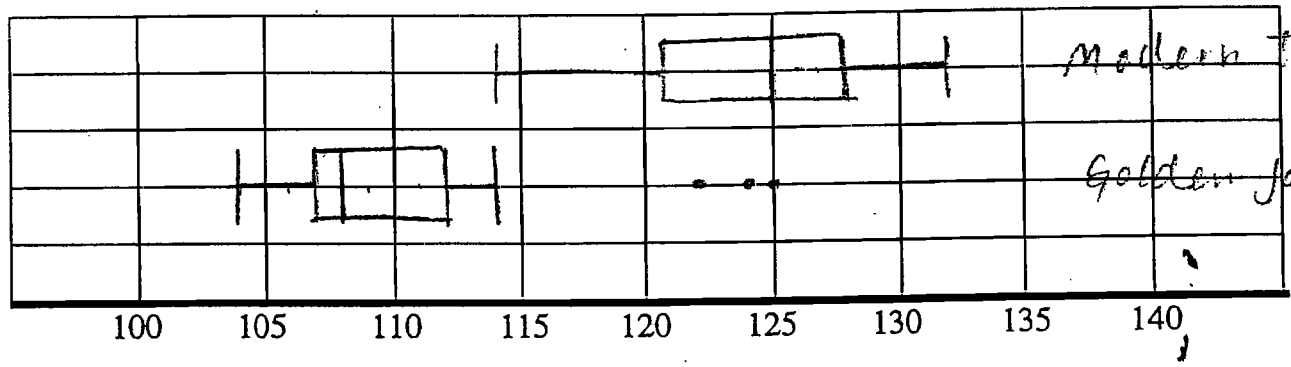
AP® Statistics
2004 Sample Student Responses
Form B

A1

5. A researcher thinks that modern Thai dogs may be descendants of golden jackals. A random sample of 16 animals was collected from each of the two populations. The length (in millimeters) of the mandible (jawbone) was measured for each animal. The lower quartile, median, and upper quartile for each sample are shown in the table below, along with all values below the lower quartile and all values above the upper quartile.

Sample	Values Below Q_1	Q_1	Median	Q_3	Values Above Q_3
Modern Thai dog	114, 116, 116, 120	121	125	128	129, 130, 130, 132
Golden jackal	104, 104, 105, 106	107	108	112	114, 122, 124, 125

(a) Display parallel boxplots of mandible lengths (showing outliers, if any) for the modern Thai dogs and the golden jackals on the grid below.



Based on the boxplots, write a few sentences comparing the distributions of mandible lengths for the two types of dogs.

the median of the modern thai dog mandible length is alot higher to that of golden jackals. the range of the golden jackal, 21, is larger than that of the modern thai dog, 18. The interquartile range of the modern thai dog is greater than that of the golden jackal. The distribution of mandible lengths of the golden jackal is highly skewed to the right, while that of the modern thai Dog is roughly normal, with a slight skew to the left.

A2

(b) Is it reasonable to use the sample of mandible lengths of modern Thai dogs to construct an interval estimate of the mean mandible length for the population of modern Thai dogs? Justify your answer. (Note: You do not have to compute the interval.)

yes, it is reasonable because a sample size of 16 falls in the medium sized range, and to construct an interval for a medium sized sample, the data needs to be roughly normal with few or no outliers, and that is true of the thai dog distribution.

(c) Is it reasonable to use the sample data of mandible lengths of modern Thai dogs and the sample data of mandible lengths of golden jackals to perform a two-sample t-test for the difference in mean mandible lengths for the two types of dogs? Justify your answer. (Note: You do not have to conduct the test.)

It is not reasonable to do a two sample t test because the distribution for the golden jackal is not roughly bell shaped and symmetric and has many strong outliers, which is unacceptable.

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B1

5. A researcher thinks that modern Thai dogs may be descendants of golden jackals. A random sample of 16 animals was collected from each of the two populations. The length (in millimeters) of the mandible (jawbone) was measured for each animal. The lower quartile, median, and upper quartile for each sample are shown in the table below, along with all values below the lower quartile and all values above the upper quartile.

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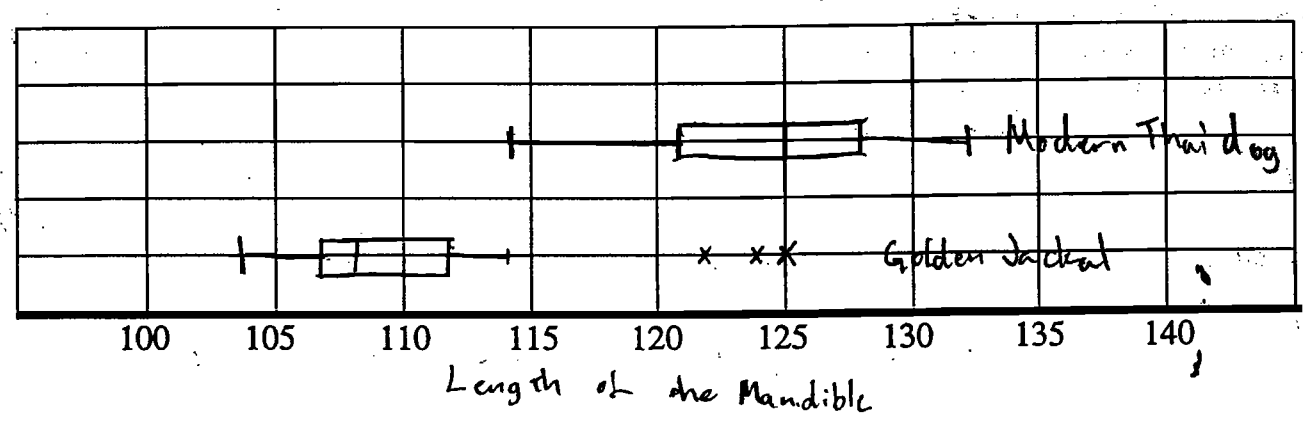

Based on the boxplots, write a few sentences comparing the distributions of mandible lengths for the two types of dogs.

Modern Thai dog has more variety in its Mandible length than Golden Jackal, since IQR of Modern thai dog is 7, where as that of golden is 5. If outliers are excluded, than range of Modern thai dog also becomes greater than those of Jackal. Since median of Modern Thai dog is greater than the maximum of golden Jackal [excluding outliers] it is obvious that Modern Thai dog has longer mandible than golden Jackal.

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(b) Is it reasonable to use the sample of mandible lengths of modern Thai dogs to construct an interval estimate of the mean mandible length for the population of modern Thai dogs? Justify your answer. (Note: You do not have to compute the interval.)

Yes, it is reasonable, because first, there is no outlier in the sample, which Lower extreme is 114 which is greater than $Q_1 - IQR \times 1.5 = 121 - (128-121) \times 1.5 = 110.5$ and maximum is 132 which is less than $Q_3 + IQR \times 1.5 = 128 + (128-121) \times 1.5 = 138.5$. Also Median $- Q_1 = 4$, $Q_3 - \text{median} = 3$, indicates that there is no strong skewed ness in the sample, which is why confidence interval can be used to estimate the population mean even though sample size is only 16.

(c) Is it reasonable to use the sample data of mandible lengths of modern Thai dogs and the sample data of mandible lengths of golden jackals to perform a two-sample t-test for the difference in mean mandible lengths for the two types of dogs? Justify your answer. (Note: You do not have to conduct the test.)

No, it isn't. Although sample of Modern thai dogs exhibit no strong skewed ness, Sample of golden jackal does.

The golden jackal sample has three outliers, 122, 124 and 125 which are all greater than $Q_3 + 1.5\,IQR = 112 + (112-109) \times 1.5 = 119.5$. Also $Q_3 - \text{Median}\ (4)$ is greater than $\text{median} - Q_1$, which indicates graph is skewed to the right. Because of outliers and skewed ness, T-test using a small sample doesn't apply.

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C1

5. A researcher thinks that modern Thai dogs may be descendants of golden jackals. A random sample of 16 animals was collected from each of the two populations. The length (in millimeters) of the mandible (jawbone) was measured for each animal. The lower quartile, median, and upper quartile for each sample are shown in the table below, along with all values below the lower quartile and all values above the upper quartile.

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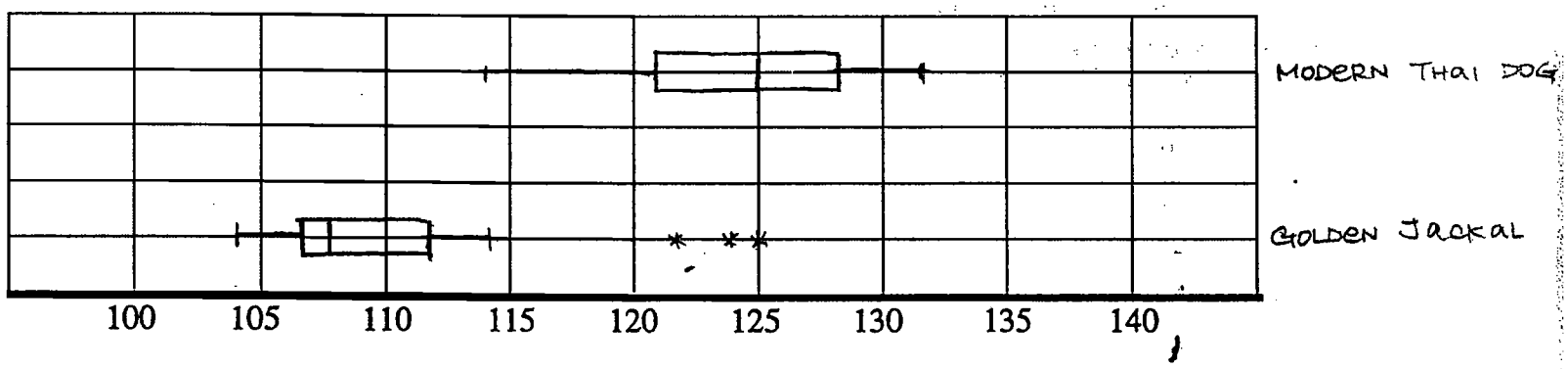

Based on the boxplots, write a few sentences comparing the distributions of mandible lengths for the two types of dogs.

THE MANDIBLE LENGTHS FOR THE TWO TYPES OF DOGS LOOK SIGNIFICANTLY DIFFERENT FROM EACH OTHER. THE DISTRIBUTION OF MODERN THAI DOG LOOKS QUITE NORMAL WHERE AS THAT OF GOLDEN JACKAL IS SKEWED TO THE RIGHT WITH OUTLIERS @ HIGHER END.

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C_2

(b) Is it reasonable to use the sample of mandible lengths of modern Thai dogs to construct an interval estimate of the mean mandible length for the population of modern Thai dogs? Justify your answer. (Note: You do not have to compute the interval.)

YES IT IS.

SINCE $n = 16 \leq 30$, THE T-INTERVAL NEEDS TO BE USED INSTEAD OF Z-INTERVAL. SINCE WE HAVE TO ASSUME NORMALITY FOR T-INT, AND THE DISTRIBUTION SEEMS QUITE NORMAL (FROM BOX PLOT), IT IS REASONABLE.

(c) Is it reasonable to use the sample data of mandible lengths of modern Thai dogs and the sample data of mandible lengths of golden jackals to perform a two-sample t-test for the difference in mean mandible lengths for the two types of dogs? Justify your answer. (Note: You do not have to conduct the test.)

NO, SINCE FOR THE T-TEST, WE HAVE TO ASSUME NORMALITY. THE DISTRIBUTION OF GOLDEN JACKAL AS CAN BE SEEN IN THE BOX PLOT, IS HIGHLY SKEW TO THE RIGHT; SO THE ASSUMPTION IS UNREASONABLE.

∴, THE 2-SAMPLE T-TEST WOULD BE UNREASONABLE.

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