1. A manufacturer claims that the output for a certain electric circuit is 130 V. A sample of $n = 9$ independent readings on the voltage for this circuit, when tested, yields $\bar{x} = 131.4$ V. It is assumed that the population has a normal distribution with $\sigma = 1.5$ V. At $\alpha = 0.01$, what is the p-value for testing whether the data contradict the manufacturer's claim?

a. 0.0052
b. 0.1052
c. 0.0064
d. 0.9750
e. 0.0252

2. We have created a 95% confidence interval for μ with the result (10, 15). What decision will we make if we test $H_0: \mu \leq 11$ against $H_1: \mu > 11$ at 0.05 level of significance?

a. We cannot tell what our decision will be from the information given.
b. Reject H0 in favor of H1 at the 5% level.
c. Accept H0 in against H1.
d. Fail to reject H0 in favor of H1 at the 10% level.
e. Reject H0 in favor of H1 at the 10% level.

3. A restaurant adds a new commercial oven to its kitchen. It is hoped that the new oven has more evenly distributed heat than the current oven. The ovens are heated to 350F, using a thermostat control, and temperature readings are obtained from thermometers placed at 9 locations in each oven, yielding the following data:

Current oven: $n_1 = 9, \bar{x}_1 = 352.4, \quad S_1 = 2.3$
New oven: $n_2 = 9, \bar{x}_2 = 350.2, \quad S_2 = 1.1$

Test $H_o: \sigma_1^2 \leq \sigma_2^2 \quad vs\ H_1: \sigma_1^2 > \sigma_2^2$ using the 5 percent level of significance. The test statistic is?

a. 4.372
b. 3. 438
c. 2.300
d. 1.100
e. 1.404

4. Suppose a random sample of 480 heart-bypass operations at hospital A showed that 72 patients did not survive, whereas a random sample of 360 operations at hospital B showed that 30 patients did not survive. Find the p-value of the test of the hypothesis that the survival probabilities are the same at the two hospitals.

a. 0.003
b. 0.040
c. 0.002
d. 0.010
e. 0.500

5. A hydraulic press is operating correctly when the standard deviation of the pressure is less than 120 pounds-per-square-inch(psi). Suppose you take a random sample of 15 measurements throughout the day of the psi and find the standard deviation to be 148. Suppose you want to test whether the press is operating correctly. Compute the test statistic

a. 21.2955
b. 20.3356
c. 18.5643
d. 40.3367
e. 0.16790

The director of the MBA program of a state university wanted to know if a one-week orientation would change the proportion among potential incoming students who would perceive the program as being good. Given below is the result from 215 students' view of the program before and after the orientation.

	After the Orientation		
Before the Orientation	Good	Not good	Total
Good	93	37	130
Not good	71	14	85
Total	164	51	215

Based on the above information, answer the next two questions:

6. Which test should she use?

a. McNemar test for difference in proportions
b. Chi-squared test for difference in proportions
c. Z-test for difference in proportions
d. F-test for difference in proportions
e. T-test for difference in proportions

7. The p-value of the test statistic using a 5% level of significance is

a. 0.001
b. 0.0005
c. 0.002
d. 0.01
e. 0.005

8. Which of the following assumptions concerning the probability distribution of the random error term is stated incorrectly?

a. The variance of the distribution increases as X increases.
b. The errors are independent.
c. The distribution is normal
d. The mean of the distribution is 0
e. X and Y are linearly related

9. If the correlation co-efficient (r) = 1.00, then

a. there is no unexplained variation
b. the Y-intercept (b_o) must equal 0
c. the explained variation equals the unexplained variation
d. there is unexplained variation
e. the slope must be negative

10. Durbin Watson Statistic is used to test

a. Independence
b. Normality
c. Linearity
d. Equality of Variance
e. Slope

Exponential trend model was fitted on the monthly time series data that represents the average traffic on google recorded at the beginning of each month from Jan 2004 to Aug 2010. The regression equation is shown below:

$\log(\hat{Y})$ = 0.0801 - 0.0038 X - 0.1067 Jan + 0.0794 Feb + 0.1008 Mar + 0.0761 Apr + 0.0795 May + 0.1084 Jun - 0.1101 Jul + 0.0874 Aug + 0.0204 Sep + 0.0106 Oct + 0.0051 Nov

Where X represents the coded observations (0 - 79) and Jan, Feb, . . . , Nov represents the monthly dummy variables.

Based on the above information, answer the next two questions:

11. The best interpretation of the multiplier for June is

a. The average traffic in June is 28.4% higher than that in December after adjusting for the given monthly growth rate.
b. The average traffic in June is 28.4% higher than the average monthly traffic after adjusting for the given monthly growth rate.
c. The average traffic in June is 128.4% of the average monthly traffic after adjusting for the given monthly growth rate.
d. The average traffic in June is 28.4% lower than that in December after adjusting for the given monthly growth rate.
e. The average traffic in June is 28.4% of that in December after adjusting for the given monthly growth rate.

12. The fitted value for August 2010 is

a. 73.67%
b. 13.27%
c. 87.71%
d. 27.33%
e. 78.71%

13. A microeconomist wants to determine how corporate sales are influenced by capital and wage spending by companies. He proceeds to randomly select 26 large corporations and record information in millions of dollars. A statistical analyst discovers that capital spending by corporations has a significant inverse linear relationship with wage spending. What should the microeconomist who developed this multiple regression model be particularly concerned with?

a. Collinearity
b. Randomness of the error terms
c. Normality of residuals
d. Missing observations
e. Coefficient of determination

14. In multiple regression, the ----------procedure permits variables to enter and leave the model at different stages of its development.

a. stepwise regression
b. forward selection
c. residual analysis
d. backward elimination
e. best Subsets regression

15. Which of the following is used to find a best model?

a. Mallow's C_p
b. Odds ratio
c. Slope
d. SST
e. VIF

16. The logarithm transformation can be used

a. to overcome violations to the homoscedasticity assumption
b. to overcome violations to the autocorrelation assumption.
c. to test for possible violations to the autocorrelation assumption
d. to overcome violations to the normality assumption.
e. to overcome violations to the independence assumption.

17. Using the best-subsets approach to model building, models are being considered when their

a. $C_p \leq (k+1)$
b. $C_p > k$
c. $C_p \leq k$
d. $C_p > (k+1)$
e. $C_p \leq (k-1)$

18. In a model with only two independent variables, if the coefficient of determination between two independent variables is 0.20, which of the following statement is correct?
a. The VIF is 1.25 and there is no evidence of collinearity.
b. The VIF is 5 and there is evidence of collinearity
c. The VIF is 2.25 and there is no evidence of collinearity
d. The VIF is 2 and there is evidence of collinearity
e. The VIF is 7.5 and there is evidence of collinearity

A nationwide sporting goods stores' company is investigating the relationship between the monthly Sales (in $) and the demographic information about its customers. The demographic information are given by the following variables

Age: Median age of customer base (in years)

HS: Percentage of customer base with a high school diploma

College: Percentage of customer base with a college degree

Growth: Annual population growth rate of customer base

Income: Median family income of customer base (in $)

Minitab full regression analyses were made and the results are shown below

Analysis of Variance

Source	DF	Seq SS	Contribution	Adj SS	Adj MS	F-Value	P-Value
Regression	5	7.45407E+12	24.45%	7.45407E+12	1.49081E+12	2.07	0.095
Error	32	2.30348E+13	75.55%	2.30348E+13	7.19839E+11		
Total	37	3.04889E+13	100.00%				

Model Summary

S	R-sq	R-sq(adj)	PRESS	R-sq(pred)
848433	24.45%	12.64%	4.68963E+13	0.00%

Coefficients

Term	Coef	SE Coef	95% CI	T-Value	P-Value	VIF
Constant	-2270706	3696533	(-9800298, 5258886)	-0.61	0.543	
Age	-27384	93046	(-216911, 162144)	-0.29	0.770	1.32
Growth	2084	44098	(-87740, 91909)	0.05	0.963	1.44
Income	2.4	30.5	(-59.7, 64.6)	0.08	0.937	3.79
HS	62735	35090	(-8741, 134211)	1.79	0.083	3.52
College	-5702	28359	(-63467, 52063)	-0.20	0.842	2.74

Backward Elimination of Terms

Candidate terms: Age, Growth, Income, HS, College

	-----Step 1-----		-----Step 2-----		-----Step 3-----		-----Step 4-----	
	Coef	P	Coef	P	Coef	P	Coef	P
Constant	-2270706		-2248337		-2384267		-2126081	
Age	-27384	0.770	-28438	0.751	-26107	0.751	-29076	0.715
Growth	2084	0.963						
Income	2.4	0.937	2.1	0.944				
HS	62735	0.083	62922	0.076	64498	0.017	60953	0.002
College	-5702	0.842	-5103	0.839	-4732	0.845		
S		848433		835508		823193		811809
R-sq		24.45%		24.44%		24.43%		24.35%
R-sq(adj)		12.64%		15.28%		17.76%		20.02%
R-sq(pred)		0.00%		0.00%		5.38%		8.72%
Mallows' Cp		6.00		4.00		2.01		0.04

	-----Step 5-----	
	Coef	P
Constant	-2969741	
Age		
Growth		
Income		
HS	59660	0.002
College		
S		802004
R-sq		24.05%
R-sq(adj)		21.94%
R-sq(pred)		17.20%
Mallows' Cp		-1.83

α to remove = 0.1

Best Subsets Regression: Sales versus Age, Growth, ... me, HS, College

Response is Sales

Vars	R-Sq	R-Sq (adj)	R-Sq (pred)	Mallows Cp	S	Age	Growth	Income	HS	College
1	24.1	21.9	17.2	-1.8	802004				X	
1	14.7	12.3	4.0	2.1	849860			X		
2	24.3	20.0	8.7	0.0	811809	X			X	
2	24.2	19.9	14.0	0.1	812572				X	X
3	24.4	17.8	5.4	2.0	823193	X			X	X
3	24.4	17.7	0.0	2.0	823626	X	X		X	
4	24.4	15.3	0.0	4.0	835508	X		X	X	X
4	24.4	15.3	0.0	4.0	835563	X	X		X	X
5	24.4	12.6	0.0	6.0	848433	X	X	X	X	X

Using the above results, answer the next six questions:

19. If a Backward Elimination procedure is applied to find the most appropriate model, the first predictor to be removed from the model is

a. Growth because it is the least significant to the Sales with a p-value of 0.963.
b. HS because it is the most significant to the Sales with a p-value of 0.083.
c. Age because it is the least significant to the Sales with a p-value of 0.751.
d. Income because it is the most significant to the Sales with a p-value of 0.944.
e. College because it is the least significant to the Sales with a p-value of 0.842.

20. The most appropriate model using Backward Elimination procedure has the following predictor(s)

a. HS
b. College & Age
c. College & HS
d. Age
e. College

21. At alpha = 0.1, the significant predictor(s) to the Sales in full model is/are

a. HS
b. College & Age
c. College & HS
d. Age
e. College

22. Using the Backward Elimination procedure the ***coefficient of determination*** and the ***standard error of the estimate*** of the final model are respectively;

a. 24.05% and 802004
b. 21.94% and 802004
c. 24.05% and 59660
d. 21.94% and 59660
e. 24.35% and 811809

23. In the full model, which of the predictors are causing collinearity

a. None of the predictors
b. Income
c. HS
d. College
e. Income & College

24. Using the Best subsets approach and the ***standard error of the estimate's*** criterion, among the given models which group of predictors is the ***worst*** to explain the variation in the Sales?

a. Income
b. Growth
c. HS
d. Age
e. College

The following data provide Norway's export of goods and services as a percentage of GDP (gross domestic product) from 2006 to 2017.

Year	Exports
2006	44.7
2007	43.3
2008	45.9
2009	39.2
2010	39.7
2011	41.2
2012	40.6
2013	39.1
2014	38.8
2015	37.7
2016	35.2
2017	36.2

Use the information above to answer the next two questions:

25. If a five-year moving average is used to smooth this series, how many forecasts would the analysis have?

a. 8
b. 10
c. 3
d. 11
e. 9

26. If this series is smoothed using exponential smoothing with a smoothing constant of 0.25, what would be the third value?

a. 44.7375
b. 44.3500
c. 44.7000
d. 43.3531
e. 42.4398

27. A second-order autoregressive model for average mortgage rate is:

$$Rate_i = -2.0 + 1.8(Rate)_{i-1} - 0.5\,(Rate)_{i-2}.$$

If the average mortgage rate in 2012 was 7.0, and in 2011 was 6.4, the forecast for 2014 is

a. 7.82
b. 7.4
c. 6.02

d. 6.9
e. 8.12

28. The effect of an unpredictable, rare events will be contained in the----------component
    a. Irregular
    b. Trend
    c. Cyclical
    d. Seasonal
    e. Both a and b

29. Which of the following methods should not be used for short-term forecasts into the future?
    a. Moving averages
    b. Exponential smoothing
    c. Linear trend model
    d. Autoregressive modeling
    e. Quadratic trend model

30. Which of the following statements about moving averages is **not** true?

    a. It gives greater weight to more recent data
    b. It can be used to smooth a series
    c. It gives a series of arithmetic means over time
    d. It is simpler than the method of exponential smoothing
    e. It is used to get the pattern of movement over time

The level of price and production of metals is one measure of the strength of the industrial economy. The table below lists the 1997 prices ($ per ton) and production (in tons) for three important metals from January to April.

	Copper		Steel		Lead	
Month	**Price**	**Production**	**Price**	**Production**	**Price**	**Production**
Jan	1065.2	220.7	131.14	8735	983	28800
Feb	1051.6	200.7	143.5	8266	1000	28500
Mar	1061.8	216.7	139.7	9175	974	31900
Apr	1080	216.3	132.59	8882	960	30400

Answer the next three questions:

31. The Steel's price simple index number of Feb based on Jan is:

    a. 109.43%

b. 94.63%
c. 106.53%
d. 99.11%
e. 98.44%

32. The unweighted price index number for the three metals of Mar based on Feb is:

a. 99.11%
b. 109.43%
c. 98.44%
d. 94.63%
e. 106.53%

33. The Laspeyres's price index number of Apr based on Mar is:

a. 98.44%
b. 99.11%
c. 109.43%
d. 94.63%
e. 106.53%

A contractor developed a multiplicative time-series model to forecast the number of contracts in future quarters, using quarterly data on number of contracts during the 3-year period from 1996 to 1998. The following is the resulting regression equation:

$$\ln\hat{Y} = 3.32 + 0.117\,X - 0.083\,Q_1 + 1.28\,Q_2 + 0.617\,Q_3$$

where

$Y\hat{}$ is the estimated number of contracts in a quarter

X is the coded quarterly value with $X = 0$ in the first quarter of 1996.

Q_1 is a dummy variable equal to 1 in the first quarter of a year and 0 otherwise.

Q_2 is a dummy variable equal to 1 in the second quarter of a year and 0 otherwise.

Q_3 is a dummy variable equal to 1 in the third quarter of a year and 0 otherwise.

Based on this answer the next two questions:

34. To obtain a forecast for the fourth quarter of 1999 using the model, which of the following sets of values should be used in the regression equation?

a. X = 15, Q1 = 0, Q2 = 0, Q3 = 0
b. X = 15, Q1 = 1, Q2 = 0, Q3 = 0
c. X = 15, Q1 = 1, Q2 = 1, Q3 = 0
d. X = 16, Q1 = 0, Q2 = 0, Q3 = 0
e. X = 16, Q1 = 1, Q2 = 0, Q3 = 0

35. The best interpretation of the coefficient of X (0.117) in the regression equation is:
a. the quarterly compound growth rate in contracts is around 12.4%.
b. the annually compound growth rate in contracts is around 11.7%.
c. the quarterly compound growth rate in contracts is around 11.7%.
d. the annually compound growth rate in contracts is around 1.124%.
e. the quarterly compound growth rate in contracts is around 1.124%.