LESSON 12.2

The Median-Median Line

You will need:

graph paper

FITTING A LINE

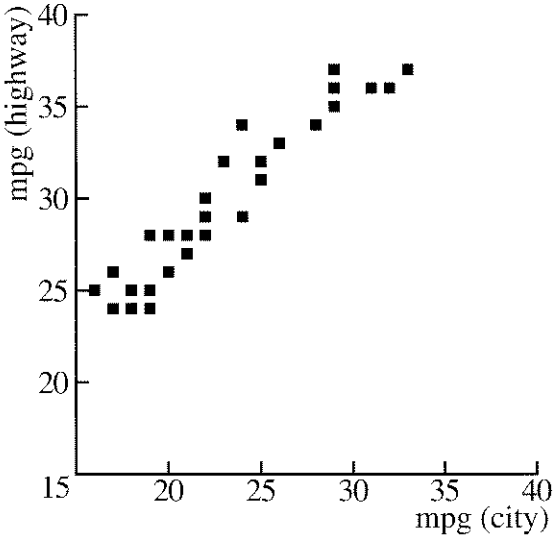
The table shows fuel efficiency data for 28 automobiles equipped with manual transmission.

Highway vs. City Mileage

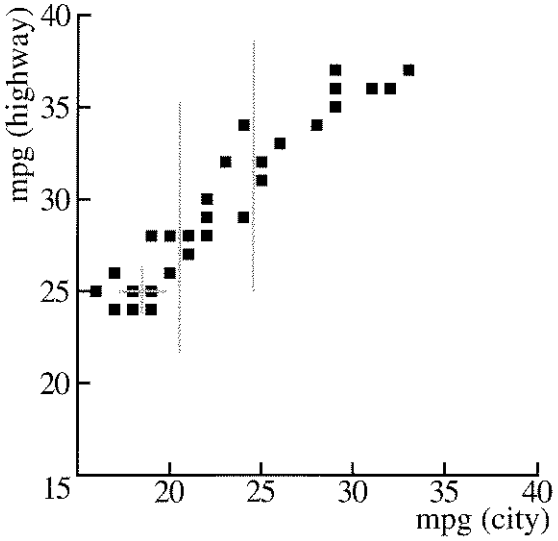
EPA Fuel Efficiency Data for 28 Cars with Manual Transmission		
Car	miles per gallon	
	City	**Highway**
Corvette	16	25
Firebird	17	26
Thunderbird	17	24
Nissan 300ZX	18	24
Subaru XT	18	25
Stealth	19	24
Saab 9000	19	25
Sunbird	19	28
Volvo 740	20	26
Shadow	20	28
Probe	21	27
Sonata	21	28
Nissan NX	22	28
Colt Vista	22	29
Celica	22	30
Eclipse	23	32
Accord	24	29
Acclaim	24	34
Capri	25	31
Cabriolet	25	32
Impulse	26	33
Geo Prizm	28	34
Colt 5-speed	29	35
Escort	29	36
Sentra	29	37
Colt 4-speed	31	36
Civic CRX	32	36
Tercel	33	37

1. Explain the meaning of the words *city mileage* and *highway mileage*.

Can average highway mileage be predicted from average city mileage? A graph of highway mileage versus city mileage shows that the data points lie approximately in a straight line. In this lesson you will learn a formal method for fitting a line to data. You can then use this line to make predictions for other cars.



2. On your own graph paper, make a full-page graph of the data. Your graph should have both scales starting at (0, 0). Use vertical lines to divide the data points into three approximately equal sets of points, as shown in the following graph. There are ten points in the first set, eight in the middle set, and ten in the third set.



Look at the first set of data points. In your table, this is (16, 25) through (20, 28). It is easy to see on the graph that the median of the x-values in this first set of points is 18.5, and the median of the y-values is 25. The median point is marked with a +. Five points are to the left of it and five to the right. Five points are below it, (or even with it), and five are above, (or even with it).

3. Plot the point (18.5, 25) on your graph to show the medians of the x-values and y-values. Mark it with a +.

4. Find the median of the x-values and the median of the y-values for the second set of points. Mark it with a +.

5. Repeat for the third set of points.

The three +'s do not all lie exactly on the same line, but we can find a line that is close to all of them.

6. Place your ruler next to the first + and the third +, as if you were going to connect them with a line, but do not draw a line. Instead, move your ruler slightly toward the second +, about one-third of the way. Then draw the line.

7. Using two points on the line, find its equation. (Use points on the line, not actual data points — unless they happen to lie on the line.)

The line for which you found the equation is called the *median-median* line. Its equation provides an approximate relationship between city and highway mileage for a given car.

EXAMINING THE MODEL

Summary

8. What is the slope of the fitted line? What is its meaning in terms of this application?

9. What is the y-intercept of your line? What is its meaning in terms of this application?

10. Find two data points that are at least two units above the fitted line. What cars do they represent? What does it mean for points to be above the fitted line?

11. Find two data points that are at least two units below the fitted line. What cars do they represent? What does it mean for points to be below the fitted line?

12. Find two data points that are exactly on the line, or very near it. What cars do they represent? What does it mean for points to be on or near the fitted line?

USING THE MODEL

13. Using your model (the equation of your fitted line), predict the highway mileage for a car that got city mileage of:

a. 30 miles per gallon;

b. 27 miles per gallon.

14. For a city mileage of 26, what is the

a. actual highway mileage based on the data?

b. predicted highway mileage based on the fitted line?

15. For a highway mileage of 28,

a. what range of city mileages might you expect, based on the data?

b. what city mileage would you expect, based on the fitted line?

EXTENDING THE MODEL

16. Use the equation of the fitted line to predict highway mileage, if the city mileage is the following:

a. 53 b. 11

17. Based on your model, what city mileage would you expect for highway mileage of:

a. 58? b. 15?

Car	miles per gallon	
	City	**Highway**
Lamborghini	9	14
Ferrari	10	15
BMW M5	11	20
Suzuki Swift	45	50
Civic HF	49	52
Geo Metro	53	58

This table shows data for cars with very high and very low mileage.

18.

a. Does your model seem to work for very high and very low values?

b. For what range of values does your model work well? Explain.

YOUR OWN DATA

19. **Project** Collect your own data (at least twenty *pairs* of numbers), either from an almanac, newspaper, or magazine, or by surveying people you know. Graph the data. *If the points seem to fall more or less in a line*, find the median-median line and find an equation for it. In any case, write a paragraph about what you find out. The following are possible topics, but you may choose any two variables which are related.

a. arm span vs. height

b. weight vs. height

c. height vs. shoe size

d. points scored vs. time on the court

e. hits vs. times at bat