

Use **CAPITAL** letters to record your answers in the table on the cover page  
If a bubble sheet is given to you, complete it also and put your name on it.

Due to rounding, the answer you compute may not exactly match any of the options listed.  
Therefore, you must choose the option which comes closest to what you have computed.

Use the following information for Questions 1 -2.

The following is sample data from 50 orders received from clients at your company for a particular item. The data shows order quantity for each order.

| Order Qty. | Frequency |  |  |  |
|------------|-----------|--|--|--|
| 30-39      | 7         |  |  |  |
| 40-49      | 12        |  |  |  |
| 50-59      | 18        |  |  |  |
| 60-69      | 9         |  |  |  |
| 70-79      | 4         |  |  |  |
|            | 50        |  |  |  |

- 1) What was the mean quantity ordered?
  - A. 48.0
  - B. 52.7
  - C. 10
  - D. 74.5
  
- 2) What percentage of orders is for quantity between 50-59 units?
  - A. 92%
  - B. 74%
  - C. 36%
  - D. 26%
  
- 3) For each of the past 30 days, a researcher has recorded the number of individuals in a city who signed up for insurance under the Healthcare Reform Act. Which of the following graphical summaries is **most appropriate** to display the data she has collected?
  - A. Histogram
  - B. Pie chart
  - C. Bar chart
  - D. Line graph
  - E. Stem and leaf diagram

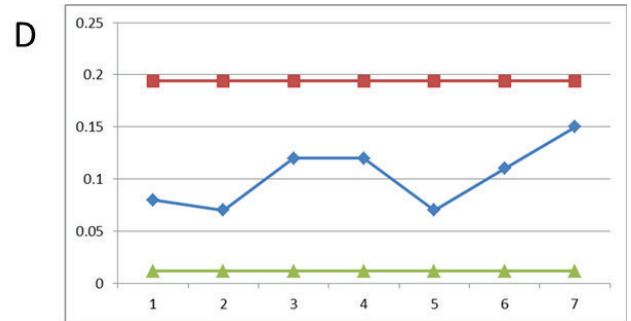
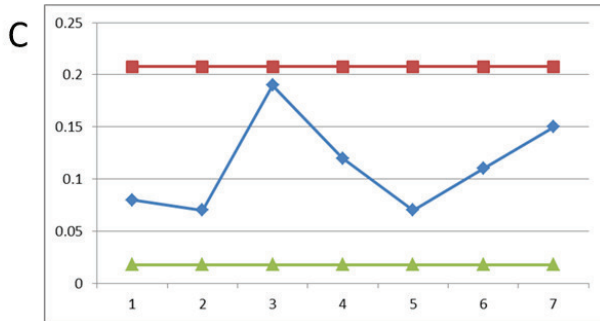
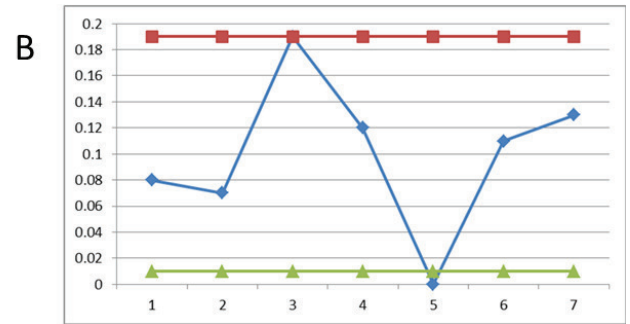
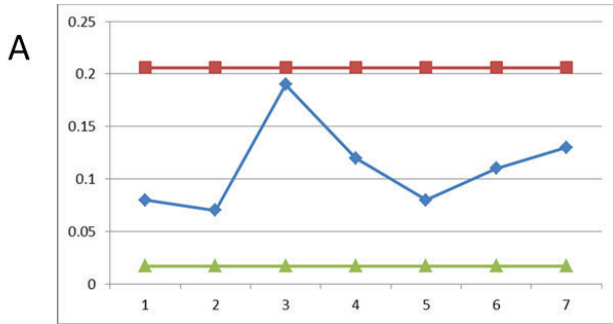
Use the following data for Questions 4-6.

XYZ Corporation has advertised an open position. The number of applications received during 5 randomly selected days is listed below.

| Day | # of Applications |  |  |  |  |
|-----|-------------------|--|--|--|--|
| 1   | 20                |  |  |  |  |
| 2   | 40                |  |  |  |  |
| 3   | 22                |  |  |  |  |
| 4   | 28                |  |  |  |  |
| 5   | 35                |  |  |  |  |

- 4) What is the mean number of applications received in this sample?
- A. 29.0
  - B. 25.0
  - C. 28.0
  - D. 22.0
- 5) What is the median number of applications received in this sample?
- A. 29.0
  - B. 25.0
  - C. 28.0
  - D. 22.0
- 6) What is the standard deviation for this sample of applicants?
- A. 72
  - B. 7.6
  - C. 57.6
  - D. 8.5
- 7) The time that a telemarketer spends on the phone in an attempt to make a sale is normally distributed with a mean of 8 minutes and a standard deviation of 1.2 minutes. What is the probability that the call takes longer than 10 minutes?
- A. 0.05
  - B. 0.13
  - C. 0.22
  - D. 0.01

- 8) The manager of the telemarketing call center (discussed in problem 7) is concerned about calls that are too short (agent is not pushy enough) or too long (agent is inefficient). He wants to identify the middle 97% of call times, and issue warnings to an agent when the call time falls outside of that range. Compute the lower and upper limit for the middle 97% of calls.
- A. Approximately 5.7 to 10.3 minutes
  - B. Approximately 4.8 to 9.7 minutes
  - C. Approximately 5.4 to 10.6 minutes
  - D. Cannot be estimated with the available data
- 9) The telemarketing company has determined that 20% of the calls their agents make result in a successful sale. Assume 15 calls are made one morning. What is the probability that **3 or fewer** of the calls are successful (i.e., make a sale). Assume binomial distribution.
- A. 0.25
  - B. 0.65
  - C. 0.40
  - D. 0.61
  - E. 0.36
- 10) Contact information about potential customers arrives at the telemarketing company at an average rate of 8 every 15 minutes. What is the probability that in the next 15 minutes information about **10 or fewer potential customers** arrives? Assume Poisson arrivals.
- A. 0.816
  - B. 0.772
  - C. 0.395
  - D. 0.886
- 11) The time it takes for the steam-engine train to travel the scenic route in Colorado between Durango and Silverton is uniformly distributed with a range of 155 to 220 minutes. What is the probability that the train ride on that route takes between 160 to 205 minutes?
- A. 0.743
  - B. 0.50
  - C. 0.692
  - D. 0.258
- 12) Every college at State University sends 3 students to serve as its ambassadors on the Student Council. The student body of the college of engineering is composed of 30% female students. If ambassadors are chosen at random, what is the probability that all 3 engineering ambassadors will be female?
- A. 0.365
  - B. 0.03
  - C. 0.90
  - D. 0.027
- 13) What can be said about the control charts below?



- A. All charts exhibit common cause variation only
- B. Chart B exhibits special cause variation
- C. Charts A, C, and D require an adjustment in the process
- D. Nothing can be inferred from the control charts

14) The following table reports the number of defective light bulbs found in samples taken over 7 days at the “Brighten-Up Your Day” Company. What is the UCL computed from the associated P-chart?

| Day | # Light Bulbs | # Defective |
|-----|---------------|-------------|
| 1   | 100           | 8           |
| 2   | 100           | 7           |
| 3   | 100           | 12          |
| 4   | 100           | 12          |
| 5   | 100           | 7           |
| 6   | 100           | 11          |
| 7   | 100           | 15          |

- A. 0.1028
- B. 0
- C. 0.0117
- D. 0.1940

15) A sample of 5 separate pages published by the ACME Book Company was checked for quality. The number of typos per page was recorded below. What is the LCL for the C chart?

| Page | # of typos on the page |
|------|------------------------|
| 1    | 3                      |
| 2    | 5                      |
| 3    | 2                      |
| 4    | 6                      |
| 5    | 4                      |

- A. 0 (it does not exist)
- B. 10
- C. 4
- D. -2

Use the following to answer Questions 16-17. The table includes summary of data concerning customer waiting times at Billy Bob's emporium.

| Day | Subgroup size | Subgroup Mean | Subgroup Range |
|-----|---------------|---------------|----------------|
| 1   | 5             | 2.01          | 9.02           |
| 2   | 5             | 3.99          | 22.02          |
| 3   | 5             | 3.47          | 3.28           |
| 4   | 5             | 1.65          | 12.02          |
| 5   | 5             | 2.33          | 3.61           |
| 6   | 5             | 9.32          | 7.62           |
| 7   | 5             | 3.23          | 4.22           |

16) What is the D4 value associated with the R-chart?

- A. 2.954
- B. 2.114
- C. 5
- D. 8.232

17) Is the **variation** of this process in control?

- A. Yes, the variation of the process is in control
- B. No, the variation is out of control
- C. Need to check if mean of the process is under control first
- D. No, the sample size or subgroup must be 11 or more

18) Assume a process is in control and sample size (n) equals 7. Also, Upper Specification Limit is 8 minutes for order completion,  $\bar{X} = 6.814$ ,  $\bar{R} = 4.894$ . What percentage of orders will be made within the 8 minute or less specification?

- A. .66
- B. .74
- C. .35
- D. .22

19) Assume a process is in control and sample size (n) equals 7. Also, Upper Specification Limit is 8 minutes for order completion,  $\bar{X} = 6.814$ ,  $\bar{R} = 4.894$ . What is the upper capability index (CPU) for order delivery process?

- A. .6552
- B. .7438
- C. .3452
- D. .2184

20) Calculate the linear regression equation for the following data

| Ad expenditures (\$1000) | Pizza sales (\$1000) |  |  |  |  |
|--------------------------|----------------------|--|--|--|--|
| 1.5                      | 5.1                  |  |  |  |  |
| 2.8                      | 3.9                  |  |  |  |  |
| 2.1                      | 4.9                  |  |  |  |  |
| 1.1                      | 5.8                  |  |  |  |  |

- A.  $Y = 6.85 - 1.03x$
- B.  $Y = 5.22 - 1.92x$
- C.  $Y = 6.85 + 1.03x$
- D.  $Y = 3.72 + 2.46x$

**Use the following data for questions 21 to 23**

| SUMMARY OUTPUT |  |  |  |  |  |
|----------------|--|--|--|--|--|
|                |  |  |  |  |  |

| <i>Regression Statistics</i> |                     |                       |               |                |                       |                  |
|------------------------------|---------------------|-----------------------|---------------|----------------|-----------------------|------------------|
| Multiple R                   |                     |                       |               |                |                       |                  |
| R Square                     |                     |                       |               |                |                       |                  |
| Adjusted R Square            | 0.1688              |                       |               |                |                       |                  |
| Standard Error               | 1.2952              |                       |               |                |                       |                  |
| Observations                 | 11                  |                       |               |                |                       |                  |
| ANOVA                        |                     |                       |               |                |                       |                  |
|                              | <i>df</i>           | <i>SS</i>             | <i>MS</i>     | <i>F</i>       | <i>Significance F</i> |                  |
| Regression                   | 1                   | 5.0850                | 5.0850        | 3.0315         | 0.1156                |                  |
| Residual                     | 9                   | 15.0968               | 1.6774        |                |                       |                  |
| Total                        | 10                  |                       |               |                |                       |                  |
|                              | <i>Coefficients</i> | <i>Standard Error</i> | <i>t Stat</i> | <i>P-value</i> | <i>Lower 95%</i>      | <i>Upper 95%</i> |
| Intercept                    | 0.4839              | 1.3464                | 0.3594        | 0.7276         | -2.5618               | 3.5296           |
| sales                        | 0.5484              | 0.3150                | 1.7411        | 0.1156         | -0.1641               | 1.2609           |

21) What is the sum of squares total?

- A. 5.0850
- B. 1.6774
- C. 15.0968
- D. 20.1818

22) What is the correlation coefficient?

- A. 0.5020
- B. 0.1688
- C. 0.5484
- D. 0.4839

23) Which of the following is true about the coefficient of determination for the above data?

- A. It equals 0.2520 and it is statistically different from zero at alpha = 0.05
- B. It equals 0.2520 and it is not statistically different from zero at alpha = 0.05
- C. It equals 0.5020 and it is statistically different from zero at alpha = 0.05
- D. None of the above are correct

**Use the following data for questions 24 and 25**

Your colleague performed a regression analysis and obtained the results below. She explored the relationship between advertisements played on radio and number of new customers in your store.

|                              | ads | New customers         | xy            | x <sup>2</sup> | y <sup>2</sup> |
|------------------------------|-----|-----------------------|---------------|----------------|----------------|
| Totals                       | 69  | 100                   | 771           | 509            | 1206           |
| SUMMARY OUTPUT               |     |                       |               |                |                |
| <i>Regression Statistics</i> |     |                       |               |                |                |
| Multiple R                   |     | 0.9557                |               |                |                |
| R Square                     |     | 0.9133                |               |                |                |
| Adjusted R Square            |     | 0.9036                |               |                |                |
| Standard Error               |     | 1.6914                |               |                |                |
| Observations                 |     | 11                    |               |                |                |
| ANOVA                        |     |                       |               |                |                |
|                              |     | <i>df</i>             | <i>SS</i>     | <i>MS</i>      | <i>F</i>       |
| Regression                   |     | 1                     | 271.1609      | 271.1609       | 94.7813        |
| Residual                     |     | 9                     | 25.7482       | 2.8609         |                |
| Total                        |     | 10                    | 296.9091      |                |                |
| <i>Coefficients</i>          |     |                       |               |                |                |
|                              |     | <i>Standard Error</i> | <i>t Stat</i> | <i>P-value</i> |                |
| Intercept                    |     | -2.7434               | 1.3182        | -2.0812        | 0.0671         |
| ads                          |     | 1.8866                | 0.1938        | 9.7356         | 0.0000         |

24) If you run 9 ads, what is the expected number of new customers?

- A. 9.0338
- B. 14.2360
- C. 19.7228
- D. 16.3425

25) Regardless of your answer in problem 24, assume if you ran 9 ads the expected number of new customers is 11.5 construct a 95% confidence interval for the number of new customers.

- A. ~8 to ~12
- B. ~11 to ~12
- C. ~9 to ~14
- D. Not enough information is provided

26) Which of the following statements is true

- A. Correlation coefficient is always greater than 0
- B. Coefficient of determination is between 0 and 1
- C. Correlation coefficient is between -1 and 1



D. Both B and C are correct

Use this information to answer questions 27-30. The following table shows number of pints of ice cream sold at Spirit World Ice Cream for the last 6 weeks:

| Week | Pints of ice cream |
|------|--------------------|
| 1    | 365                |
| 2    | 388                |
| 3    | 412                |
| 4    | 392                |
| 5    | 356                |
| 6    | 368                |

27) Make a **3-week moving average forecast** for week 7. Round to the nearest integer.

- A. 391
- B. 386
- C. 381
- D. 372

28) Make a **3-week weighted moving average forecast** for week 7. Use the weights of 0.45, 0.35, and 0.20 for the most recent, next most recent, and most distant data, respectively.

**Round to the nearest integer.**

- A. 378
- B. 369
- C. 363
- D. 358

Use the following table for Q29-30. Actual and forecasted weekly sales are recorded.

| Week | Cars sold | Forecasts |  |  |  |
|------|-----------|-----------|--|--|--|
| 4    | 39        | 35        |  |  |  |

|   |    |       |  |  |  |
|---|----|-------|--|--|--|
| 5 | 37 | 39.67 |  |  |  |
| 6 | 43 | 39.33 |  |  |  |

29) What is the Mean Absolute Deviation for the above time series?

- A. 3.44
- B. 2.29
- C. 4.87
- D. 3.98

30) What is the Mean Absolute Percent Deviation for the above time series?

- A. 7.09%
- B. 7.43%
- C. 8.68%
- D. 9.48%

**Use this data to answer questions 31 and 32.** National Fire Incident Reporting System collects statistics and makes forecast for all categories of incidents nationwide. This national database shows the following numbers for residential building cooking fires:

| Year | Incidents |
|------|-----------|
| 2010 | 162,600   |
| 2011 | 164,900   |
| 2012 | 166,000   |
| 2013 | 166,600   |

31) Use exponential smoothing method with  $\alpha = 0.3$  to forecast the number of incidents **for year 2014**. Assume: initial forecast for year 2010 was 162,000 incidents. **The 2014 forecast, rounded to the nearest 10 is:**

- A. 163, 930 incidents
- B. 164, 380 incidents
- C. 164, 620 incidents
- D. 164,710 incidents

32) Use **adjusted exponential smoothing** method with  $\alpha = 0.3$  and  $\beta = 0.5$  to forecast the number of incidents for **year 2011**. Assume initial forecast for year 2010 was 162,000 and trend factor for 2010 was zero. **The 2011 forecast, rounded to the nearest 10 is:**

- A. 162,270 incidents
- B. 165,620 incidents
- C. 166,100 incidents
- D. 166,530 incidents

33) Using the method in your textbook and the time series in the following table, calculate the seasonal factor for Quarter 3.

| Year | Quarter1 | Quarter2 | Quarter3 | Quarter4 | Annual Total |
|------|----------|----------|----------|----------|--------------|
| 1    | 19       | 38       | 42       | 38       | 137          |
| 2    | 21       | 41       | 48       | 41       | 151          |
| 3    | 14       | 43       | 46       | 45       | 148          |

- A. 0.25
- B. 0.28
- C. 0.31
- D. 0.32

Use the following data for Questions 34 and 35

| Activity | Optimistic | Most likely | Pessimistic |
|----------|------------|-------------|-------------|
| A        | 3          | 5           | 6           |
| B        | 11         | 12          | 17          |
| C        | 4          | 9           | 10          |
| D        | 2          | 4           | 6           |

34) What is the expected completion time for activity B?

- A. 12.67
- B. 13.33
- C. 12.00
- D. 9.67

35) What is the variance for activity D?

- A. 4.00
- B. 1.12
- C. 0.44
- D. 0.67

Use the following data for Q36 & Q37. Use the space provided to draw the network.

| Activity | Activity time | Predecessor 1 | Predecessor 2 |
|----------|---------------|---------------|---------------|
| A        | 8             |               |               |
| B        | 5             |               |               |
| C        | 12            | A             | B             |
| D        | 6             | A             | B             |
| E        | 9             | C             | D             |
| F        | 3             | C             | D             |
| G        | 4             | E             | F             |
| H        | 11            | F             |               |

36) What is the expected project completion time?

- A. 58
- B. 34
- C. 33
- D. 42

37) How much slack is there in activity D?

- A. 0 (there is no slack in activity D)
- B. 6
- C. 1
- D. 3

**Use the following data for Questions 38 and 39**

A project costs \$4650 to complete as scheduled. The following table shows the crash schedule and crash costs for the project.

| Project time (wks) | Period cost | Cumulative cost | A | B | C | D | E | F | G | H |
|--------------------|-------------|-----------------|---|---|---|---|---|---|---|---|
| 38                 | 0           | 0               |   |   |   |   |   |   |   |   |
| 37                 | 80          | 80              |   |   |   |   |   |   |   | 1 |
| 36                 | 100         | 180             | 1 |   |   |   |   |   |   | 1 |
| 35                 | 100         | 280             | 2 |   |   |   |   |   |   | 1 |
| 34                 | 105         | 385             | 2 |   |   |   |   |   | 1 | 2 |
| 33                 | 105         | 490             | 2 |   |   |   |   |   | 2 | 3 |
| 32                 | 130         | 620             | 2 |   |   |   | 1 |   | 2 | 4 |
| 31                 | 130         | 750             | 2 |   |   |   | 2 |   | 2 | 5 |
| 30                 | 150         | 900             | 2 |   | 1 |   | 2 |   | 2 | 5 |
| 29                 | 150         | 1050            | 2 |   | 2 |   | 2 |   | 2 | 5 |

38) For every week the project is completed early your company earns a bonus of \$110. As the project manager what would you recommend?

- A. Don't crash the project at all
- B. Crash the project to 34 weeks
- C. Crash the project to 33 weeks
- D. Crash the project to 32 weeks

39) As the project manager you have determined you need to get the project done in 35 weeks, what should you do?

- A. Crash activity A by 1 week and activity H by 1 week
- B. Crash activity A by 2 weeks and activity E by 1 week
- C. Crash activity A by 2 weeks, activity G by 1 week and activity H by 2 weeks
- D. Crash activity A by 2 weeks and activity H by 1 week

40) This table lists all activities for a project. What is the variance for the project?

| Activity | Activity time | Early Start | Early Finish | Late Start | Late Finish | Slack | Variance |
|----------|---------------|-------------|--------------|------------|-------------|-------|----------|
| A        | 5.67          | 0           | 5.67         | 1.17       | 6.83        | 1.17  | 1.77     |
| B        | 6.83          | 0           | 6.83         | 0          | 6.83        | 0     | 1.37     |
| C        | 17.17         | 6.83        | 24           | 6.83       | 24          | 0     | 1.37     |
| D        | 6.5           | 6.83        | 13.33        | 17.5       | 24          | 10.67 | 2.25     |
| E        | 4.67          | 24          | 28.67        | 24         | 28.67       | 0     | 0.45     |

- A. 4.02
- B. 3.19
- C. 7.21
- D. Not enough information is provided to answer the question.