INSTRUCTIONS:
Write your name, lab section #, and ID# above. Note the statement at the bottom of this page that you must sign when you are finished with the exam.

Supply the following information on SIDE ONE of the scantron sheet:

⇒ Enter your name (last name first!) in the "name" section; no nicknames! FILL IN THE BUBBLES.
⇒ Enter your 3 digit lab section number in the "special code" section. FILL IN THE BUBBLES.
⇒ Enter your social security number in the "identification number" section. FILL IN THE BUBBLES.
⇒ IMPORTANT! Enter the version number (either "1", "2" or "3") of your copy of the exam in the section marked "GRADE OR EDUCATION". The version number of this test is 1. BUBBLE IN THIS NUMBER!

There are 28 multiple choice questions. On the test circle the letter that corresponds to the answer you select. Also indicate your selection on the opscan sheet. Use a #2 pencil!

• For each wrong answer 4 points will be subtracted from 100.

• When you are finished: separate your scantron sheet from the test!
  i) place your scantron sheet in the folder labeled with your version of the test
  ii) place the cover page of your test on the left side of the stage in the appropriate lab section stack
GOOd LUCK!!

Statement of academic honesty:

I have neither given assistance to another student nor received assistance from another student while taking this exam.

Signed__________________________
1. A sample of 44 cordless telephones had a sample mean working range $\bar{x}$ of 142 feet and a sample standard deviation $s = 12$ feet. A 98% confidence interval for the mean working range $\mu$ is
   a. (139.02, 144.98)  b. (138.45, 145.55)  c. (137.79, 146.21)  d. (137.34, 146.66)  e. (137.63, 146.37)

2. If the level of confidence is changed from 90% to 95% and the sample size remains the same, then
   a. this means that the interval is less likely to include the population value
   b. this means that the interval is more likely to include the population value
   c. this means that the interval will necessarily be narrower
   d. this means that the probability of error has increased
   e. the 95% confidence interval will be 5% longer than the 90% confidence interval

3. A study reports that a 95% confidence interval for the mean SAT math score $\mu$ of Illinois high school seniors is 452 to 470. The correct statistical interpretation of this interval is that
   a. 95% of Illinois high school seniors have SAT math scores between 452 and 470
   b. there is a 95% chance that the true mean SAT math score $\mu$ of Illinois high school seniors is in the interval (452, 470).
   c. the probability is .95 that an individual Illinois high school senior will score between 452 and 470 on the SAT math test
   d. if we take many samples of Illinois high school senior SAT math scores and compute the sample mean $\bar{x}$ for each sample, 95% of the sample means will be in the interval (452, 470).
   e. we are 95% confident that the interval (452, 470) contains the true mean SAT math score $\mu$ of Illinois high school seniors.

4. The scatter plot below is from a small data set.

   ![Scatter plot](image)

   The data were classified as either of type 1 or of type 2. Those of type 1 are indicated by o's and those of type 2 by x's. The overall correlation of the data in this scatterplot is
   a. positive.
   b. negative, since the o's display a negative trend and the x's display a negative trend.
   c. near 0, since the o's display a negative trend and the x's display a negative trend, but the trend from the o's to the x's is positive. The different trends cancel.
   d. near 0 because of the gap between the two groups of data

5. Twenty-five weather stations measure rainfall at random locations in a state. In 2005 they recorded a mean rainfall of $\bar{x} = 12$ inches with a standard deviation $s = 1.2$ inches. Construct a 95% confidence interval for the mean rainfall $\mu$ in this state in 2005.
   a. (11.505, 12.495)  b. (11.530, 12.470)  c. (11.906, 12.094)  d. (11.571, 12.429)
6. The following is a scatter plot of the calories and sodium content of several brands of meat hot dogs. The least-squares regression line has been drawn in on the plot.

Referring to the scatter plot above, the value of the residual for the point labeled x is about
a. 40  b. 1300  c. 425  d. −45  e. 380

7. We have calculated a 95% confidence interval and would prefer for our next confidence interval to have a smaller margin of error without losing any confidence. In order to do this, we can
   I. change the $z^*$ value to a smaller number.
   II. take a larger sample.
   III. take a smaller sample.
   a. I only  b. II only  c. III only  d. I and II  e. I and III

Questions 8 and 9 refer to the following information:
A biologist has collected bivariate data where the independent ($x$) variable is the number of cricket chips per minute and the dependent ($y$) variable is the temperature in °F. The data can be summarized as follows:
$n = 7, \bar{x} = 17.429, s_x = 1.988, \bar{y} = 80.571, s_y = 8.696, r = .976$

8. The slope of the least squares line is approximately
   a. 6.13  b. 4.27  c. .234  d. .163  e. .976

9. What proportion of the variation in temperature ($y$) is explained by the linear relationship between the number of cricket chirps ($x$) and temperature?
   a. .024  b. .976  c. $\frac{1.988}{8.696}$  d. $\left(0.976\right)^2$  e. $\frac{17.429}{80.571}$

10. In developing a confidence interval for a population mean $\mu$ from sample data, the confidence interval was 52.84 to 59.84. The population standard deviation was assumed to be 6.50, and a sample of 100 observations was used. The mean $\bar{x}$ of the sample was
   a. 56.34  b. 62.96  c. 13.24  d. 66.15  e. 65.00

11. The correlation coefficient between the hours that a person is awake during a 24-hour period and the hours that same person is asleep during the same 24-hour period is
   a. exactly +1.0  b. near +0.8  c. near 0  d. near -0.8  e. exactly -1.0
12. Select the one choice a., b., c., d or e. that gives the correlation $r$ for all the scatterplots shown below. For example, the choice (A: $+0.5$; B: $-0.5$; C: near 0; D: $+1.0$) means scatterplot A has correlation $+0.5$, scatterplot B has correlation $-0.5$, scatterplot C has correlation near 0, and scatterplot D has correlation $+1.0$.
   a. (A: $+0.5$; B: $-0.5$; C: near 0; D: $+1.0$)  
   b. (A: $+1.0$; B: $-1.0$; C: near 0; D: near 0)  
   c. (A: near 0; B: near 0; C: $-0.9$; D: $0.5$)  
   d. (A: $+0.5$; B: $-0.5$; C: $-1.0$; D: $+1.0$)  
   e. (A: $+1.0$; B: $-1.0$; C: $-0.9$; D: $+0.95$)

13. You are interested in purchasing a new car. One of the many points you wish to consider is the resale value of the car after 5 years. Since you are particularly interested in a certain foreign sedan, you decide to estimate the resale value of this car with a 99% confidence interval. You manage to obtain data on 17 recently resold 5-year-old foreign sedans of the same model. These 17 cars were resold at an average price of $12,610 with a standard deviation of $700. What is the 99% confidence interval for the true mean resale value of a 5-year-old car of this model?
   a. $12,610 \pm 2.9208$  
   b. $12,610 \pm 2.8982$  
   c. $12,610 \pm 2.58$  
   d. $12,610 \pm 2.9208$  
   e. $12,610 \pm 2.9208\sqrt{\frac{700}{17}}$

14. Circle the letter of the one statement below that does not contain a mistake.
   a. The correlation between height and weight is 0.568 inches per pound.  
   b. The correlation between weight and length of foot is 0.488.  
   c. The correlation between the breed of a dog and its weight is 0.435.  
   d. There is a high correlation (1.09) between the height of a corn stalk and its age in weeks.  
   e. If the correlation between blood alcohol level and reaction time is 0.73, then the correlation between reaction time and blood alcohol level is -0.73.
Use the following information to answer questions 15 and 16.
A philosophy professor has found a correlation of 0.80 between the number of hours students study for his exams and their exam score. During the time he collected the data, students studied an average of 10 hours with a standard deviation of 2.5 hours, and scored an average of 82 points with a standard deviation of 7.5 points.

15. Calculate the slope of the least squares regression line where the x-variable is the number of hours students study for the professor's exams and the y-variable is their exam score.
   a. 0.267  b. 0.80  c. 3.0  d. 2.40  e. 0.33

16. A particular student usually studies 5 hours for an exam. If this student studies an additional 2 hours for an exam, on average by how many points will the student's exam score change?
   a. increase by 0.80  b. increase by 6.0  c. decrease by 6.0  d. increase by 4.8  decrease by 4.8

17. A lakeside restaurant uses a least squares line to predict the number of meals they will serve in a day (the y-variable) from the daily temperature (the x-variable). The correlation between the daily temperature and the number of meals they serve is \( r = 0.40 \). On a day when the temperature is 2 standard deviations above the mean, the number of meals they should plan on serving is ____ the mean?
   a. equal to  b. 0.16 SD above  c. 0.4 SD above  d. 0.8 SD above  e. 2.0 SD above

18. An economist studying energy trends used data for the years 1995 to 2005 to construct a least squares line where the independent variable (\( x \)) is the price (in US dollars) of a barrel of crude oil and the dependent variable (\( y \)) is the price (in cents) of a gallon of gasoline. The least squares prediction line is \( \hat{y} = 33.42 + 2.93x \). Choose the correct interpretation of the slope of the least squares line.
   a. If the price of a barrel of crude oil increases by $2.93, the price of a gallon of gasoline increases by 1¢.
   b. If the price of a barrel of crude oil increases by $2.93, the price of a gallon of gasoline increases by 33.42¢.
   c. If the price of a barrel of crude oil increases by $1, the price of a gallon of gasoline increases by 2.93¢.
   d. If the price of a barrel of crude oil increases by $1, the price of a gallon of gasoline increases by 33.42¢.

19. A student wonders if people of similar heights tend to date each other. She measures herself and five other women in her dormitory. Then she measures the height of the next man each woman dates. The data are shown in the table below (heights are in inches).

<table>
<thead>
<tr>
<th>Women (x)</th>
<th>66</th>
<th>64</th>
<th>66</th>
<th>65</th>
<th>70</th>
<th>65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men (y)</td>
<td>72</td>
<td>68</td>
<td>70</td>
<td>68</td>
<td>74</td>
<td>69</td>
</tr>
</tbody>
</table>

The summary data is as follows: \( \bar{x} = 66, s_x = 2.10, \bar{y} = 70.17, s_y = 2.40, r = .913 \)
If women height is the x-variable and men height is the y-variable, the slope of the least squares line is:
   a. 0.9565  b. 1.043  c. -0.9565  d. 0.913  e. 1.167

20. Medical research indicate that people with more education tend to live longer. Let \( x \) be a person's years of education and \( y \) the person's lifespan. The slope of the least squares line that predicts lifespan from years of education is 0.8 and the correlation between the variables \( x \) and \( y \) is 0.48. If a medical researcher wants to reverse the roles of the variables and predict years of education from lifespan, what is the slope of the line that predicts years of education from lifespan?
   a. 0.288  b. \( \frac{1}{0.8} \)  c. -0.8  d. \( -\frac{1}{0.8} \)  e. \( \frac{0.8}{0.48} \)

21. Private colleges and universities rely on money contributed by individuals and corporations for their operating expenses. Much of this money is invested in a fund called an endowment, and the college spends only the interest earned by the fund. A recent survey of eight private colleges in the United States resulted in the following summary statistics for their endowments (in millions of dollars): \( \bar{x} = 180.975 \) and \( s = 143.042 \). Calculate a 99% confidence interval for the mean endowment of all private colleges in the United States.
   a. 180.975 ± 176.980  b. 180.975 ± 189.199  c. 180.975 ± 130.478  d. 180.975 ± 169.693
For a company to maintain a competitive edge in the marketplace, spending on research and development (R&D) is essential. To determine the optimum level for R&D spending and its effect on a company's value, a simple linear regression analysis was performed. Data collected for the largest R&D spenders was used to fit the straight-line model

\[ y = a + bx \]

where \( y \) = price/earnings (P/E) ratio, \( x \) = R&D expenditures/sales (R/S) ratio.

Questions 22 – 23 refer to the EXCEL computer output shown on the next page based on 20 companies used in the study.

**EXCEL Output**

**SUMMARY OUTPUT**

<table>
<thead>
<tr>
<th>Regression Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>R Square</td>
</tr>
<tr>
<td>Adjusted R Square</td>
</tr>
<tr>
<td>Standard Error</td>
</tr>
<tr>
<td>Observations</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>ANOVA</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>Significance F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1</td>
<td>86.40357</td>
<td>86.40357</td>
<td>20.090</td>
<td>0.0003</td>
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<tr>
<td>Residual</td>
<td>18</td>
<td>77.41393</td>
<td>4.30077</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td>163.8175</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Standard Error</th>
<th>t Stat</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>5.977162</td>
<td>0.91737112</td>
<td>6.516</td>
</tr>
<tr>
<td>R/S ratio</td>
<td>74.067607</td>
<td>16.5247840</td>
<td>4.482</td>
</tr>
</tbody>
</table>

22. The predicted value of the P/E ratio for a company with a R/S ratio of .08 is approximately
   a. 74.07   b. 12.851   c. 16.739   d. 13.414   e. 11.903

23. The proportion of the variation in the P/E ratio that is explained by the linear relationship between the P/E ratio and R/S ratio is
   a. .917   b. .726   c. .5274   d. .2782   e. .0003

24. The exercise habits of Russian male and female adults was compared. A random sample of Russian adults showed that 28% of 200 males exercise regularly compared to only 18% of 200 females who exercise regularly. Which formula calculates the 95% confidence interval for the difference in the proportions of Russian male and female adults who exercise regularly?
   a. \( .28 - .18 \pm 1.96 \sqrt{\frac{(\cdot.28)(\cdot.72)}{400}} + \frac{(\cdot.23)(\cdot.77)}{200} \)
   b. \( .28 - .18 \pm 1.96 \sqrt{\frac{(\cdot.28)(\cdot.72)}{200}} + \frac{(\cdot.23)(\cdot.77)}{200} \)
   c. \( .28 - .18 \pm 1.96 \sqrt{\frac{(\cdot.23)(\cdot.77)}{400}} + \frac{(\cdot.28)(\cdot.72)}{200} \)
   d. \( .28 - .18 \pm 1.96 \sqrt{\frac{(\cdot.28)(\cdot.72)}{200}} + \frac{(\cdot.18)(\cdot.82)}{200} \)
   e. \( .28 - .18 \pm 1.96 \sqrt{\frac{(\cdot.28)(\cdot.72)}{400}} + \frac{(\cdot.18)(\cdot.82)}{400} \)

25. Is it a good idea to listen to music when studying for a big test? In a study conducted by some Statistics students, 62 people were randomly assigned to listen either to rap music, music by Mozart, or no music while attempting to memorize objects pictured on a page. They were then asked to list all the objects they could remember. The data are summarized below.
Calculate a 99% confidence interval for the difference $\mu_1 - \mu_2$ in mean memory scores for students who study while listening to rap music and students who study while listening to Mozart. ($\mu_1$ is the mean memory score for students who listen to rap music). Use $\min(n_1 - 1, n_2 - 1)$ to estimate the degrees of freedom.

a. $(-1.933, 3.373)$  
b. $(-2.222, 3.662)$  
c. $(-0.839, 2.279)$  
d. $(-2.044, 3.484)$

Use the following to answer questions 26 and 27:

A major airline is concerned that the mean waiting time $\mu$ for customers at their ticket counter may be exceeding their target mean of 190 seconds. To test $H_0 : \mu = 190 \text{ vs. } H_A : \mu > 190$, the company selects a random sample of $n = 50$ customers and times them from when the customer first arrives at the checkout line until he or she is at the counter being served by the ticket agent. The mean time for this sample is $\bar{x} = 202$ seconds and the standard deviation is $s = 38$ seconds.

26. The value of the test statistic is
   a. $z = 2.268$  
b. $t = 2.233$  
c. $z = .3158$  
d. $t = -2.268$  
e. $t = -2.233$

27. Lower and upper bounds on the $P-value$ for this hypothesis test are:
   a. $(0.02, 0.05)$  
b. $(2.0096, 2.4049)$  
c. $(0.01, 0.025)$  
d. $(-2.4049, -2.0096)$  
e. $(-0.025, -0.01)$

28. If the hypothesis test $H_0 : \mu = 10 \text{ vs. } H_A : \mu \neq 10$ has test statistic value $t = 2.4786$ and a sample size $n = 27$, what is the $P-value$?
   a. $.025$  
b. $.05$  
c. $.01$  
d. $.02$  
e. $.005$

29. In testing the validity of a multiple regression model, a large value of the $F$-test statistic indicates that:
   a. most of the variation in the independent variables is explained by the variation in $y$  
b. most of the variation in $y$ is explained by the regression equation  
c. most of the variation in $y$ is unexplained  
d. the model provides a poor fit

30. A multiple regression model has the form
   $$\hat{y} = 5.25 + 2x_1 + 6x_2$$
   As $x_2$ increases by 1 unit, holding $x_1$ constant, then the value of $y$ will increase by:
   a. 2 units  
b. 7.25 units  
c. 6 units on average  
d. $\frac{6x_2}{2} = 4$ units on average

31. Data was collected on several characteristics of the U. S. movie theater industry. For the 19 years 1987 to 2005 data was collected for U. S. movie theater box office grosses (in $\text{billion}$), total number of movie admissions (billions), average U.S. ticket price ($\text{S}$), and number of movie screens. The Excel output (with some values omitted) for the multiple regression model with U. S. movie theater box office grosses as the response variable and the other variables as the explanatory variables is shown below.
Regression Statistics

Multiple R 0.999338088
R Square 0.998411938
Adjusted R Square 0.998411938
Standard Error 0.074565187
Observations 19

ANOVA

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>Significance F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>3</td>
<td>62.9364426</td>
<td>20.97881</td>
<td>3773.19</td>
<td>8.37865E-22</td>
</tr>
<tr>
<td>Residual</td>
<td></td>
<td>0.083399507</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td>63.01984211</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Coefficients

<table>
<thead>
<tr>
<th></th>
<th>Standard Error</th>
<th>t Stat</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-6.924166601</td>
<td>0.187968594</td>
<td>-36.8368</td>
</tr>
<tr>
<td>Admissions</td>
<td>5.368759014</td>
<td>0.265381196</td>
<td>20.23037</td>
</tr>
<tr>
<td>AvePrices</td>
<td>1.51832223</td>
<td>0.047321034</td>
<td>3.08E-15</td>
</tr>
<tr>
<td>Screens</td>
<td>-3.40576E-05</td>
<td>9.33407E-06</td>
<td>-3.64874</td>
</tr>
</tbody>
</table>

i). From the output, what is the prediction equation for U. S. movie theater box office grosses?
   a. \( \hat{y} = 0.187968594 + 0.265381196 \times \text{admissions} + 0.047321034 \times \text{AvePrices} + 9.33407E-06 \times \text{Screens} \)
   b. \( \hat{y} = 0.187968594 \times \text{intercept} + 0.265381196 \times \text{admissions} + 0.047321034 \times \text{AvePrices} + 9.33407E-06 \times \text{Screens} \)
   c. \( \hat{y} = -6.924166601 + 5.368759014 \times \text{admissions} + 1.51832223 \times \text{AvePrices} -3.40576E-05 \times \text{Screens} \)
   d. \( \hat{y} = 0.187968594 \times x_1 + 0.265381196 \times x_2 + 0.047321034 \times x_3 + 9.33407E-06 \times x_4 \)
   e. \( \hat{y} = -6.924166601 \times x_1 + 5.368759014 \times x_2 + 1.51832223 \times x_3 + -3.40576E-05 \times x_4 \)

ii) What is the value of SSE, the sum of the squares of the residuals?
   a. 62.9364426    b. 0.083399507    c. 63.01984211    d. 0.005559967

iii) What proportion of the variation in U. S. movie theater box office grosses is accounted for by admissions, average ticket prices, and number of movie screens.
   a. 0.999338088    b. 0.998676615    c. 0.083399507    d. 0.074565187

iv) What is the degrees of freedom df associated with the residuals?
   a. 19    b. 18    c. 3    d. 15

v) For the hypothesis test \( H_0 : \beta_{\text{AvePrices}} = 0, H_A : \beta_{\text{AvePrices}} \neq 0 \), what is the value of the test statistic?
   a. 32.08556749    b. 0.047321034    c. 1.51832223    d. 0.083399507

vi) If the average ticket price increases by $1, approximately by how much on average will U. S. movie theater box office grosses increase if the other explanatory variables are held constant?
   a. $1.52    b. $1,520    c. $152,000    d. $1,520,000    e. $1,520,000,000

ANSWERS

1. e, 142 ± 2.4163 \frac{42}{\sqrt{44}}
2. b, 3, c, 4, a; 5. a, 12 ± 2.0639 \frac{14}{\sqrt{25}}
6. a; 7. b II only; 8. b, slope \( b_1 = 0.976 \times 8.096 \times 1.388 = 4.27 \)
9. d; 10. a the sample mean is the midpoint of the interval;
11. e, if \( x \) is the number of hours you sleep and \( y \) is the number of hours you're awake, \( y = 24 - x \), so \( x \) and \( y \) are related exactly by a linear equation with a negative slope.
12. b; 13. a; 14. b; 15. d, \( b_1 = r_{xy} = 0.80 \frac{72}{27} = 2.4 \).
16. d, the slope 2.4 means that for each additional hour spent studying, the exam score will increase by 2.4 points, so if a student studies an additional 2 hours, the exam score will increase by \( 2 \times 2.4 = 4.8 \) points;
17. d, since the slope is \( b_1 = r_{xy} \), for each increase in \( x \) of one standard deviation \( s_x \), \( y \) will change by one \( y \) standard deviation \( s_y \) times \( r \); so if \( x \) is 2 standard deviations above \( \mu \), \( y \) will change by \( 2r = 2(0.4) = 0.8 \) \( y \) standard deviations, that is, \( y \) will increase by 0.8 \( y \) standard deviations.
18. c; 19. b, \( b_1 = r_{xy} = \frac{.913}{2.10} = 1.043 \);
20. a, \( b_1 = r_{xy} \Rightarrow .8 = \frac{.45}{\frac{s_y}{s_x}} \Rightarrow \frac{s_y}{s_x} = \frac{8}{.45} \); since the roles of the variables are reversed the new slope
\[ b_1^* = \frac{.45}{s_x} = \frac{.48}{1.5} = .48(.5999) = .288. \]
21. a, 180.975 \pm 3.4995 \frac{1.645}{\sqrt{8}} \approx 5.977162; 22. e, \( \hat{y} = 5.977162 + 74.067607(.08) = 11.903; \)
23. c; 24. d; 25. b, \( .72 \pm 2.8609 \sqrt{\frac{3.99^2}{29} + \frac{3.19^2}{29}} \)
26. b, \( t = \frac{202 - 100}{2.233} = 2.233; \)
27. c, for 49 degrees of freedom the test statistic 2.233 is between the table values 2.0096 and 2.4049. The area to the right of 2.4049 is .01 and the area to the right of 2.0096 is .025.
28. d, \( P - value = 2P(t > 2.4786) = .02 \) from the \( t \)-table with 26 df.
29. b, most of the variation in \( y \) is explained by the regression equation
30. c, 6 units on average
31. i) c. ii) b. \( \text{SSE} = 0.083399507 \) (see output below)
\[ \text{iii) b; } R^2 = 1 - \frac{\text{SSE}}{\text{SSTotal}} = 1 - \frac{0.083399507}{63.01984211} = 0.998676615 \] (see output below)
\[ \text{iv) d; } df = n - (k + 1) = 19 - (3 + 1) = 15, \text{ where } k = \text{the number of explanatory variables (see output below)} \]
\[ \text{v) test statistic } t = \frac{b_{\text{AvePrices}}}{s_{b_{\text{AvePrices}}}} = \frac{1.51832223}{0.047321034} = 32.08556749 \text{ (see output below)} \]
\[ \text{vi) e. } $1,520,000,000 \text{ Since the units of U. S. movie theater box office grosses are billions of dollars, U. S. movie theater box office grosses will increase by $1.52 billion = $1,520,000,000.} \]

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