EXCEL 6-SIGMA QUALITY TOOLS - PART-3

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Quiz Questions

BASICS, Excel Worksheet.

1. Correlation is not always cause.

a. True
b. False

2. Industrial statistical experimentation research known as DOE:

a. measures process variables.
b. measures and adjusts process variables.
c. reduces the number of process variables.

3. The, “Null Hypothesis” states that for any given value of probability alpha:

a. “There is a greater than alpha difference in the means of groups of process values.”
b. “There is a less than alpha difference in the means of groups of process values.”
c. “The groups of process values do not come from the same population.”

4. The total probability P (area) under the normal distribution curve above is:

a. 0.500.
b. 1.000.
c. 2.000.

5. Total Population Z-score is equal to the:

a. number of standard deviations, σ between the minimum and maximum process values.
b. number of standard deviations, σ between zero and the maximum process value.
c. number of standard deviations, σ above the mean value Mu.

6. A p-value of 0.05 indicates that the relation measured between variables is correct:

a. 5% of the time.
b. 50% of the time.
c. 95% of the time.

7. Calculate the full factorial number of test runs if there are 6 factors when each factor has a low and high level.

a. 12 test runs.
b. 64 test runs.
c. 128 test runs.

8. A cube plot provides a:

a. summary of the responses for eight test runs each combining three factors.
b. summary of the responses for six test runs each combining three factors.
c. summary of the responses for three test runs each combining eight factors.

9. Design of Experiments, DOE is a systematic method for testing:

a. the effect of each factor on a process response.
b. the effect of each factor on the interaction between factors.
c. the effect of each factor on a process response and the interaction between factors.

10. Factorial experiments can be used when there are more than two levels of each factor.

a. True
b. False

ANOVA Examples, Excel Worksheet.

11. Analysis of Variance, ANOVA compares the effect of several sets of control variables on one or more response variables.

a. True
b. False

12. When the Interaction line segments of an ANOVA plot are _____, there is no interaction between the control variables.

a. crossing
b. approximately parallel
c. approximately at 45 degrees to each other

13. A1 and A2 are two chemicals. B1, 2, and 3 are process control factors that influence response variable Y recorded in the shaded cells, 4.00 … 13.00. Use the ANOVA table provided in this lesson to determine the interaction probability P given the data below.
(Hint: select and copy the top table number set below 4.00 … 9.00 then copy the bottom number set 6.00 … 13.00 into the appropriate lesson spreadsheet table).

Input	B1	B2	B3
Chemical A1	4.00	7.00	10.00
	5.00	9.00	12.00
	6.00	8.00	11.00
	5.00	12.00	9.00

Chemical A2	6.00	13.00	12.00
	6.00	15.00	13.00
	4.00	12.00	10.00
	4.00	12.00	13.00

a. P = 0.0172
b. P = 0.0372
c. P = 0.0572

ANOVA Problems, Excel Worksheet.

14. A1 and A2 are two chemicals. B1, B2, and B3 are levels of pressure that influence the flow rate Y (gpm) variable recorded in the shaded cells, 4.00 … 13.00. Use the ANOVA table below to determine the F distribution probability of two factors A and three levels B with two replications on the response variable Y given the table below.

(Hint: select and copy the number set in the table below 5.00 … 12.00 into the appropriate lesson spreadsheet table).

Input	B1	B2	B3
Factor A1	5.00 4.00	9.00 8.00	11.00 10.00
Factor A2	5.00 5.00	12.00 16.00	13.00 12.00

a. Factor A = 0.0030, Level B = 0.0005, Interaction = 0.0773
b. Factor A = 0.0130, Level B = 0.0006, Interaction = 0.0873
c. Factor A = 0.0230, Level B = 0.0007, Interaction = 0.0973

15. A1, A2, and A3 are three chemicals. B1, B2, and B3 are levels of temperature that influence fiber strength Y recorded in the shaded cells, 19.00 … 14.00. Use the table below to determine the F distribution probability of the three factors A and three levels B with two replications on the response variable Y.

(Hint: select and copy the number set in the table below 19.00 … 14.00 into the appropriate lesson spreadsheet table).

Input	B1	B2	B3
Factor A1	15.00 22.00	20.00 22.00	16.00 18.00
Factor A2	14.00 16.00	25.00 27.00	20.00 22.00
Factor A3	8.00 8.00	18.00 16.00	14.00 16.00

a. Factor A = 0.0003, Level B = 0.0003, Interaction = 0.0387
b. Factor A = 0.0004, Level B = 0.0004, Interaction = 0.0487
c. Factor A = 0.0005, Level B = 0.0005, Interaction = 0.0587

16. A1 and A2 are two chemicals. B1, B2, and B3 are levels of pressure that influence the flow rate Y (gpm) variable recorded in the shaded cells, 3.00 … 13.00. Use the ANOVA table below to determine the F distribution probability of two factors A and three levels B with four replications on the response variable Y given the table below.

(Hint: select and copy the top table number set below 3.00 … 10.00 then copy the bottom number set 5.00 … 13.00 into the appropriate lesson spreadsheet table).

Input	B1	B2	B3
Chemical Factor A1	3.00	6.00	9.00
	6.00	10.00	13.00
	5.00	9.00	11.00
	6.00	11.00	10.00

Input	B1	B2	B3
Chemical Factor A2	5.00	10.00	11.00
	7.00	15.00	13.00
	3.00	12.00	11.00
	4.00	12.00	13.00

a. Factor A = 0.0150, Level B = 0.0000, Interaction = 0.1287
b. Factor A = 0.1150, Level B = 0.0000, Interaction = 0.3287
c. Factor A = 0.2150, Level B = 0.0000, Interaction = 0.5287

EXPERIMENTS, Excel Worksheet.

17. DOE refers to procedures for adjusting industrial process control parameters called factors through a range of levels in a systematic way so as to obtain optimum outcomes called response variables in the least number of experimental test runs.

a. True
b. False

18. A range of key quality control parameters are identified as a first step to improving the quality of any manufacturing operation.

a. True
b. False

19. “Part Matching” as described in this course is the quality control procedure of:

a. manufacturing identical parts.
b. separating pairs of mating parts out of the production run that fit and function together.
c. interchangeably assembling parts with mating parts.

20. If there are, N = 3 different process control factors; X1, X2 and X3, each tested at, L = 2 levels the full number of test runs are:

a. L x N = 6.
b. $L^N = 8$.
c. $N^L = 9$.

21. This course presented a method for reducing the number of test runs from 343 to 9 by testing the minimum, mean, and maximum values of control factor X1 while fixing X2 and X3 at one of the three levels: minimum, mean, and maximum. However the accuracy was reduced by 17%.

a. True
b. False

RESPONSE SURFACE, Excel Worksheet.

22. This course describes a, "Response Surface" as being:

a. a graph of a process response due to two control factors.
b. a graph of a process response due to three control factors.
c. a graph of a process response due to four control factors.

23. Sensitivity in this lesson is defined as the:

a. the peak of the response surface.
b. the steepness of the response surface.
c. the minimum value of the response surface.

24. A, B, and C are critical dimensions of a manufactured part. Given the upper and lower specification limits below, calculate the defects per million opportunities for dimension A.
(Hint: select and copy the numerical data from 1.020 to 3.020 into the appropriate table in this course.)

PROCESS	Lower Spec Limit	Upper Spec Limit
A	1.020	1.100
B	0.050	0.060
C	3.000	3.020

a. 3862 DPMO
b. 4862 DPMO
c. 5862 DPMO

25. A, B, and C are critical dimensions of a manufactured part. The existing upper specification limit for A is 6.050 and DPMO is 9024. Given the upper and lower specification limits below, use Excel's "Goal Seek" to calculate the upper specification limit for A that will reduce the number of defects per million opportunities from 9024 to 3000.
(Hint: select and copy the numerical data from 6.000 to 6.050 into the appropriate table in this course.)

PROCESS	Lower Spec Limit	Upper Spec Limit
A	6.000	6.050
B	4.000	4.020
C	3.000	3.020

a. 6.091 inches
b. 6.191 inches
c. 6.291 inches

MATH TOOLS, Excel Worksheet.

26. Excel can be used to optimize and document engineering calculations.

a. True
b. False

27. Excel's, "Goal Seek" adjusts one input cell value to cause a different cell value containing a calculated formula to equal a new value typed in by you.

a. True
b. False

28. To unprotect an Excel spread sheet select:
Drop down menu: Format > Protection > Unprotect Sheet > OK.

a. True
b. False

29. Five values Xn of the density of a chemical, called factors randomly selected, produced by each of 15 different companies are listed below. The companies used 3 different processes temperatures or designs listed under: Design 1, 2, and 3. Temperature is the single factor in the one-way ANOVA experiment. Use Excel's, "One-Way ANOVA" to calculate the F distribution probability P-value for a significance Alpha of 5%.

Factor	Design 1	Design 2	Design 3
1	20	24	19
2	19	22	20
3	25	24	22
4	23	24	23
5	25	26	20

a. 0.044
b. 0.064
c. 0.084

30. Should the null hypothesis, Ho: Mu1 = Mu2 = Mu3 be accepted or rejected in question 29 above if Alpha is 5%?

a. accepted.
b. rejected.

31. Given: The critical F-distribution value, Fcrit = 5.153.
Degrees of freedom of the numerator, df1 = 2.
Degrees of freedom of the denominator, df2 = 6.
What is the probability P of the means being equal?

a. 3.0%
b. 5.0%
c. 7.0%

32. Given: The critical F-distribution value, Fcrit = 3.880.
Degrees of freedom of the numerator, df1 = 2.
Degrees of freedom of the denominator, df2 = 12.
What is the probability P of the means being equal?

a. 3.0%
b. 5.0%
c. 7.0%

33. Given: The probability of the means P = 0.051
Degrees of freedom of the numerator, df1 = 2.
Degrees of freedom of the denominator, df2 = 8.
What is the critical F-distribution value, Fcrit = ?
(Hint: Start with any value for Fcrit, say 3.000. Enter df1 and df2 into the Excel calculation provided in this course and use Goal Seek to find P)

a. Fcrit = 8.434
b. Fcrit = 6.434
c. Fcrit = 4.434

34. A1, A2, and A3 are three chemicals. B1, B2, and B3 are levels of temperature that influence fiber strength Y recorded in the shaded cells, 25 … 21. Use the table below to determine the F distribution probability P-value for the rows and columns.
(Hint: select and copy the number set below, 15.00 … 16.00 into the appropriate lesson spreadsheet table).

	Design 1	**Design 2**	**Design 3**
Factor	B1	B2	B3
A1	25	18	21
A2	28	17	27
A3	30	16	21

a. P-value: Rows = 0.316, Columns = 0.19.
b. P-value: Rows = 0.516, Columns = 0.019.
c. P-value: Rows = 0.716, Columns = 0.0019.

35. The force in pounds required to extend a coil spring was measured at seven values of extension in inches is given in the table below. Use Excel to plot a trend line through the measured data points and determine the best-fit linear equation and R squared value.

Extension	**Force**
0.00	0.30
0.60	2.10
0.90	4.00
1.70	6.00
2.20	7.00
3.00	10.00
3.40	11.70

a. y = 1.2353x + 0.2176, R-squared = 0.9509.
b. y = 2.2353x + 0.3176, R-squared = 0.9709.
c. y = 3.2353x + 0.4176, R-squared = 0.9909.

36. Process factor X1 was measured at seven values of X2 as given in the table below. Use Excel to plot a polynomial, order 2, trend line through the measured data points and determine the best-fit equation and R squared value. Note: x^2 means x squared.

X1	X2
600	0.030
700	0.012
800	0.010
900	0.014
1000	0.024
1100	0.040
1200	0.050

a. y = 3E-07x^2 - 0.0005x + 0.2058, R-squared = 0.9375.
b. y = 4E-07x^2 - 0.0005x + 0.3058, R-squared = 0.9575.
c. y = 5E-07x^2 - 0.0005x + 0.4058, R-squared = 0.9775.

37. The A1, A2, and A3 factor / B1, B2, and B3 level combinations result in the response values shown in the table below. These values have an F-distribution probability interaction of 0.0781 or 7.81%. Use Excel's, "Goal Seek" to adjust the top left cell value of 15.00 to a new value so that the F-distribution probability interaction will be 0.050 or 5.00%. What does the 15.00 response value change to?
(Hint: Apply Goal Seek to the table values in the "Math Tools" worksheet.)

Input	B1	B2	B3
Factor A1	15.00 22.00	20.00 22.00	16.00 18.00
Factor A2	14.00 16.00	25.00 27.00	20.00 22.00
Factor A3	8.00 8.00	18.00 16.00	13.00 13.00

a. 13.57
b. 15.57
c. 17.57

GENERAL QUESTIONS from all the Excel Worksheets.

38. This course makes the statement: "Industrial statistical analysis may be divided into _____ divisions."

a. two
b. three
c. four

39. The research hypothesis is the purpose of the research.

a. True
b. False

40. In general, the null hypothesis, Ho states: “The difference in the response means

a. is less than significance alpha.”
b. is equal to significance alpha.”
c. is equal to or more than significance alpha.”

41. Replication as described in this course is:

a. repeat factor levels.
b. repeat measurements.
c. repeat experiments.

42. When there are many factors, many experimental runs will be necessary, even without replication.

a. True
b. False

43. A factorial experiment can not be analyzed using ANOVA or regression analysis.

a. True
b. False

44. DOE can be used to find answers in situations such as "what is the main contributing factor to a problem?"

a. True
b. False

45. Analysis of Variance, ANOVA compares the effect of several sets of control variables on one or more response variables.

a. True
b. False

This is the end of the, EXCEL 6-SIGMA QUALITY TOOLS - PART-3 - QUIZ.