LAB: INTRO TO STAT ANALYSIS

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Office Hours: JC 201, Tuesday 4-5 PM & Thursday 3-4 PM

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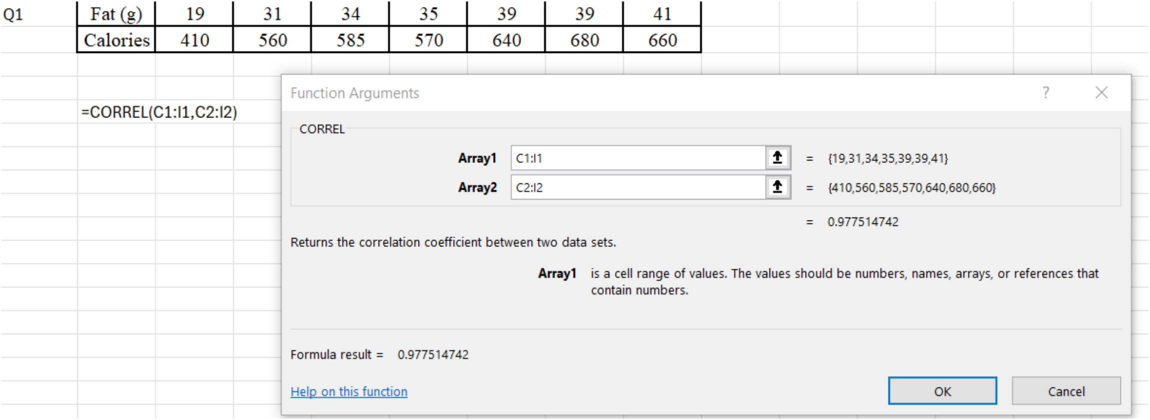
Question 1

- Fast food is often considered unhealthy because much of it is high in fat and calories. Are **fat** and **calories** related? Analyze the association between fat content and calories by calculating the correlation coefficient and drawing a scatterplot (Use a computer)

Fat (g)	19	31	34	35	39	39	41
Calories	410	560	585	570	640	680	660

Question 1



Q1	Fat (g)	19	31	34	35	39	39	41
	Calories	410	560	585	570	640	680	660

=CORREL(C1:I1,C2:I2)

CORREL

Array1 C1:I1 = {19,31,34,35,39,39,41}

Array2 C2:I2 = {410,560,585,570,640,680,660}

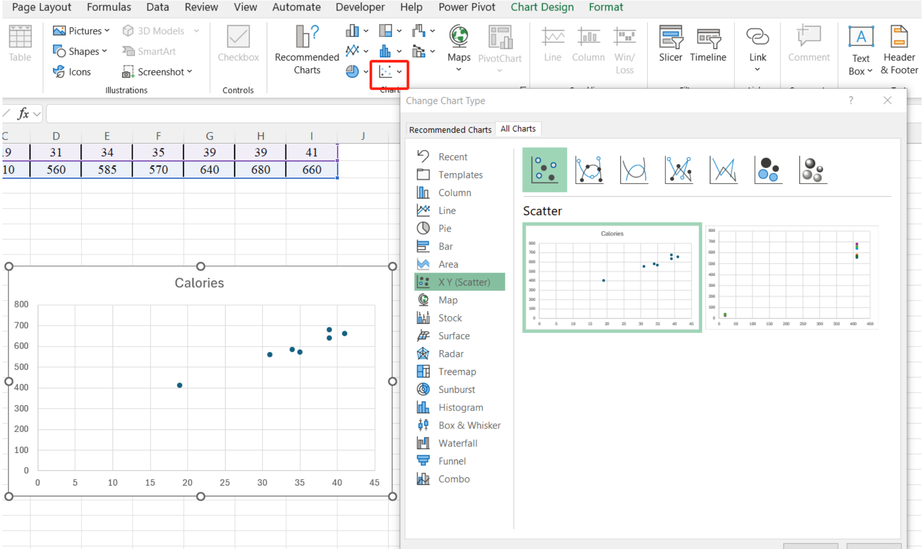
= 0.977514742

Returns the correlation coefficient between two data sets.

Array1 is a cell range of values. The values should be numbers, names, arrays, or references that contain numbers.

Formula result = 0.977514742

Question 1



C	D	E	F	G	H	I	J
.9	31	34	35	39	39	41	
10	560	585	570	640	680	660	

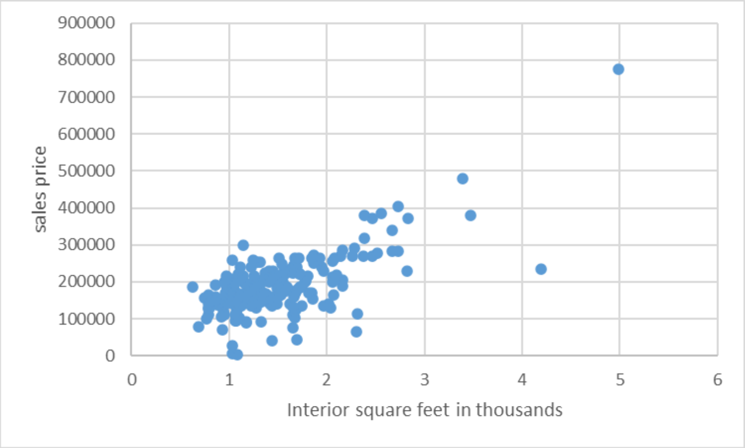
Question 2

This question asks you to work with housing sales data from the 01602 zip code of Worcester, which is across Park Ave from the Clark neighborhood. All of the houses are single-family houses. Please use the Excel Spreadsheet that is on the page for this assignment.

- a. Please use the “Single Family” Tab first. Please find the scatterplot for **floor area of the house (interior square feet in thousnds)** and **sales price**. Why would it seem to make the most sense to put the floor area on the “x-axis and the sales price on the “y-axis.”?

It is logical to treat sales price as something that responds to changes in floor area

Question 2: a



- It is logical to treat sales price as something that responds to changes in floor area

Question 2: b

- b. Please describe the scatterplot you have created according to these criteria:
  - i. direction of association (positive or negative?) **positive**
  - ii. is the form curved, straight, or “exotic?” **straight (linear)**
  - iii. is the strength of association apparently strong or weak? **strong**

Question 2: c

- c. Using the data from the “Single Family” tab, calculate the correlation coefficient by hand and then check your work using the excel command. **(0.688743)**

$$Z_{x_i} = \frac{x_i - \bar{x}}{Stdev_x}, \quad Z_{y_i} = \frac{y_i - \bar{y}}{Stdev_y}$$

$$r = \sum_{i=1}^{n} \frac{Z_{x_i} Z_{y_i}}{n-1}$$

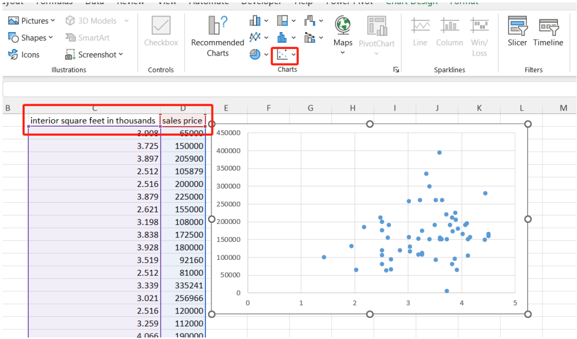
- Order of calculation by hand
  - Mean of x & y
  - Deviation from x & deviation from y
  - Stdev of x & y
  - Z score of x & y
  - Correlation

Question 2: d

- d. Using the data on the “Three Family” tab, you will find three-family houses that were sold in the adjacent 01603 zip code that is in South Worcester further down Main Street away from downtown. Please find the same kind of scatter plot that you did in part a., but now it will be for three-family houses and describe it using the criteria in part b.:
    - i. direction of association (positive or negative?)
    - ii. is the form curved, straight, or “exotic?”
    - iii. is the strength of association apparently strong or weak?

Question 2: d

- Positive
- Straight, though there is a considerable spread in the data points
- (Moderate to) Strong
- Other factors may also play a significant role, leading to the observed variability

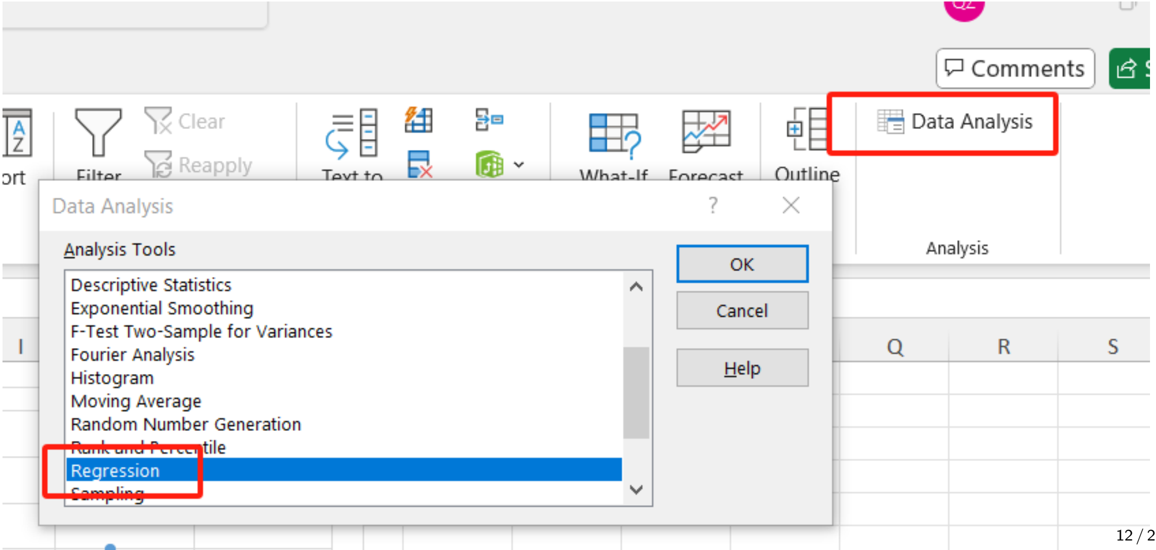


interior square feet in thousands	sales price
3.908	65000
3.725	150000
3.897	205900
2.512	105879
2.516	200000
3.879	225000
2.621	155000
3.198	108000
3.838	172500
3.928	180000
3.519	92160
2.512	81000
3.339	335241
3.021	256966
2.516	120000
3.259	112000
4.066	190000

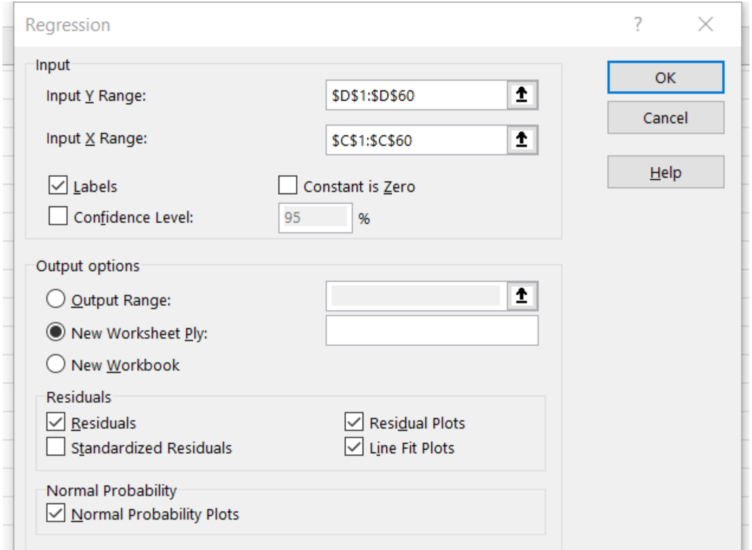
Question 2: e & f

- e. Using the data on the “Three Family” tab, test the regression assumptions
  - Linearity Assumption
  - Independence Assumption
  - Equal Variance Assumption
  - Normal Population Assumption
- f. Estimate a regression model using Excel. What is the interpretation of the coefficients (i.e., put the coefficients in a sentence)?

Question 2: e & f



Question 2: e & f



Regression

Input

Input Y Range: $D$1:$D$60

Input X Range: $C$1:$C$60

☑ Labels

□ Constant is Zero

□ Confidence Level: 95 %

Output options

○ Output Range:

● New Worksheet Ply:

○ New Workbook

Residuals

☑ Residuals

☑ Residual Plots

□ Standardized Residuals

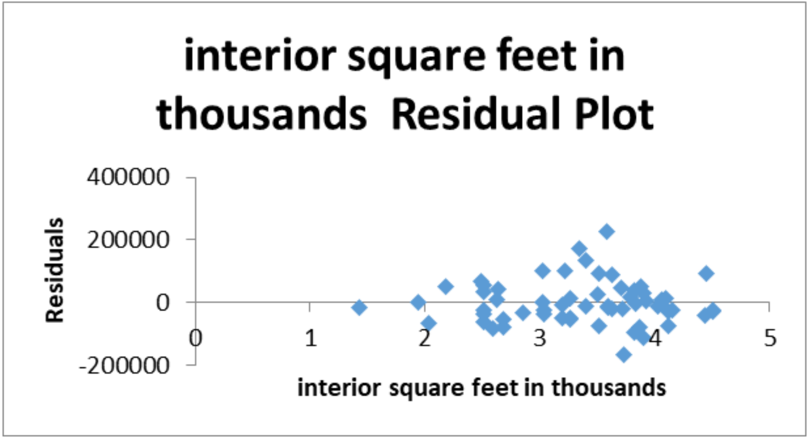
☑ Line Fit Plots

Normal Probability

☑ Normal Probability Plots

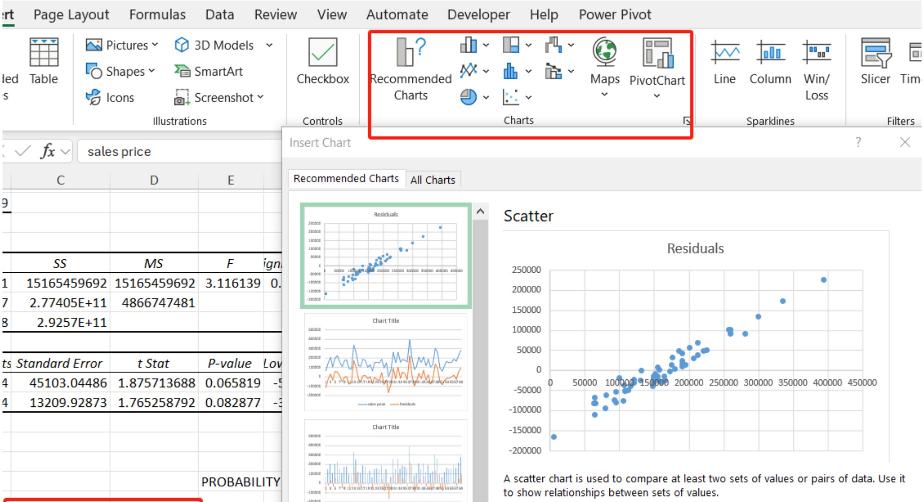
Question 2: e & f

- Independence Assumption



Question 2: e & f

- Linearity Assumption **Put y into new sheet**



sales price

	C	D	E	
9				
	SS	MS	F	igni
1	15165459692	15165459692	3.116139	0.
7	2.77405E+11	4866747481		
8	2.9257E+11			
ts	Standard Error	t Stat	P-value	Low
4	45103.04486	1.875713688	0.065819	-5
4	13209.92873	1.765258792	0.082877	-3

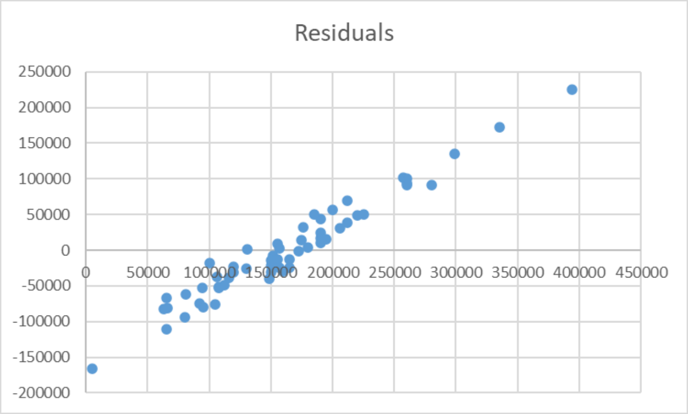
PROBABILITY

Scatter

A scatter chart is used to compare at least two sets of values or pairs of data. Use it to show relationships between sets of values.

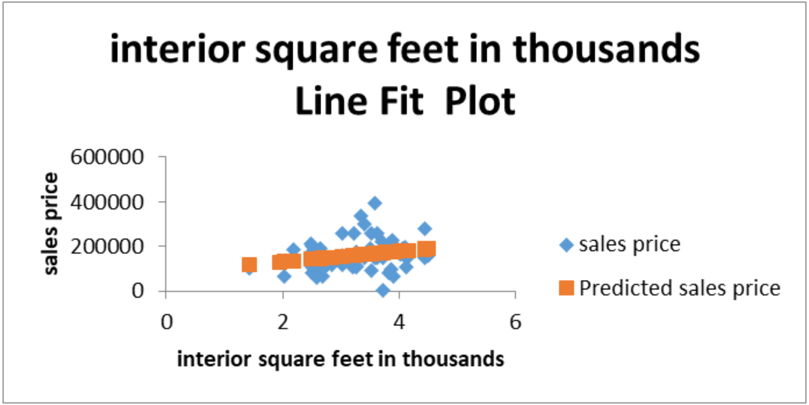
Question 2: e & f

- Linearity Assumption



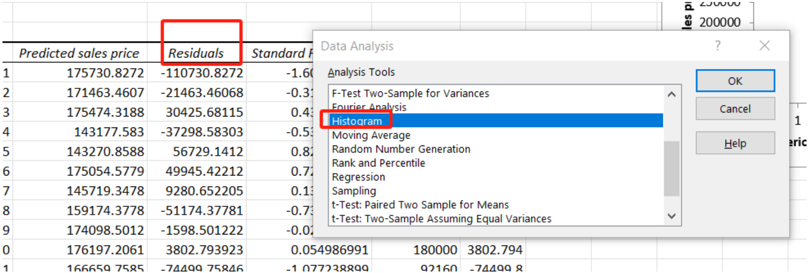
Question 2: e & f

- Equal Variance Assumption



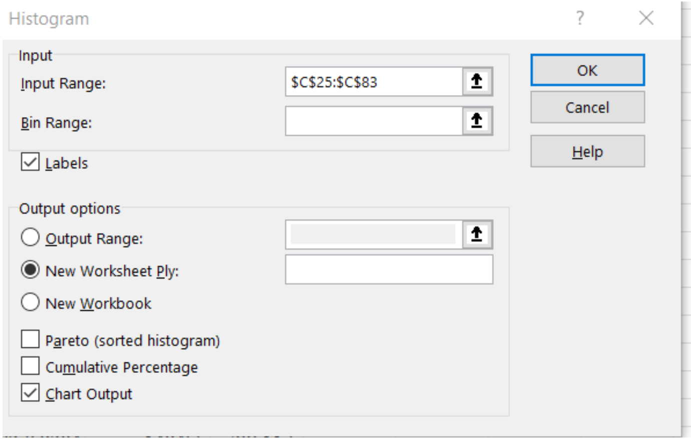
Question 2: e & f

- Normal Population Assumption



	Predicted sales price	Residuals	Standard F		
1	175730.8272	-110730.8272	-1.60		
2	171463.4607	-21463.46068	-0.31		
3	175474.3188	30425.68115	0.43		
4	143177.583	-37298.58303	-0.53		
5	143270.8588	56729.1412	0.82		
6	175054.5779	49945.42212	0.72		
7	145719.3478	9280.652205	0.13		
8	159174.3778	-51174.37781	-0.73		
9	174098.5012	-1598.501222	-0.02		
0	176197.2061	3802.793923	0.054986991	180000	3802.794
1	166659.7585	-74499.75846	-1.077238899	92160	-74499.8

Question 2: e & f



Histogram

Input

Input Range: $C$25:$C$83

Bin Range:

☑ Labels

Output options

○ Output Range:

● New Worksheet Ply:

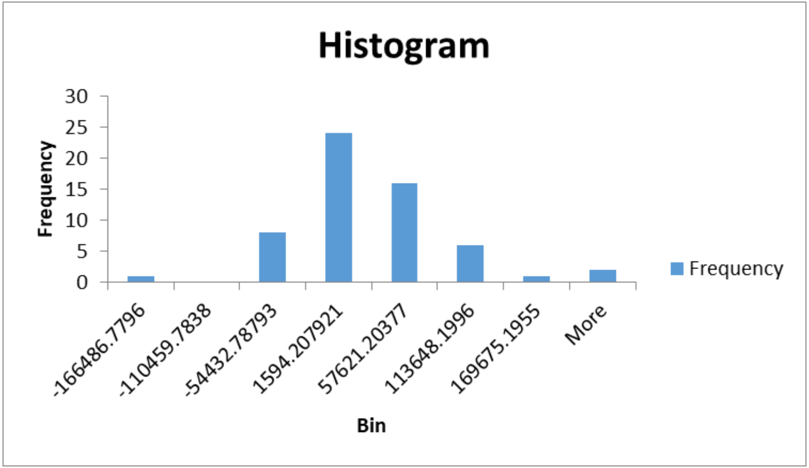
○ New Workbook

□ Pareto (sorted histogram)

□ Cumulative Percentage

☑ Chart Output

Question 2: e & f



Question 2: e & f

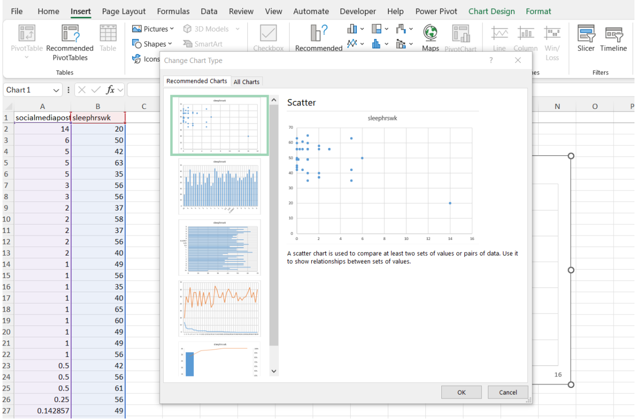
- All else being equal, for each additional 1,000 square feet of house area, the expected increase in the sales price is $23,318.94

Question 3

For this question, please use the data from the student survey on social media use (“socialmedia&sleep” Tab).

- a. Find the scatter diagram for social media posts per day and hours of sleep per week.
- b. Find the correlation coefficient using excel.
- c. Suppose that we multiplied the “posts per day” variable by 7 so that it was measured in terms of weeks (rather than days). Would that influence the correlation coefficient (r)? How?
- d. Calculate the mean and standard deviation of the two variables. Then calculate the regression slope and regression intercept by hand. Write out the regression model.
- e. Estimate the regression model using Excel. Do the answers in d. and e. match?

Question 3: a & b & c



	A	B
1	socialmediapost	sleephrswk
2	14	20
3	6	50
4	5	42
5	5	63
6	5	35
7	3	56
8	3	56
9	2	37
10	2	58
11	2	37
12	2	56
13	2	40
14	1	49
15	1	56
16	1	35
17	1	40
18	1	65
19	1	60
20	1	49
21	1	49
22	1	56
23	0.5	42
24	0.5	56
25	0.5	61
26	0.25	56
27	0.142857	49

A scatter chart is used to compare at least two sets of values or pairs of data. Use it to show relationships between sets of values.

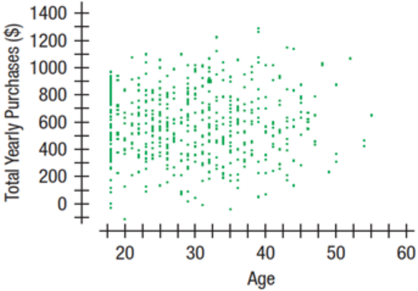
- r=CORREL(A2:A40,B2:B40)=-0.477231403
- If we multiplied the “posts per day” variable by 7, r =-0.477231403 still holds

Question 3: d & e

- hours of sleep per week = b0 + b1 social media posts per day
- mean of x =AVERAGE(A2:A40)=1.59
- mean of y =AVERAGE(B2:B40)=49.76
- Stdev of x =STDEV(A2:A40)=2.59
- Stdev of y =STDEV(B2:B40)=9.53
- b1=r Sy/Sx =SLOPE(B2:B40,A2:A40)=1.75
- b0=mean of y - b1 mean of x =INTERCEPT(B2:B40,A2:A40)=52.55
- **Data Analysis** will give you same answaer

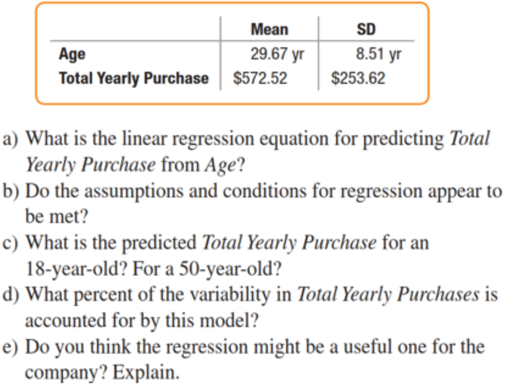
Question 4

Online clothes An online clothing retailer keeps track of its customers' purchases. For those customers who signed up for the company's credit card, the company also has information on the customer's *Age* and *Income*. A random sample of 500 of these customers shows the following scatterplot of *Total Yearly Purchases* by *Age:*



The correlation between *Total Yearly Purchases* and *Age* is $r = 0.037$. Summary statistics for the two variables are:

Question 4



	Mean	SD
Age	29.67 yr	8.51 yr
Total Yearly Purchase	$572.52	$253.62

a) What is the linear regression equation for predicting *Total Yearly Purchase* from *Age*?

b) Do the assumptions and conditions for regression appear to be met?

c) What is the predicted *Total Yearly Purchase* for an 18-year-old? For a 50-year-old?

d) What percent of the variability in *Total Yearly Purchases* is accounted for by this model?

e) Do you think the regression might be a useful one for the company? Explain.

Question 4

- Total Yearly Purchases = b0 + b1 Age
- b1=r Sy/Sx = 11.37
- b0=mean of y - b1 mean of x =268.56
- Total Yearly Purchases=268.56+11.37×Age
- R2=0.001369
- If age=18, predicted y=268.56+11.37×18=473.22
- If age=50, predicted y=268.56+11.37×50=837.06