1. The number of pounds of steam (y_i) used per month by a chemical plant is thought to be related to the average ambient temperature (x_i) in °F for that month. Summary quantities are: *n = 12, S_{XX} = 1000.92, S_{YY} = 57734.41, S_{XY} = 7599.58* and *SSE = 33.8389*.
   A 99% confidence interval estimate for the slope of the regression line is

a. [7.4085, 7.7767]
b. [11.3991, 12.0595]
c. [8.4736, 8.9362]
d. [10.6020, 10.9818]
e. [9.6025, 9.9974]

2. A random sample of 50 observations was made on the diameter of spot welds and the corresponding weld shear strength. Given that $r = 0.67$, test the hypothesis that ρ = 0, using α = 0.01. What are the critical t-value and the decision reached?

a. 2.6822; Reject H_0
b. 2.0106; reject H_0
c. 2.4066; do not reject H_0
d. 1.6772; reject H_0
e. 1.2994; do not reject H_0

3. An article in Concrete Research presented data on compressive strength x and intrinsic permeability y of various concrete mixes and cures. The estimated simple linear regression model is $\hat{Y} = 15.52 + 0.40X$ using a sample of size 14. Suppose that the observed value of permeability at $x = 3.3$ is $y = 45.6$. Calculate the value of the corresponding residual.

a. 28.76
b. 16.84
c. 42.30
d. -16.84
e. 48.90

4. You fit a least squares regression line to five pairs of observations (x_i, y_i) using the model

$$y_i = \beta_0 + \beta_1 x_i + \epsilon_i \ .$$

You determine:

$$\sum x_i = 10, \quad \sum x_i^2 = 30, \quad \sum (y_i - \hat{y}_i)^2 = 15.$$

The estimated variance of $\hat{\beta}_1$ is

a. 0.5
b. 0.3
c. 1.0
d. 2.0
e. 3.0

5. You are given the following information concerning a simple linear regression:

$$\sum_{i=1}^{8} (y_i - \bar{y}_i)^2 = 435.0$$

$$R^2 = 0.65$$

Calculate MSE.

a. 25.4
b. 21.8
c. 19.0
d. 40.4
e. 47.1

6. You are given the following linear regression model fitted to 12 observations:

$$y = \beta_0 + \beta_1 x + \epsilon.$$

The results of the regression are as follows:

Parameter	Estimate	Standard Error
β_0	15.52	3.242
β_1	0.40	0.181

Determine the results of the hypothesis test H_0: $\beta_1 = 0$ against the alternative H_1: $\beta_1 \neq 0$.

a. Reject at $\alpha = 0.1$, Do Not Reject at $\alpha = 0.05$
b. Reject at $\alpha = 0.01$
c. Reject at $\alpha = 0.02$, Do Not Reject at $\alpha = 0.01$
d. Reject at $\alpha = 0.05$, Do Not Reject at $\alpha = 0.02$
e. Do Not Reject at $\alpha = 0.10$

7. Consider the following partially completed computer printout for a regression analysis where the dependent variable is the price of a personal computer (in SR) and the independent variable is the size of the hard drive (in GB).

SUMMARY OUTPUT					
Regression Statistics					
Multiple R	0.819361805				
R Square					
Adjusted R Square	0.661687702				
Standard Error					
Observations	36				
ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	33116034.84	33116034.84		
Residual		16211214.72			
Total	35	49327249.56			
	Coefficients	*Standard Error*	*t Stat*	*P-value*	
Intercept	50.84102383	246.9869514	0.205844979	0.838139607	
Hard Drive Capacity	217.7539792	26.12854674		9.95844E-10	

Based on the information provided, which of the following statements is true if alpha = 0.05?

a. The slope is significantly different from zero.
b. The intercept is significantly different from zero
c. The error degree of freedom is 35.
d. MSE of the model is 33116034.84.
e. The price of computer increases, on average, by 50.541 SR due to 1 GB increase in size of hard drive, and vice versa.

8. You have fitted a regression model with two predictors to a dataset having 20 observations. The total sum of squares is 1200 and the regression sum of squares is 1000. What is the value of adjusted R^2 for this model?

a. 0.8137
b. 0.1863
c. 0.3416
d. 0.6584
e. 0.8333

9. You have fitted a regression model with five predictors to a data set that has 40 observations. The total sum of squares is 2000 and the regression sum of squares is 1500. What is the value of the F-statistic for testing the significance of regression?

a. 20.39
b. 13.51
c. 300
d. 22.21
e. 14.70

The editors of a national automotive magazine recently studied 30 different automobiles sold in the United States with the intent of seeing whether they could develop a multiple regression model to explain the variation in highway miles per gallon. A number of different independent variables were collected. The following regression output **Table A** (with some values missing) was recently presented to the editors by the magazine's analysts:

Table A

Regression Statistics						
Multiple R	0.906876					
R Square						
Adjusted R Square						
Standard Error						
Observations	30					
ANOVA						
	df	*SS*	*MS*	*F*		
Regression						
Residual		89.88341785				
Total		506.1666667				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	41.77425	5.612843566				
Curb Weight	-0.00608	0.00145286				
cylinders	0.959134	0.887531206				
Horse Power	0.052399	0.023938405				
Torque	-0.01747	0.024737052				
0 to 60 mph	0.492998	0.486960357				
Price as Tested	-0.00015	4.31238E-05				
Displacement	-2.11223	0.88675014				

10. Based on the output of **Table A** and your understanding of multiple regression analysis, what is the estimated standard error of the model rounded to 2 decimal points?

a. 2.02
b. 5.97
c. 14.05
d. 8.06
e. 4.09

11. Based on the output of **Table A** and your understanding of multiple regression analysis, what is the critical value for testing the significance of the overall regression model at a 0.05 level of statistical significance?

a. 2.46
b. 5.92
c. 3.80
d. 4.75
e. 3.42

A multiple regression is shown in the following **Table B** for a data set of yachts where the dependent variable is the price in thousands of dollars.

Table B

Regression Statistics						
Multiple R	0.82731					
R Square	0.68445					
Adjusted R Square	0.60030					
Standard Error	37.40252					
Observations	20					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	
Regression	4	45515.77	11378.94	8.13	0.00107	
Residual	15	20984.23	1398.95			
Total	19	66500.00				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	120.50886	82.22254	1.46564	0.16339	-54.74434	295.76205
Rooms	7.46415	12.24022	0.60981	0.55112	-18.62526	33.55355
Age	-1.7783	0.7179	-2.47713	0.02564	-0.33084	-0.02482
Length	2.82719	1.40160	2.01711	0.06195	-0.16025	5.81463
Nav. Equip.	0.35408	0.22411	1.57995	0.13497	-0.12360	0.83176

12. Based on the output of **Table B**, which of the independent variables appear to be significantly helping to predict the price of a yacht, using a 0.10 level of significance?

a. Age and Length
b. Age only
c. Rooms and Nav. Equip.
d. Length and Nav. Equip.
e. Age and Rooms

13. Given the information in **Table B**, what percentage of variation in the dependent variable is explained by the regression model?

a. About 68 percent
b. About 83 percent
c. About 37 percent
d. About 60 percent
e. About 20 percent

14. The paper "The Pedaling Technique of Elite Endurance Cyclists" reported the accompanying data on single-leg power at a high workload. Find the inter-quartile range of the following data:

160, 174, 176, 180, 180, 183, 187, 191, 194, 200, 205, 211, 211, 244

a. 27.5
b. 20.86
c. 179
d. 189
e. 206.5

15. Three events occur with probabilities $P(E_1) = 0.35$, $P(E_2) = 0.15$, $P(E_3) = 0.40$. Moreover, $P(E_1 \mid B) = 0.25$ and $P(B) = 0.30$. Compute $P(E_1 \text{ or } B)$.

a. 0.575
b. 0.075
c. 0.021
d. 0.475
e. 0.425

16. The following probability distribution has been assessed for the number of accidents that occur in a Midwestern city each day:

Accidents	0	1	2	3	4
Probability	0.25	0.20	0.30	0.15	0.10

Based on this distribution, the expected number of accidents in a given day is:

a. 1.65
b. 0.30
c. 2.00
d. 2.50
e. 1.25

17. A batch contains 40 bacteria cells and 12 of the cells are not capable of cellular replication. Suppose that you examine three bacteria cells selected at random without replacement. What is the probability that at least one of the selected cells cannot replicate?

a. 0.6684

b. 0.6834
c. 0.7161
d. 0.1839
e. 0.3316

18. Specifications call for the thickness (X) of aluminum sheets that are to be made into cans be in thousandth of an inch. Let $f(x)$ be the probability density function of X.

$$f(x) = \begin{cases} cx & 8 \le x \le 11 \\ 0 & \text{otherwise.} \end{cases}$$

Find the value of c.

a. $\frac{2}{57}$
b. $\frac{2}{507}$
c. $\frac{57}{2}$
d. 507
e. $\frac{1}{3}$

19. The manager of a computer help desk operation has collected enough data to conclude that the distribution of time per call is normally distributed with a mean equal to 8.21 minutes and a standard deviation of 2.14 minutes. Based on this, what is the probability that a call will last longer than 13 minutes?

a. 0.0125
b. 0.4875
c. 0.5125
d. 0.9875
e. 0.3714

20. The State Department of Weights and Measures is responsible for making sure that commercial weighing and measuring devices, such as scales, are accurate so customers and businesses are not cheated. Periodically, employees of the department go to businesses and test their scales. For example, a dairy bottles milk in 1-gallon containers. Suppose that if the filling process is working correctly, the mean volume of all gallon containers is 1.00 gallon with a standard deviation equal to 0.10 gallon. Assume that the filling volume is normally distributed. The department's test process requires that they select a random sample of n = 9 containers. If the sample mean is less than 0.97 gallons,

the department will fine the dairy. Based on this information, what is the probability that the dairy will be fined even when its filling process is working correctly?

a. 0.1841
b. 0.90
c. 0.3159
d. 0.3821
e. 0.8159

21. The brightness of a television picture tube can be evaluated by measuring the amount of current required to achieve a particular brightness level. A sample of 20 tubes results in $\bar{X} = 317.2$ and s = 15.7. Find a 99% confidence interval on mean current required.

a. $307.16 \leq \mu \leq 327.24$
b. $311.42 \leq \mu \leq 322.98$
c. $307.52 \leq \mu \leq 322.88$
d. $308.29 \leq \mu \leq 326.11$
e. $308.29 \leq \mu \leq 322.88$

22. The following are two confidence interval estimates for the mean of the cycles to failure of a mechanical device calculated from the same dataset: $3124.9 \leq \mu \leq 3215.7$ and $3079.5 \leq \mu \leq 3261.1$

The value of the sample mean cycles to failure is equal to

a. 3170.3
b. 90.10
c. 181.6
d. 6204.4
e. 3102.2

23. For the following hypothesis test:

$H_0 : \mu \leq 45$
$H_A : \mu > 45$
$\alpha = 0.02$

With n = 80, σ = 9, and sample mean = 47.1, state the decision rule in terms of the critical value of the test statistic.

a. Reject the null hypothesis if the calculated value of the test statistic, z, is greater than the critical value, 2.05. Otherwise, do not reject.
b. Reject the null hypothesis if the calculated value of the test statistic, z, is greater than the critical value, 1.645. Otherwise, do not reject.
c. Accept the null hypothesis if the calculated value of the test statistic, z, is greater than the critical value, 1.645. Otherwise, do not accept.
d. Accept the null hypothesis if the calculated value of the test statistic, z, is greater than the critical value, 2.05. Otherwise, do not accept.
e. Reject the null hypothesis if the calculated value of the test statistic, z, is greater than the critical value, 2.33. Otherwise, do not reject.

24. When testing proportion $H_0: p = 0$ versus $H_1: p \neq 0$, the test statistic value was -2.13. The p-value for the test would be.

a. 0.0332
b. 0.0166
c. 0.9668
d. 0.9834
e. 0.8756