum salary at Corporation B. If I accept the offer from Corporation A, I might be able to make a higher salary at Corporation A than at Corporation B.
- (ii) Five years after starting, the minimum salary at Corporation B is greater than at Corporation A. In fact, at Corporation A it looks like some people are still making the starting salary of \$36,000 and never received a raise in the five years since they were hired. So if I work at Corporation A, I might never receive a raise in salary.

Scoring

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

Part (a) is scored as follows:

Essentially correct (E) if the response includes the following four components:

1. A correct comparison of center.
2. A correct comparison of spread.
3. A discussion of the outliers for Corporation A.
4. The response is in context.

Partially correct (P) if the response includes only three of the four components.

Incorrect (I) if the response includes at most two of the four components.

Note: Any mention of shape should be ignored because complete shape information cannot be determined from a boxplot.

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Question 1 (continued)

Part (b) is scored as follows:

Essentially correct (E) if the response includes the following four components:

1. In part (b-i) a relevant statistical measure is identified (or described) or a relevant statistical comparison is provided that supports the choice of Corporation A.
2. In part (b-i) an explanation is provided for why the measure or comparison is relevant.
3. In part (b-ii) a relevant statistical measure is identified (or described) or a relevant statistical comparison is provided that supports the choice of Corporation B.
4. In part (b-ii) an explanation is provided for why the measure or comparison is relevant.

Partially correct (P) if the response includes only two or three of the four components.

Incorrect (I) if the response includes none or one of the four components.

Note: If a response does not provide a statistical measure or comparison in part (b-i) or (b-ii), the second and fourth components can still be satisfied if an acceptable explanation is provided that would follow from a relevant statistical measure or comparison. For example, if the response in part (b-i) only states “At Corporation A, I have the potential to earn a higher salary,” the second component is satisfied.

4 Complete Response

Both parts essentially correct

3 Substantial Response

One part essentially correct and one part partially correct

2 Developing Response

One part essentially correct and one part incorrect

OR

Both parts partially correct

1 Minimal Response

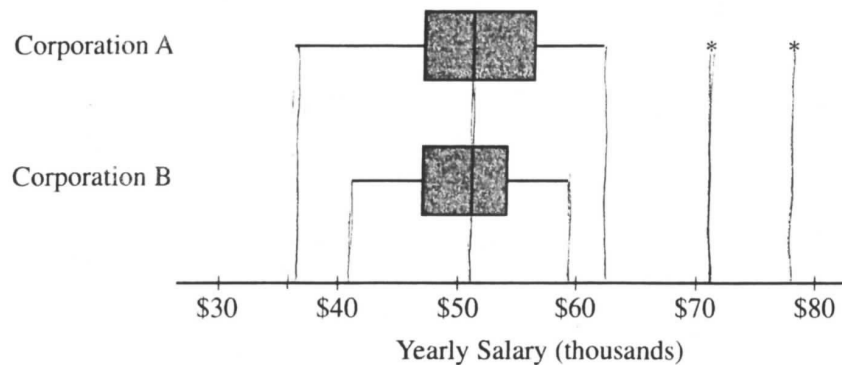
One part partially correct and one part incorrect

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. Two large corporations, A and B, hire many new college graduates as accountants at entry-level positions. In 2009 the starting salary for an entry-level accountant position was \$36,000 a year at both corporations. At each corporation, data were collected from 30 employees who were hired in 2009 as entry-level accountants and were still employed at the corporation five years later. The yearly salaries of the 60 employees in 2014 are summarized in the boxplots below.



- (a) Write a few sentences comparing the distributions of the yearly salaries at the two corporations.

While both groups of employees have about the same median salary of approximately \$51,000 per year, the range from A is much larger than that of B. A has a more extreme minimum & maximum salary than B & has 2 outliers while B has none.

(b) Suppose both corporations offered you a job for \$36,000 a year as an entry-level accountant.

(i) Based on the boxplots, give one reason why you might choose to accept the job at corporation A.

After 5 years A has a much higher maximum salary (approximately \$79,000) which is about \$20,000 more than the highest salary at corporation B. So if you are willing to be the hardest working employee and earn the most raises you should pick A since the apparent salary ceiling is higher.

(ii) Based on the boxplots, give one reason why you might choose to accept the job at corporation B.

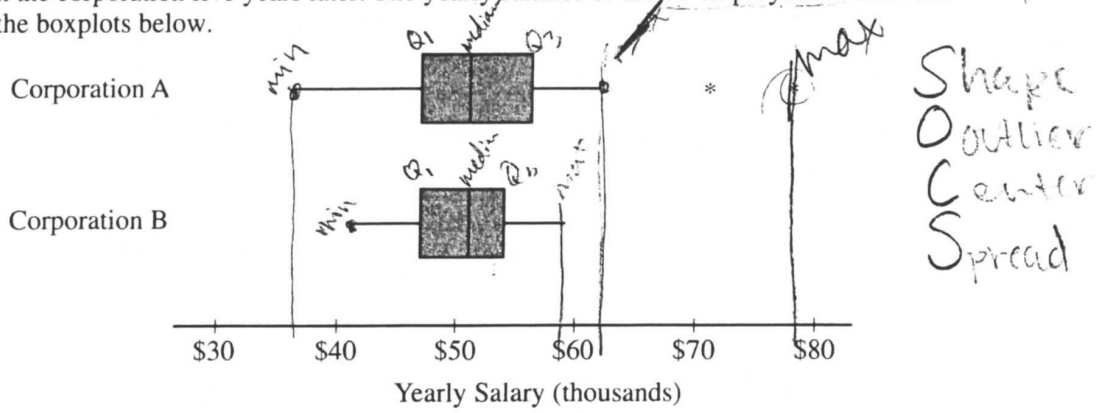
While A has outliers with high salaries, its minimum salary is much lower than the minimum at B. So even though you might only make ^{about} \$41,000/yr at B, that is better than earning \$36,000/yr at A. Essentially you might choose B because, according to the boxplot, the lowest salary at B is still higher than the lowest salary at A.

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. Two large corporations, A and B, hire many new college graduates as accountants at entry-level positions. In 2009 the starting salary for an entry-level accountant position was \$36,000 a year at both corporations. At each corporation, data were collected from 30 employees who were hired in 2009 as entry-level accountants and were still employed at the corporation five years later. The yearly salaries of the 60 employees in 2014 are summarized in the boxplots below.



- (a) Write a few sentences comparing the distributions of the yearly salaries at the two corporations.

A) The range of corporation A's salaries is greater than the range of corporation B's salaries.
Also, Corporation A's distribution of 2014 salaries contains 2 outliers, while corporation B's distribution of 2014 salaries has no outliers.

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(b) Suppose both corporations offered you a job for \$36,000 a year as an entry-level accountant.

(i) Based on the boxplots, give one reason why you might choose to accept the job at corporation A.

One reason I might choose to accept the job at corporation A is because the maximum salary is greater than corporation B's max salary. The max salary for corporation A is approximately $\$78,000$ (per year) while max salary for corporation B is approximately $\$58,000$ (per year). I would hope to reach this higher maximum salary.

(ii) Based on the boxplots, give one reason why you might choose to accept the job at corporation B.

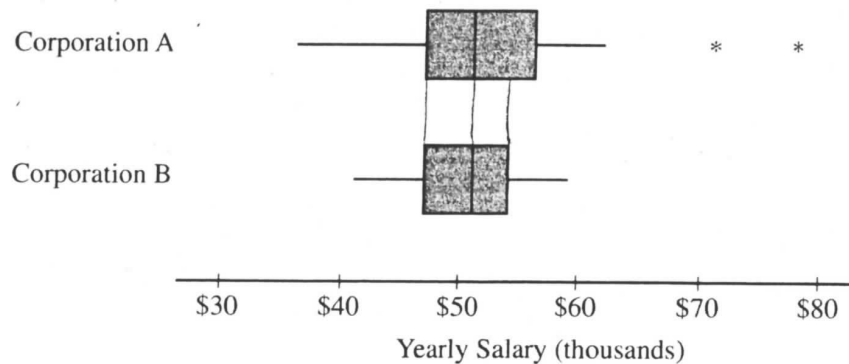
One reason I might choose to accept the job at corporation B is because the minimum salary for corporation B is higher than the minimum salary for corporation A. Corporation B has a minimum salary of approximately $\$41,000$ (per year), while corporation A has a minimum salary of approximately $\$36,000$ (per year). I would hope to avoid remaining at $\$36,000$ per year, and would have a better chance of salary increase with corporation B, since the min is $\$41,000$.

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. Two large corporations, A and B, hire many new college graduates as accountants at entry-level positions. In 2009 the starting salary for an entry-level accountant position was \$36,000 a year at both corporations. At each corporation, data were collected from 30 employees who were hired in 2009 as entry-level accountants and were still employed at the corporation five years later. The yearly salaries of the 60 employees in 2014 are summarized in the boxplots below.



- (a) Write a few sentences comparing the distributions of the yearly salaries at the two corporations.

Corporation A has a larger range and IQR than Corporation B. Corporation A has two outliers while Corporation B has none. Corporation B looks more normal than Corporation A.

(b) Suppose both corporations offered you a job for \$36,000 a year as an entry-level accountant.

(i) Based on the boxplots, give one reason why you might choose to accept the job at corporation A.

I could choose Corporation A because the maximum salary from the sample of Corporation A was greater than the maximum salary from the sample of Corporation B. Therefore, it is possible that after several years working there, I too could reach a salary as large as Corporation A's maximum.

(ii) Based on the boxplots, give one reason why you might choose to accept the job at corporation B.

I could choose Corporation B because the minimum salary from the sample for Corporation B is over \$40,000 while the minimum from the sample for Corporation A appears to still be at \$36,000 which was the starting salary. Therefore, I would choose Corporation B because if I went to Corporation A I could work there for several years and never get a pay raise in those years.

AP[®] STATISTICS

2015 SCORING COMMENTARY

Question 1

Overview

The primary goals of this question were to assess a student's ability to (1) compare features of two distributions of data displayed in boxplots and (2) identify statistical measures that are important in making decisions based on data sets.

Sample: 1A

Score: 4

The first sentence in part (a) provides a comparison of the medians and a comparison of the range. Thus, the first and second components are satisfied. The inclusion of the word "salary" and a dollar sign provides context, thus satisfying the fourth component. The response continues with a comparison of the maximum and minimum values and states that the salary distribution of Corporation A has two outliers, thus satisfying the third component. Because all four components are satisfied, part (a) was scored as essentially correct. In part (b-i) the response uses a comparison of maximum salaries as the basis for the choice, thus satisfying the first component. The response follows with an explanation of why the higher maximum salary at Corporation A is relevant to the decision with the statement "So if you are willing to be the hardest working employee . . . you should pick A since the apparent salary ceiling is higher." The explanation satisfies the second component. In part (b-ii) the response uses a comparison of minimum salaries as the basis for the choice, thus satisfying the third component. The response continues with the explanation that the higher minimum salary is relevant to the decision because "the lowest salary at B is still higher than the lowest salary at A," thus satisfying the fourth component. Because all four components are satisfied, part (b) was scored as essentially correct. Because both parts were scored as essentially correct, the response earned a score of 4.

Sample: 1B

Score: 3

In part (a) the response begins with a correct comparison of the ranges of salaries, thus satisfying the second component. The response continues by noting that the salary distribution of Corporation A has two outliers while the distribution of Corporation B has none, thus satisfying the third component. The inclusion of the word "salaries" in the statements satisfies the fourth component. However, any discussion or comparison of centers is missing. Because only three of the four components are satisfied, part (a) was scored as partially correct. In part (b-i) the response uses a comparison of maximum salaries as the basis for the choice, thus satisfying the first component. The response follows with an explanation of why the higher maximum salary at Corporation A is relevant to the decision with the statement "I would hope to reach this higher maximum salary," and the second component is satisfied. In part (b-ii) the response uses a comparison of minimum salaries as the basis for the choice, thus satisfying the third component. The response continues by identifying the minimum salary values and provides an explanation of why the higher minimum salary is relevant to the choice, and the fourth component is satisfied. With all four components satisfied, part (b) was scored as essentially correct. Because one part was scored as essentially correct, and one part was scored as partially correct, the response earned a score of 3.

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2015 SCORING COMMENTARY

Question 1 (continued)

Sample: 1C

Score: 2

In part (a) the response correctly compares the ranges and interquartile ranges. Either of these comparisons is sufficient to satisfy the second component. The response continues with a statement indicating that the distribution of Corporation A has two outliers while the distribution of Corporation B has none, thus satisfying the third component. The response follows with a comparison of the shapes of the distributions. However, shape was not assessed because information about the complete shape of a distribution cannot be determined from a boxplot. No discussion or comparison of centers or reference to the context is provided, thus the first and fourth components are not satisfied. Because only two of the four components are satisfied, part (a) was scored as incorrect. In part (b-i) the response uses a comparison of maximum salaries as the basis for the choice, thus satisfying the first component. The response follows with an explanation of why the higher maximum salary at Corporation A is relevant to the decision with the statement “I too could reach a salary as large as Corporation A’s maximum.” Thus, the second component is satisfied. In part (b-ii) the response uses a comparison of minimum salaries as the basis for the choice, thus satisfying the third component. The response continues by identifying the minimum salary values and explains that someone could work at Corporation A for several years and never get a pay raise, and the fourth component is satisfied. Because all four components are satisfied, part (b) was scored as essentially correct. Because one part was scored as essentially correct, and one part was scored as incorrect, the response earned a score of 2.