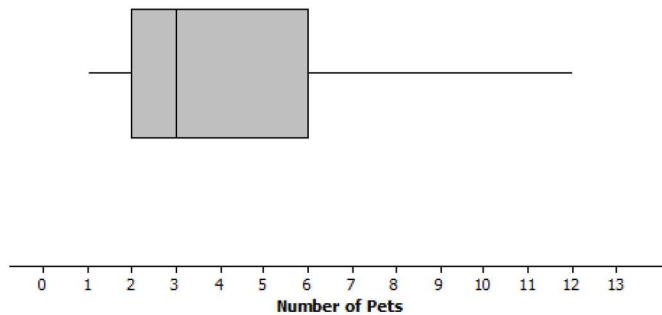


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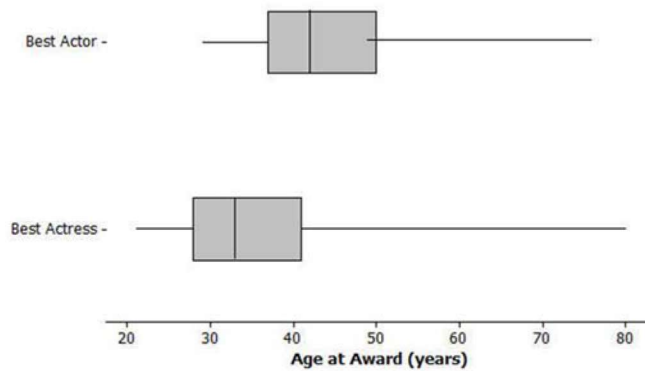
Understanding Box Plots

The number of pets per family for students in a sixth grade class is below:



1. Can you tell how many families have two pets? Explain why or why not.
2. Given the plot above, which of the following statements are true? If the statement is false, modify it to make the statement true.
 - a. Every family had at least one pet.
 - b. About one fourth of the families had six or more pets.
 - c. Most of the families had three pets.
 - d. Half of the families had five or fewer pets.
 - e. Three fourths of the families had two or more pets.

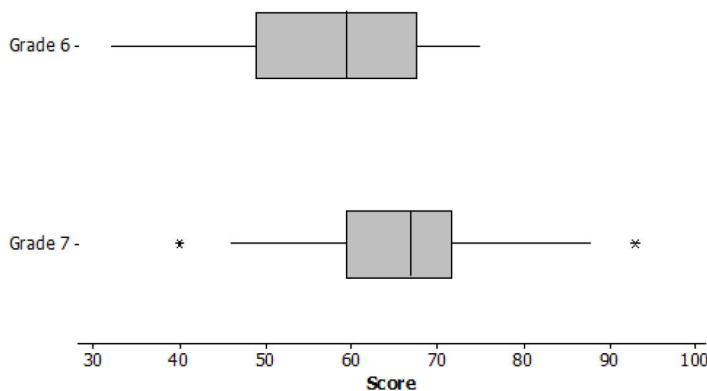
1. The box plots below summarize the ages at the time of the award for leading actress and leading actor Academy Award winners.



Data Source: http://en.wikipedia.org/wiki/List_of_Best_Actor_winners_by_age_at_win
http://en.wikipedia.org/wiki/List_of_Best_Actress_winners_by_age_at_win

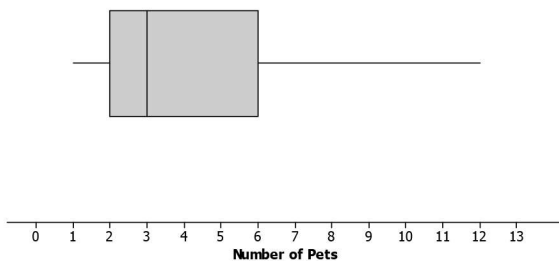
- Do you think it is harder for an older woman to win an academy award for best actress than it is for an older man to win a best actor award? Why or why not?
- The oldest female to win an academy award was Jessica Tandy in 1990 for *Driving Miss Daisy*. The oldest actor was Henry Fonda for *On Golden Pond* in 1982. How old were they when they won the award? How can you tell? Were they a lot older than most of the other winners?
- The 2013 winning actor was Daniel Day-Lewis for *Lincoln*. He was 55 years old at that time. What can you say about the percent of male award winners who were older than Daniel Day-Lewis when they won their Oscar?
- Use the information you can see in the box plots to write a paragraph supporting or refuting the claim that fewer older actresses than actors win academy awards.

2. The scores of sixth and seventh graders on a test about polygons and their characteristics are summarized in the box plots below.



- In which grade did the students do the best? Explain how you can tell.
 - Why do you think two of the data values in grade seven are not part of the line segments?
 - How do the median scores for the two grades compare? Is this surprising? Why or why not?
 - How do the IQRs compare for the two grades?
3. A formula for IQR could be written as $Q3 - Q1 = IQR$. Suppose you knew the IQR and the Q1. How could you find the Q3?
4. Consider the statement, "Historically, the average length of service as Chief Justice on the Supreme Court has been less than 15 years; however, since 1970 the average length of service has increased." Use the data given in Exercise 1 to answer the following questions.
- Do you agree or disagree with the statement? Explain your thinking.
 - Would your answer change if you used the median number of years rather than the mean?

The number of pets per family for students in a sixth grade class is below:



1. Can you tell how many families have two pets? Explain why or why not.

You cannot tell from the box plot. You only know that the lower quartile (Q1) is 2 pets. You do not know how many families are included in the data set.

2. Given the plot above, which of the following statements are true? If the statement is false, modify it to make the statement true.

- a. Every family had at least one pet.

True.

- b. About one fourth of the families had six or more pets.

True.

- c. Most of the families had three pets.

False because you cannot determine the number of any specific data value. Revise to "You cannot determine the number of pets most families had."

- d. Half of the families had five or fewer pets.

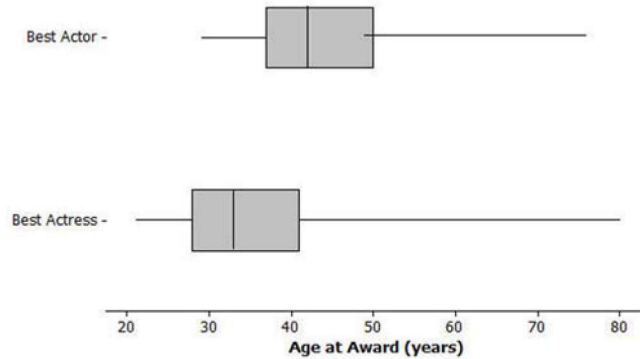
False. Revise to "More than half of the families had five or fewer pets."

- e. Three fourths of the families had two or more pets.

True.

All students should do problems 1 and 2. Problem 4 could be an extension, making connections to previous work on the mean.

1. The box plots below summarize the ages at the time of the award for leading actress and leading actor Academy Award winners.



- a. Do you think it is harder for an older woman to win an academy award for best actress than it is for an older man to win a best actor award? Why or why not?

Answers will vary: Students might take either side as long as they given an explanation for why they made the choice they did.

- b. The oldest female to win an academy award was Jessica Tandy in 1990 for *Driving Miss Daisy*. The oldest actor was Henry Fonda for *On Golden Pond* in 1982. How old were they when they won the award? How can you tell? Were they a lot older than most of the other winners?

Henry Fonda was 76 and Jessica Tandy was 80. Those are the maximum values. But there might have been some that were nearly as old—you cannot tell from the box plot.

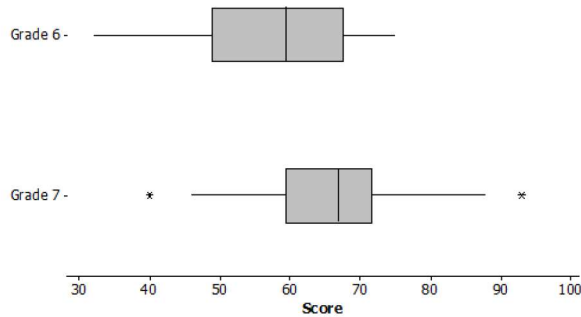
- c. The 2013 winning actor was Daniel Day-Lewis for *Lincoln*. He was 55 years old at that time. What can you say about the percent of male award winners who were older than Daniel Day-Lewis when they won their Oscar?

He was in the upper quarter as one of the older actors. There were less than 25% of the male award winners who were older than Daniel Day-Lewis.

- d. Use the information you can see in the box plots to write a paragraph supporting or refuting the claim that fewer older actresses than actors win academy awards.

Overall, the box plot for actresses starts about 10 years younger than actors and is centered around a lower age than for actors: the median age for actresses who won the award is 33, and for actors it was 42. The upper quartile is also lower for actresses, 41, compared to 49 for actors. The range for actresses' ages was larger, $80 - 21 = 59$, compared to $76 - 29 = 47$ for actors. About $\frac{3}{4}$ of the actresses who won the award were younger than the median for the men.

2. The scores of sixth and seventh graders on a test about polygons and their characteristics are summarized in the box plots below.



- a. In which grade did the students do the best? Explain how you can tell.

Three fourths of the seventh grade students did better than half of the sixth graders. You can tell by comparing Q1 for grade seven to the median of grade six.

- b. Why do you think two of the data values in grade seven are not part of the line segments?

The highest and lowest scores were pretty far away from the other scores so they were marked separately.

- c. How do the median scores for the two grades compare? Is this surprising? Why or why not?

The median score in grade seven was higher than the median in grade six. This makes sense because the seventh graders should know more than the sixth graders.

- d. How do the IQRs compare for the two grades?

The middle half of the Grade 7 scores were close together in a span of about 11 with the median around 66. The middle half of the Grade 6 scores were spread over a larger span, about 17 points from about 50 to 67.

3. A formula for IQR could be written as $Q3 - Q1 = IQR$. Suppose you knew the IQR and the Q1. How could you find the Q3?

$Q3 = IQR + Q1$. Add the lower quartile to the IQR.

4. Consider the statement, "Historically, the average length of service as Chief Justice on the Supreme Court has been less than 15 years; however, since 1970 the average length of service has increased." Use the data given in Exercise 1 to answer the following questions.

- a. Do you agree or disagree with the statement? Explain your thinking.

The mean number of years as Chief Justice overall is about 13. The mean number of years since 1969 is about 14.7. Even though the mean has increased, it does not seem really like a big difference because there have only been three justices since then to cover a span of 43 years (and three times 13 is 39, so not enough to really show an increasing trend).

- b. Would your answer change if you used the median number of years rather than the mean?

The median overall was 11 years; the median since 1970 was 17 years, which is considerably larger. This seems to justify the statement.