Engineering Mathematics III

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SMA 2217 Tutorial two

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Box and whisker plot

- **At times it is useful to get a general idea of how data clusters together. Box-and-whisker plots display the distribution of data items along a number line. The data are divided into four equal parts, separated by points called quartiles. A box-and-whisker plot also displays the smallest data point (the extreme minimum) and the largest data point (the extreme maximum).**
- First, place the data in order from smallest to largest.
  Next, create a number line that shows the range of the data using equal intervals.

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- The median will be used as the middle point on the box-and-whisker plot and to split the data in half.
- Next, the median of each half, the quartile, is then calculated. These separate the data into quarters.
- Then, use the highest data point and the lowest data point as the endpoints or extremes.
- Boxes are drawn between the quartiles, and whiskers are drawn to the extremes.

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- We draw a box-and-whisker plot for the given data.
  $16, 51, 32, 16, 24, 37, 7, 22, 19, 40, 10, 31, 29, 38, 21, 11$
- First, put the data in order from smallest to largest.
  $7, 10, 11, 16, 16, 19, 21, 22, 24, 29, 31, 32, 37, 38, 40, 51$
- Next, draw a number line that includes the extremes, 7 and 51. In this case, use a number line from 5 to 55 using intervals of 5.

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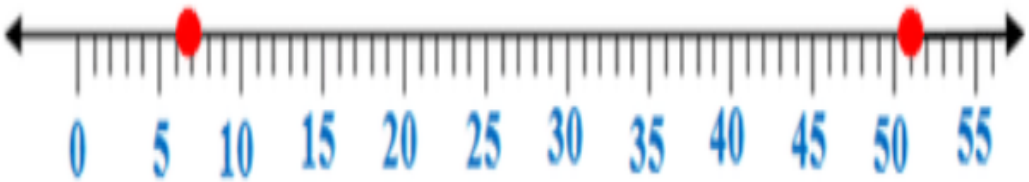

Figure:

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- Then, determine the median of the data. The middle points in the data are 22 and 24 so the median is 23. Mark the median with a point beneath the number line.

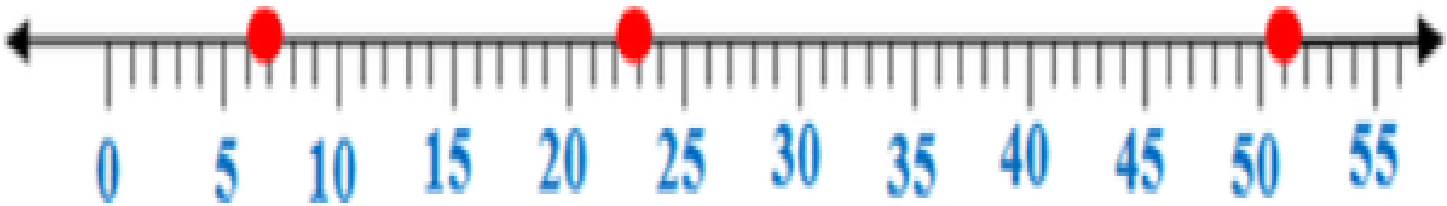

Figure:

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- Then, the median separates the data into two groups as shown below:

$$7, 10, 11, 16, 16, 19, 21, 22 \quad 24, 29, 31, 32, 37, 38, 40, 51$$

- Find the median of each of these groups. These medians are the quartiles which are 16 and 34.5. These divide the data into four groups. Mark the quartiles as you did the median, with a point.

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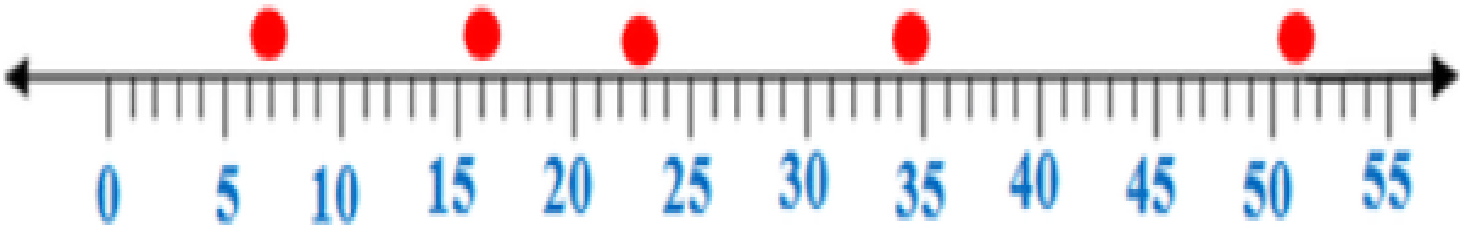

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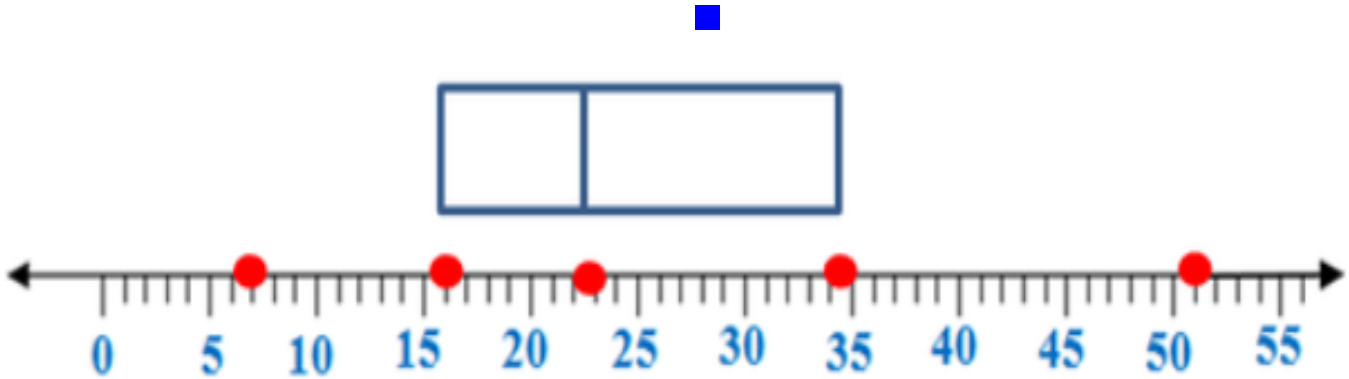
- Then, draw boxes between the quartiles and the median.



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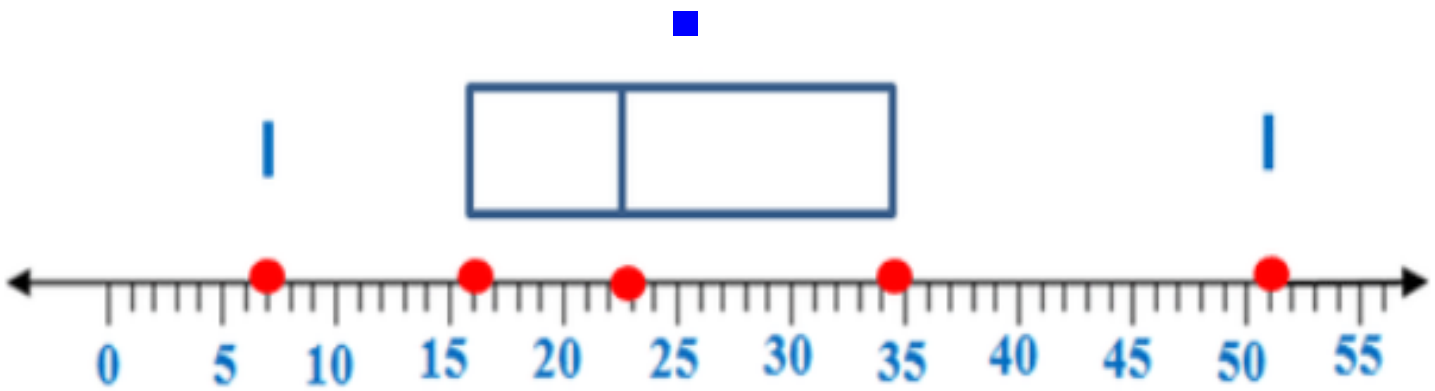
- Then, mark the extremes, the smallest and largest numbers, with points. In this case, the extremes are 7 and 51.



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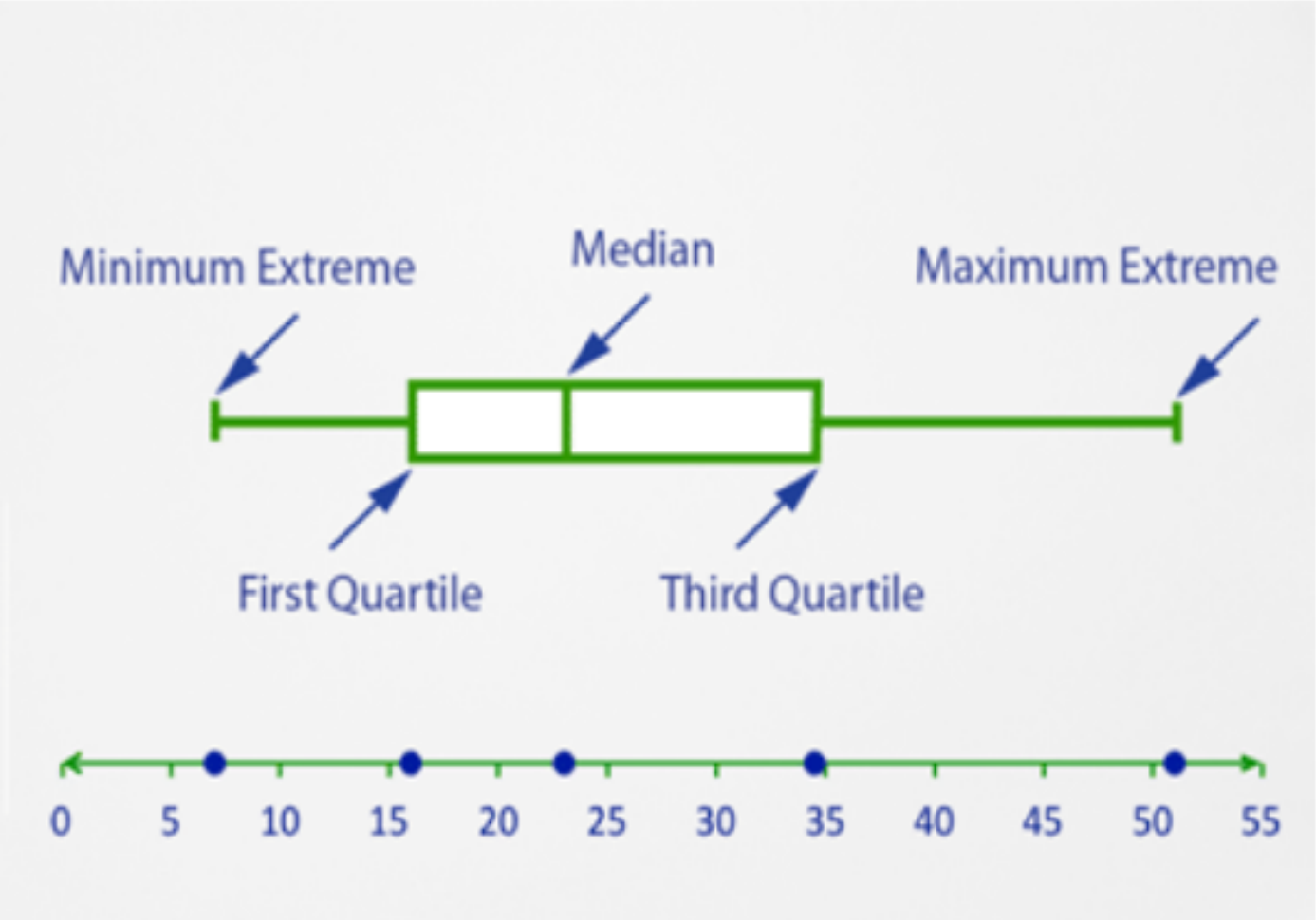
- Then, draw whiskers, or horizontal lines, to connect the quartiles to the extremes.



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- It can be seen from the box-and-whisker plot that half of the data will be found between the first quartile and the third quartile.
- A quarter of the data is between the minimum and the first quartile and the last quarter is between the third quartile and the maximum.
- The median, of course, marks the half-way point between the data.

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- In this particular situation, the second half of the data is stretched out over a further area than the first half and about half way is between 15 and 35.
- Double plots or graphs can be made when there are two factors being compared.
- A double box-and-whisker plot can be made by drawing the second factor beneath the first factor.
- This will allow both factors to be visible on the same plot.

Tutorial two Question 2

- First, find the minimum, maximum, median, and the first and third quartiles for each set of data.
- These will give you the five-point summary for both the varsity and junior varsity teams.

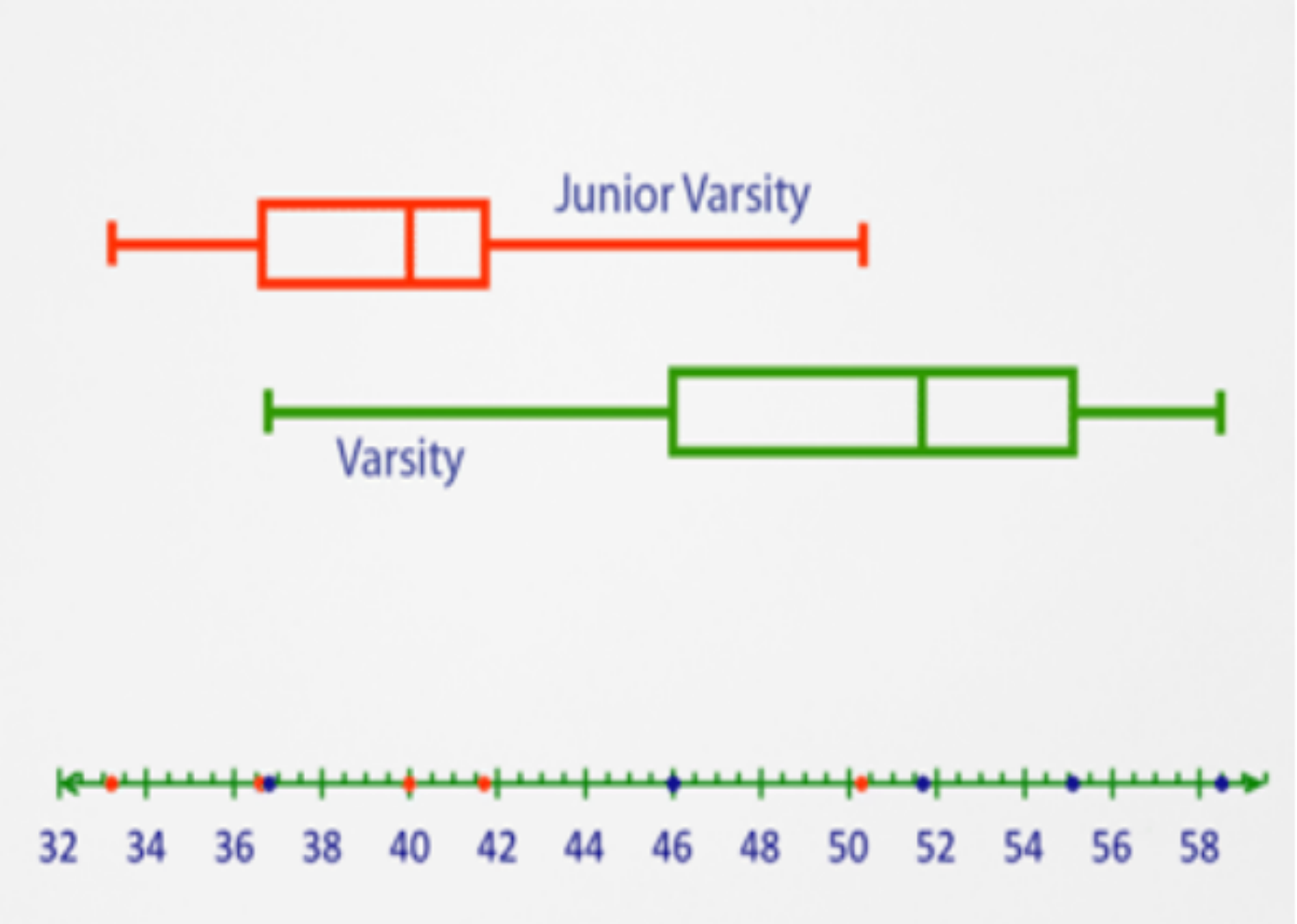
Tutorial Two Question Two

	Varsity	Junior Varsity
Minimum extreme	36.8	33.2
Maximum extreme	58.5	50.3
Median	51.7	40.0
First Quartile	46.0	36.6
Third Quartile	55.1	41.7

Figure:

Tutorial Two Question Two

- Next, draw the double box-and-whisker plot.



Tutorial Two Question Two

- From this box-and-whisker plot, the coach can tell that the team's results are what he expected.
- The varsity shot put distances are generally better than those of the junior varsity. There are a number of players whose results overlap.
- The highest junior varsity player is better than the entire first quartile of the varsity team.
- It is also apparent that the results are more dispersed, or spread out, in the varsity team than in the junior varsity team.