1. **d** You need at least 20 samples to create a retrospective quality control chart.

2. **a**
   because the statistic sample mean can be negative, but the sample standard deviation and range must be greater than or equal to zero.

3. **c**
   From the appendix B.2, when m=4, A2=.729. Therefore, From (7.80),
   \[ \bar{X} = 3.05, R = .01 \]
   \[ LCL = \bar{X} - A_2 \times R = 3.05 - .729 \times .01 = 3.043 \]

4. **b**
   The range of one point is found out of bounds and the system is not stable.

5. **c**

6. **a**
   From the minitab output, the sum of square for regression is 40.521 and the total sum of square is 40.521+13.479=54. The proportion of variation of the width of the bottles that are explained by the mass of the bottles would be 40.521/54=75%.

7. **b**
   Since the line fits the data, the residual plot should look like a random collection of points around zero.

8. **a**
   The t statistic should be
   \[ t = \frac{b_1 - \# Ho}{s_{b1}} = \frac{-6.7667 - (-7)}{0.9757} = \frac{-6.7667 + 7}{0.9757} = 0.2393 \]

9. **b**
   The hypothesis for the model utility test is to test whether the regression coefficient is significantly different from zero.

10. **a**
    From the minitab output, the fitted value when the mass is 32.9 is 25.836 and standard error for the fitted estimate is .222. t has df=n-k-1=18-1-1=16 and t is Q(.995)=2.921. Hence, the 99% confidence interval is
    \[ 25.836 \pm 2.921 \times .222 = (25.18, 26.48) \]

11. **d**
    Since 33 is within the range of data

12. **c**
    Definition of the least square regression.

13. **c**
    The data has a funnel shape appearance. We need to transform the data.

14. **d**
The basic assumption of simple linear regression is that the error has normal distribution with mean 0 and constant variance. So the last choice is not the assumption.

15. b
Comparison—hypothesis test  Data –amount –use means  Samples –Two independent
Use two independent means

16. a
Comparison – use hypothesis test  Data –amount –use means  Samples –Two independent
Use two independent means

17. b
Monitoring –use quality control Data –amount—use means  Samples –Many
Use x-bar chart
This is an industrial situation where they are monitoring quality of a product. Firestone tires take a sample of 4 tires every half hour. They are measuring the width which is an amount, so you use the x-bar chart.

18. a Monitoring an amount so this is an x-bar chart.

19. d Prediction – use Regression  Number of x’s – 2
Use Multiple Regression
You want to predict the speed of the gasoline based on two variables: amount of clay and sand.

20. c
Comparison—use the hypothesis test. Data—Yes/No—use proportion Samples –One sample of 100 items
Use one sample proportion.
The manufacturer takes one sample of 100 items and want to make inference based on the proportion of the defective batteries in the sample.

21. c
Prediction—use regression. Number of x’s – 1
Use simple linear regression.
In this question, the gpa of graduate students is the dependent variable (y) and the gpa of their college is the independent variable (x). The school board wants to predict y when they know the value of x.

22. a
The R^2’s are too small in c) and d). We can remove them from the correct answer. Compared with b), a) has one less variable: x3. But adding x3 does not change R^2 much. So the simpler model a) is preferable.

23. d
From the output of the linear regression model, the covariate associated with $\beta_3$ is pH. The p value is .169 and relatively large, so we fail to reject the null hypothesis that the slope for PH equals 0.

24. b
\[ y = 25 + 16 \times 2.2979 - 24 \times 1.1417 + 9 \times 3.033 + 35 \times .455 - 5 \times 2.8 = 63.64. \]

25. a
From the output, the mean square of the residual error is 27.54. 

\[ S_{LF} = \sqrt{MS_e} = \sqrt{27.54} = 5.25 \, . \]

26. b

The value of p is

\[ p = 5 - 3 = 2 \] or the number of slope terms set equal to 0.

27. c

From the output,

\[ F = \frac{(SSR(\text{full}) - SSR(\text{reduced}))/p}{SSE(\text{full})/(n-k-1)} = \frac{(2895.77 - 2583.39)/2}{716.10/(32 - 5 - 1)} = 5.68 \]

28. a

Let \( r, s_x, \) and \( s_y \) denote the correlation between \( x \) and \( y, \) standard deviation of \( x \) and standard deviation of \( y, \) respectively. So,

\[ b_1 = r \frac{s_y}{s_x} = 0.923 \left( \frac{19.11}{2.399} \right) = 7.35, \]

\[ b_0 = \bar{Y} - b_1 \bar{X} = 68.54 - 7.35 \times 4.615 = 34.62 \]

So,

\[ \hat{y} = 34.62 + 7.35x \]

29. a

Change \( R^2 \) to a decimal and then take its square root. Remember to get the sign of the slope from the equation or from the plot.

30. a

From the appendix, .995 quantile of the \( t_{21} = 2.831 \).

\[ \hat{y} \pm t_{21} \sqrt{S_{Fit}^2 + S_{SF}^2} = 1159.3 \pm 2.831 \sqrt{39.8^2 + 143.6^2} = (737.4, 1581.2) \]

31. A

True the standard deviation of fit changes for every value of \( x \). It is smaller for values of \( x \) closer to \( x-bar. \)