

A.P. Statistics – Linear Regression Worksheet

The busiest season for Walmart is the Christmas holiday and weekends see a tremendous number of customers. Last year, Walmart conducted a study as to the amount of waiting in time in checkout lanes its customers had to wait. On Saturdays and Sundays of its holiday season, it opened a different number of checkout lanes for customers between 1 PM and 4 PM, its busiest times. The measurement was the average wait time for a customer to go through the lane and complete the transaction. A different number of lanes was opened each day. The data is below.

Date	11/22	11/23	11/29	11/30	12/6	12/7	12/14	12/15	12/21	12/22	12/29	12/30
Weather	Sun	Cloudy	Sun	Rain	Sun	Sun	Cloudy	Cloudy	Cloudy	Rain	Snow	Sun
Lanes	5	12	11	7	12	8	6	10	8	6	4	8
Avg Wait Time (Min)	12.2	4.2	4.4	6.75	3.8	5.75	10.4	6.5	6.25	9.2	1.1	5.6

1. What is the explanatory variable? _____ What is the response variable? _____.
2. For answer # 1, make a scatterplot on your calculator and draw it below.

3. There is a clear outlier on your scatterplot. Circle it.
4. Give a reason that would justify eliminating the outlier. _____
5. Generate the least squares regression line that describes the data (with the outlier eliminated). (2 dec places). _____
6. Give the meaning of the slope in the LSRL. _____
7. What specific point is the LSRL guaranteed to go through? _____
8. Describe the data in terms of form, direction, and strength. _____
9. Find the value of r . _____ Interpret it. _____
10. Find the value of r^2 . _____ Interpret it. _____
11. What is the predicted average waiting time if Walmart opens 9 lanes? _____
12. What is the predicted average waiting time if Walmart opens 7 lanes? _____
13. What is the difference between the actual waiting time and predicted waiting time for 7 lanes? _____
14. If Walmart decides that it wants its customers to wait no longer than 4.5 minutes, how many lanes should it open? _____
15. If Walmart decides that it wants its customers to wait no longer than 10 minutes, how many lanes should it open? _____
16. What is the predicted average waiting time if Walmart opens only one lane? _____
17. What is the predicted average waiting time if Walmart opens 20 lanes? _____
18. Why do the last two problems and answers make little sense for this problem? _____

On the same days of the previous problem, Walmart will need to hire extra staff to man the checkout lanes. They will have to pay out more money for the workers. The chart below describes how much money in pay it paid out during those hours on these specific days.

Date	11/22	11/23	11/29	11/30	12/6	12/7	12/14	12/15	12/21	12/22	12/29	12/30
Weather	Sun	Cloudy	Sun	Rain	Sun	Sun	Cloudy	Cloudy	Cloudy	Rain	Snow	Sun
Lanes	5	12	11	7	12	8	6	10	8	6	4	8
Avg Wait Time (Min)	12.2	4.2	4.4	6.75	3.8	5.75	10.4	6.5	6.25	9.2	1.1	5.6
Salary for extra staff	\$213	\$451	\$444	\$256	\$498	\$301	\$229	\$364	\$291	\$253	xxxx	\$320

19. What is the explanatory variable? _____ What is the response variable _____.
20. For answer # 19, make a scatterplot on your calculator and draw it below.

21. Generate the least squares regression line that describes the data and draw it on the graph above.
2 dec places) _____

22. Give the meaning of the slope in the LSRL. _____

23. What specific point is the LSRL guaranteed to go through? _____

24. Describe the data in terms of form, direction, and strength. _____

25. Find the value of r . _____ Interpret it. _____

26. Find the value of r^2 . _____ Interpret it. _____

27. What is the predicted extra salary if Walmart opens 9 lanes? _____

28. What is the predicted extra salary if Walmart opens 7 lanes? _____

29. What is the difference between the actual extra salary and predicted extra salary for 7 lanes? _____

30. If Walmart will pay no more than \$500 in extra salary, find the maximum lanes it can open. _____

31. If Walmart will pay no more than \$250 in extra salary, how the maximum lanes it can open. _____

32. What is the predicted extra salary if Walmart opens no lanes? _____

33. What is the predicted extra salary if Walmart opens 50 lanes? _____

34. Why do the last two problems and answers make little sense for this problem? _____

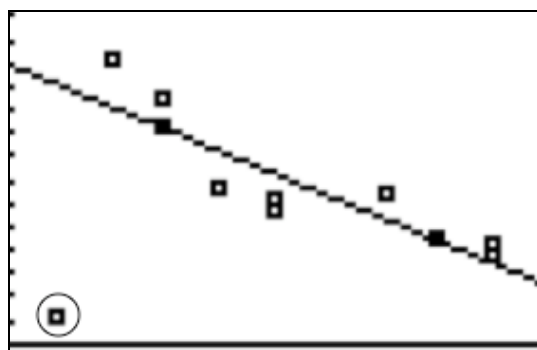
35. A Walmart manager needs to decide how many lanes to open. Based on the data of the and the previous page, explain the dilemma he has in making a decision.

A.P. Statistics – Linear Regression Worksheet - Solutions

The busiest season for Walmart is the Christmas holiday and weekends see a tremendous number of customers. Last year, Walmart conducted a study as to the amount of waiting in time in checkout lanes its customers had to wait. On Saturdays and Sundays of its holiday season, it opened a different number of checkout lanes for customers between 1 PM and 4 PM, its busiest times. The measurement was the average wait time for a customer to go through the lane and complete the transaction. A different number of lanes was opened each day. The data is below.

Date	11/22	11/23	11/29	11/30	12/6	12/7	12/14	12/15	12/21	12/22	12/29	12/30
Weather	Sun	Cloudy	Sun	Rain	Sun	Sun	Cloudy	Cloudy	Cloudy	Rain	Snow	Sun
Lanes	5	12	11	7	12	8	6	10	8	6	4	8
Avg Wait Time (Min)	12.2	4.2	4.4	6.75	3.8	5.75	10.4	6.5	6.25	9.2	1.1	5.6

- What is the explanatory variable? Lanes What is the response variable? Avg wait.
- For answer # 1, make a scatterplot on your calculator and draw it below.



$x = \text{lanes}, y = \text{avg wait}$

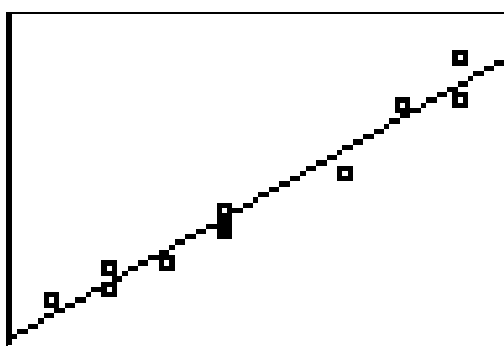
- There is a clear outlier on your scatterplot. Circle it.
- Give a reason that would justify eliminating the outlier. It was snowing. Few customers.
- Generate the least squares regression line that describes the data (with the outlier eliminated). (2 dec places). $\hat{y} = -0.96x + 14.96$
- Give the meaning of the slope in the LSRL. For every extra lane open, .96 minute less of a wait.
- What specific point is the LSRL guaranteed to go through? $(\bar{x}, \bar{y}) = (8.45, 6.82)$
- Describe the data in terms of form, direction, and strength. Fairly strong negative linear correlation
- Find the value of r . $r = -.88$ Interpret it. Fairly strong negative linear correlation
- Find the value of r^2 . $r^2 = .78$ Interpret it. 78% of the variation in waiting time can be explained by the LSRL.
- What is the predicted average waiting time if Walmart opens 9 lanes? 6.32 minutes
- What is the predicted average waiting time if Walmart opens 7 lanes? 8.24 minutes
- What is the difference between the actual waiting time and predicted waiting time for 7 lanes? -1.5 min
- If Walmart decides that it wants its customers to wait no longer than 4.5 minutes, how many lanes should it open? 11 lanes.
- If Walmart decides that it wants its customers to wait no longer than 10 minutes, how many lanes should it open? 6 lanes
- What is the predicted average waiting time if Walmart opens only one lane? 14 min.
- What is the predicted average waiting time if Walmart opens 20 lanes? -4.24 min
- Why do the last two problems and answers make little sense for this problem? Extrapolation is always dangerous. The minimum waiting time must be positive.

On the same days of the previous problem, Walmart will need to hire extra staff to man the checkout lanes. They will have to pay out more money for the workers. The chart below describes how much money in pay it paid out during those hours on these specific days.

Date	11/22	11/23	11/29	11/30	12/6	12/7	12/14	12/15	12/21	12/22	12/29	12/30
Weather	Sun	Cloudy	Sun	Rain	Sun	Sun	Cloudy	Cloudy	Cloudy	Rain	Snow	Sun
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Avg Wait Time (Min)	12.2	4.2	4.4	6.75	3.8	5.75	10.4	6.5	6.25	9.2	1.1	5.6
Salary for extra staff	\$213	\$451	\$444	\$256	\$498	\$301	\$229	\$364	\$291	\$253	xxxx	\$320

19. What is the explanatory variable? Lanes What is the response variable Salary.

20. For answer # 19, make a scatterplot on your calculator and draw it below.



$x = \text{lanes}, y = \text{salary}$

21. Generate the least squares regression line that describes the data and draw it on the graph above.

2 dec places) $\hat{y} = 38.72x + 1.71$

22. Give the meaning of the slope in the LSRL.

For every extra lane opened up, Walmart pays \$38.72 in extra salary

23. What specific point is the LSRL guaranteed to go through? $(\bar{x}, \bar{y}) = (8.45, 329.09)$

24. Describe the data in terms of form, direction, and strength. Strong positive linear association.

25. Find the value of r . $r = .98$ Interpret it. Strong positive linear association.

26. Find the value of r^2 . $r^2 = .96$ Interpret it.

96% of the variation in Salary can be explained by the LSRL.

27. What is the predicted extra salary if Walmart opens 9 lanes? \$350.19

28. What is the predicted extra salary if Walmart opens 7 lanes? \$272.75

29. What is the difference between the actual extra salary and predicted extra salary for 7 lanes? -\$16.75

30. If Walmart will pay no more than \$500 in extra salary, find the maximum lanes it can open. 12

31. If Walmart will pay no more than \$250 in extra salary, how the maximum lanes it can open. 6

32. What is the predicted extra salary if Walmart opens no lanes? \$1.71

33. What is the predicted extra salary if Walmart opens 50 lanes? \$19.37.71

34. Why do the last two problems and answers make little sense for this problem?

Extrapolation is dangerous. It shouldn't cost anything extra to open no lanes and no Walmart has 50 lanes.

35. A Walmart manager needs to decide how many lanes to open. Based on the data of the and the previous page, explain the dilemma he has in making a decision.

Open too few lanes, they don't pay much extra money but people have a long waiting time.

Open too many lane, people have a very short waiting period, but they pay a lot more money.