CQE Sample Test #2

1. The elements of project management are:
   I. Objectives.
   II. Planning.
   III. Scheduling.
   IV. Controlling.
   A. I, II and III only    B. I, II and IV only    C. I, III and IV only    D. II, III and IV only

2. Organizational roadblocks to project management implementation are a result of:
   I. Competition for the same resources
   II. Resistance to project team type organizational structure
   III. Support by upper management
   IV. Changes in objectives
   A. I, II and III only    B. I, II and IV only    C. I, III and IV only    D. II, III and IV only

3. Work breakdown structure means:
   A. Project management can only be applied to tearing down buildings, not construction of new structures.
   B. The workers have organized and have delayed the project until their demands are met.
   C. The project plan has failed due to lack of support by upper management.
   D. The statement of work is divided into the detailed listing of activities required to complete the project.
4. Consider the following network, with events marked within the circles and durations in weeks:
   The critical path is:

   ![Network Diagram]

   A. 1-3-6-8-10   B. 1-3-6-9-10   C. 1-4-6-8-10   D. 1-4-6-9-10

5. What would occur if the quality goals were not a part of the strategic plan?
   A. There would be no strategic goals.
   B. There would not be as much emphasis on quality.
   C. The total quality effort would not suffer.
   D. The quality department would still maintain the quality goals.

6. Strategic quality goals must be subdivided. Thus, they are:

7. Your top management staff has asked you, the acting quality manager, to help them install TQM. In what general order would you recommend that they proceed with the following?
   I. As a group, study the gurus.
   II. Have the CEO study the beliefs of the gurus.
   III. Go to any identified workshops.
   IV. Decide on a philosophy.

8. One of Dr. Deming's 14 points for Management states release dependence upon inspection as a way to achieve quality. The underlying tenet of this statement is which of the following?
   A. Many American companies employ too many inspectors; perhaps 5 - 10% of the work force.
   B. Quality should be built into the product not inspected in.
   C. In most cases, the workers should perform his/her own inspection and not rely on someone else.
   D. Most manual inspection will miss 10 -20% of defects under typical working conditions.

9. The MOST important step in vendor certification is to:
   A. Obtain copies of the vendor's quality manual.
   B. Familiarize the vendor with quality requirements.
   C. Analyze the vendor's first shipment.
   D. Visit the vendor's plant.

10. A vendor quality assurance function has been adopted; which of the following provisions would you advise top management to be the LEAST effective?
    A. Product audits.
    B. Source inspection.
    C. Certificate of analysis.
    D. Certificate of compliance.

11. The MOST desirable method of evaluating a supplier is:
    A. A history evaluation.
    B. A survey evaluation.
    C. A questionnaire.
    D. Discussion with the quality manager on the phone.

12. Which of the following is the BEST definition of configuration management?
    A. The collection of all product information and activities.
    B. A documentation system.
    C. A change order, record keeping system.
    D. A product production management plan.
13. You are the supplier quality engineer in charge of procured parts for manned flight space vehicles. A small manufacturing enterprise has placed a call to your office, seeking to become a supplier. You request which of the following key information from them?
   I. ISO 9000 certification number and registrar.
   II. Process capability indices on key processes.
   III. MIL-STD-45208A requirements.
   IV. A copy of their Quality Manual.

   A. I only  B. II & III only  C. I, II, & IV only  D. I, II, III, & IV

14. Training records are needed because?
   I. They can satisfy an ISO 9000 requirement.
   II. They can satisfy a Malcolm Baldrige requirement.
   III. They can satisfy an OSHA requirement.
   IV. They can satisfy an audit requirement.

   A. I and IV only  B. II and IV only  C. I, II and III only  D. I, II, III and IV

15. What is the MOST important consideration for customers who stay with a company?

16. Customer expectations follow what sequence in the hierarchy of needs?
   I. Expected.
   II. Basic.
   III. Unanticipated.
   IV. Desired.

17. A key characteristic of a business partnership is:
   A. Sharing of critical business information.          B. Limited access to human resources.
   C. Special company audits are performed.           D. Only plant managers agree on agendas.

18. As you work through a conflict situation with a customer:
   A. There is no conflict, the customer is always right.
   B. The process should not embarrass either party.
   C. The company should maintain its position.
   D. All steps and procedures are strictly followed.

19. The matrix diagram is used to show the relationship between 2 variables. Matrices can be developed in several ways. Which of the following matrix types illustrates relationships in three planes?

20. In developing a chart to plot a course of action, with many of the events or milestones unknown, which new quality tool would be used?
   A. Process decision program (PDPC) chart.         B. Activity network diagram.

21. An Ishikawa diagram is also known as:
   I. Cause and effect diagram.
   II. Process flow diagram.
   III. Scatter diagram.
   IV. Fishbone diagram.
   A. I only          B. I, III and IV only        C. I and IV only        D. I, II, III and IV
22. Tally sheets used for organizing and collecting facts and data include which two of the following?
   I. Measles chart.
   II. Checksheets.
   III. PERT charts.
   IV. Gantt charts.

   A. I and II only   B. I and III only   C. II and IV only   D. I and V only

23. Which of the following statements BEST describes a bimodal distribution?
   A. This distribution shows stratified data and two distinct peaks.
   B. This distribution shows a single mode and bell shaped distribution.
   C. This distribution is truncated.
   D. This distribution has several distribution peaks.

24. Which problem solving tool uses a cumulative line such that the defect class constituting 60% of all defects can be easily determined?
   A. Scatter diagram.
   B. Pareto diagram.
   C. Histogram
   D. Cause and effect diagram.

25. When constructing a Pareto diagram where should the other category be placed?
   A. At the beginning as the first category.
   B. Directly in the center of the chart.
   C. At the end as the last category.
   D. Where it falls according to indicated frequency.

26. The probability of event A occurring and event B occurring is equal to the probability of event A occurring multiplied by the probability of event B occurring if:
   I. Events A and B are mutually exclusive.
   II. Events A and B are independent.
   III. The covariance of events A and B is zero.

   A. I only   B. I and III only   C. II only   D. II and III only
27. A statistic is:
   A. The solution to a problem.       B. A population value.
   C. A positive number between 0 and 1 inclusive. D. A sample value.

28. A lot of 50 pieces contains 5 defectives. A sample of two is drawn without replacement. The probability that both will be defective is approximately:
   A. 0.0100       B. 0.0010     C. 0.0082      D. 0.0093

29. A process is producing material which is 20% defective. Five pieces are selected at random for inspection. What is the probability of exactly three good pieces being found in the sample?
   A. 0.184       B. 0.061     C. 0.205      D. 0.051

30. The "y" axis of a cumulative probability function shows:
   A. The incremental probability of events.
   B. The probability of an event for a given "x".
   C. The relative frequency of events.
   D. The probability of events equal to or less than a given "x".

31. The mean of either a discrete or a continuous distribution can always be visualized as:
   I. The point where 50% of the values are to the left side and 50% are to the right side.
   II. Its center of gravity.
   III. The point where most values in the distribution occur.
   A. I only       B. II only     C. II and III only        D. I, II and III

32. A sampling scoop samples about a hundred units per trial. What must be the approximate defect average for there to be a 95% chance that at least one defect will be found in the sample?
   A. 5.4        B. 4.75      C. 3.0        D. 1.8
33. The diameter of a population of ball bearings is normally distributed with a mean of 75 and a standard deviation of 8. What is the probability of the average diameter of 10 randomly selected ball bearings being greater than 77?
   A. 0.3751   B. 0.4013   C. 0.2146   D. 0.0210

34. Which of the following indicate an out of control condition?
   I. A trend of 9 points in an upward direction.
   II. 10 consecutive points above or below the center.
   III. 2 of 3 consecutive points outside the 2-sigma warning limits.
   A. I and II only   B. II and III only   C. I and III only   D. I, II and III

35. A control chart is used to:
   A. Determine if defective parts are being produced.
   B. Measure process capability.
   C. Determine causes of process variation.
   D. Detect non-random variation in processes.

36. The main purpose for using a control chart is to:
   A. Detect non-conforming material.
   B. Determine when the process is not within specification limits.
   C. Detect assignable causes of variation.
   D. Determine the process capability.

37. Which of the following statements is TRUE?
   A. The width of a confidence interval decreases as the sample size increases.
   B. The width of a confidence interval increases as the population size increases.
   C. A 90% confidence interval is wider than a 95% confidence interval.
   D. The width of a confidence interval increases as the population size decreases.
38. Which of the following is NOT correct in reference to regression?
   A. The independent variable is plotted on the x-axis.
   B. The coefficient of determination is a measure of the amount of variability explained by the regression model.
   C. The residuals are assumed to be normally distributed.
   D. There is one independent variable and one or more dependent variables.

39. Given a coefficient of determination of 0.9, what is the correlation coefficient?
   A. 0.9 or -0.9
   B. 0.81 or -0.81
   C. 0.9487 or -0.9487
   D. 0.9487

40. Given a one-way ANOVA, and given the sum of squares for error is 28, the sum of squares between treatments is 86, the mean square error is 7, and the mean square between treatments is 21.5, compute the F-statistic.
   A. 0.45
   B. 3.07
   C. 8.22
   D. 1.302

41. For a Latin Square design:
   A. The number of trials must be 8.
   B. All interactions are measured.
   C. The number of rows must equal the number of columns.
   D. The square of the result is analyzed.

42. Which of the following CANNOT be a null hypothesis?
   A. The population means are equal.
   B. P' = 0.5
   C. The sample means are equal.
   D. The difference in the population means is 3.85

43. A process calls for the mean value of a dimension to be 2.02". Which of the following should be used as the null hypothesis to test whether or not the process is achieving this mean?
   A. The mean of the population is 2.02"
   B. The mean of the sample is 2.02"
   C. The mean of the population is not 2.02"
   D. The mean of the sample is not 2.02"
44. If, in a designed experiment, you obtained an F-ratio of 0.68 with 2 and 20 degrees of freedom, you would conclude that:
   A. There were no significant differences among the means.  
   B. You had made an error.  
   C. The variances were equal.  
   D. The null hypothesis was rejected.

45. A correlation problem:
   A. Is solved by estimating the value of the dependent variable for various values of the independent variable.
   B. Considers the joint variation of two measurements, neither of which is restricted by the experimenter.
   C. Is the one case where the underlying distributions must be geometric.
   D. Is solved by assuming that the variables are normally and independently distributed with mean = 0 and variance = $s^2$.

46. Which table should be used to determine a confidence interval on the mean when $s$ is NOT known and the sample size is 10?
   A. $z$  
   B. $t$  
   C. $F$  
   D. Chi-Square

47. In every experiment there is experimental error. Which of the following statements is TRUE?
   A. This error is due to lack of uniformity of the material used in the experiment and to inherent variability in the experimental technique.
   B. This error can be changed statistically by increasing the degrees of freedom.
   C. The error can be reduced only by improving the material.
   D. In a well-designed experiment there is no interaction effect.

48. When constructing a factorial experiment, which of the following is TRUE?
   A. Factorial experiments may not contain any number of levels per factor. They must be the same for each factor.
   B. Confounding takes place in factorials when we run a fractional part of the complete experiment.
   C. Contrasts and treatment combinations are the same.
   D. In factorials, the factors must be quantitative.
49. The Risk Priority Number is used when:
   A. Auditing safety hazards.  
   B. Predicting reliability.  
   C. Constructing a fault tree.  
   D. Completing an FMEA.

50. Which of the following is best suited for modelling the reliability of a complex piece of equipment?
   A. Fault-tree.  
   B. FMEA.  
   D. Vector Space Analysis.

51. Which of the following would be considered the WEAKEST reason to initiate an audit?
   A. To compare actual practice to a defined standard.  
   B. Follow-up on corrective action.  
   C. Identify the root cause of a recent problem.  
   D. Verify that a quality system continues to meet requirements.

52. A reference dimension on a drawing
   A. Describes a feature from which tolerances are established.  
   B. Describes the location of a large number of similarly shaped features.  
   C. Describes a normal datum dimension.  
   D. Describes an information dimension, which is not to be inspected.

53. The drawing dimensions were specified in terms of a normal value +/-3 standard deviations. This is an indication that
   A. Approximately 99.73% of the typical process output would be approved.  
   B. A meaningless variation specification has been indicated.  
   C. Specification tolerances are established after the production tolerances.  
   D. The natural manufacturing process spread will be acceptable.
54. Four ingredients are blended to make a final product. Using the data below, what is the expected weight and variation of the final product?

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Weight</th>
<th>Variation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>70</td>
<td>+/- 3.00</td>
</tr>
<tr>
<td>B</td>
<td>20</td>
<td>+/- 1.73</td>
</tr>
<tr>
<td>C</td>
<td>15</td>
<td>+/- 1.73</td>
</tr>
<tr>
<td>D</td>
<td>10</td>
<td>+/- 1.00</td>
</tr>
</tbody>
</table>

A. 115 +/- 7.46 grams.  
B. 115 +/- 5.73 grams.  
C. 115 +/- 4.00 grams.  
D. 115 +/- 3.61 grams.

55. During the pre-award survey at a potential key supplier, you discover the existence of a quality control manual; this means

A. That a quality system has been developed.  
B. That a quality system has been implemented.  
C. That the firm is quality conscious.  
D. That the firm has a quality manager.

56. Which of the following statements is FALSE?

A. A quality audit should be done on a surprise basis.  
B. A quality audit should be structured.  
C. A quality audit should include recommendations.  
D. A quality audit should avoid determining blame.

57. The final audit report should contain

I. The audit team membership.  
II. The same tone and content as the audit.  
III. A description of any key observations or findings.  
IV. The scope and objectives of the audit.

A. II, III and IV only  
B. III and IV only  
C. II and IV only  
D. I, II, III and IV
58. The primary purpose of an process audit is
   A. Detect and reject defective products missed by normal inspection.
   B. Provide data to direct operator and / or inspector training.
   C. Measure the effectiveness of the current quality system.
   D. Provide data in case operator disciplinary action is required.

59. If the specification limits are wider than the control limits, then
   A. The process is capable.       B. The process capability index is greater than 1.0.
   C. The specification limits replace the control limits on the chart.
   D. None of the above.

60. Given an average of 1.93 nonconformities per 5 units, what is the upper limit of the control chart used in this situation?
   A. 6.10       B. 2.45       C. 7.13       D. 3.79

61. What is the ARL for an X bar control chart(n = 5) assuming the process remains in control?
   A. 3         B. 8         C. 283        D. 370

62. If two-sigma limits are substituted for conventional three-sigma limits on a control chart, which of the following occurs?
   A. Decrease in alpha risk.       B. Increase in beta risk.
   C. Increase in alpha risk.       D. Increase in sample size.

63. What is the upper control limit for a p chart (proportion defective) when the average daily production is 2500 units with an established fraction defective of 0.05?
   A. 0.054       B. 0.058       C. 0.063       D. 0.066
64. An X-bar and R chart with $n = 5$ has been plotted for some time and has demonstrated random variation. Upon review of the last 30 plot points, the expected number of runs around the centerline on the X-bar chart is expected to be approximately which of the following?
   A. 4       B. 9       C. 12       D. 16

65. Which of the following are the most logical reasons for providing source inspection?
    I. The supplier has consistently shown poor out-going quality.
    II. The key inspection points are hidden after assembly at the suppliers' plant.
    III. The supplier requests the inspection to save them potential shipping expenses.
    IV. The criticality of the product warrants it.
   A. I, II and IV only   B. II and IV only   C. II, III and IV only   D. I, II, III and IV

66. Consider the following statement
    "A defect which might affect the appearance or general function of essential parts"
This definition describes a seriousness classification described as:

67. Which of the following would NOT be considered as part of detailed inspection instructions?
   A. Whether the product or service conforms to specifications.
   B. What records must be kept.
   C. What must be done with non-acceptable parts.
   D. What are the applicable standards.

68. A lot is known to be 1.2% defective. Five units are randomly selected from the lot, and the lot is accepted if 1 or fewer defects are found. What is the probability of the lot being rejected?
   A. 0.9985   B. 0.01   C. 0.00141   D. 0.00223
69. For special inspection level 3, and a lot size of 300, what is the sample size code letter for ANSI/ASQ Z1.4?
   A. A       B. C       C. D       D. F

70. Which of the following statements is NOT true concerning the Dodge-Romig sampling plans?
   A. Single and Double sampling plans are available.
   B. They were developed in the 1960s.
   C. Plans exist for LTPD protection and to provide a specified AOQL.
   D. They apply only when rejected lots are 100% inspected.

71. What is the inspection level code letter for inspection level II and a lot size of 500 when using ANSI/ASQ Z1.9?
   A. C       B. E       C. G       D. I

72. The use of Program Evaluation and Review Technique (PERT) requires
   A. The critical path to be known in advance.
   B. Slack times to be added to the critical path.
   C. Time estimates for each activity in the network.
   D. Less data than a Gantt chart.

73. The first and most important project planning step is
   A. Securing resources.       B. Defining the objective.
   C. Defining the specifications.       D. Creating the Gantt chart.
74. The project planning sequence is
   I. Budgets.
   II. Statement of work.
   III. Project objective.
   IV. Work breakdown structure.


75. A thorough review of the works of the major quality gurus would indicate which of the following to be the most effective way to create quality?
   A. Effective problem solving.
   B. Benchmarking the best competitive practices.
   C. Continuous process improvement.
   D. Modern statistical control techniques.

76. Consider the following list of quality concepts and then identify the appropriate quality management luminary that is NOT identified with any of them
   I. Company wide quality control.
   II. The quality trilogy.
   III. The quality explosion.
   IV. Signal to noise ratio.
   V. Zero defects.
   VI. Total quality control.

   A. Dr. Armand V. Feigenbaum.  B. Dr. W. Edward Deming.
   C. Dr. Kaoru Ishikawa.  D. Dr. Stephen Covey.

77. For employee involvement efforts to succeed, what may be needed?
   A. Increased employee incentives.
   B. Increased basic training company wide.
   C. Employee understanding of how they can make a difference.
   D. The initiation of pilot projects.
78. What other problem solving tool is customarily used to compliment the fishbone diagram?
   A. Scatter diagrams.        B. Pareto diagrams.   C. Brainstorming.   D. Force field analysis

79. Scatter diagrams are useful in problem solving because they
   A. Display the significant few.   B. Eliminate the trivial many.
   C. Show relationships between variables.   D. Highlight assignable causes.

80. The most widely used technique for distinguishing between chronic and insignificant problems is
   A. A Pareto diagram.        B. A control chart.
   C. A cause and effect diagram.   D. A scatter diagram.

81. Process flow improvement steps normally do NOT include
   I. Asking why we do it this way.
   II. Asking what would make it "perfect".
   III. Analyzing each step in detail.
   IV. The use of Pareto diagrams.
   V. A comparison with processes different than your own.
   A. I and V only        B. II and IV only   C. III only   D. IV only

82. Historically, the number of flaws in the finish of surface has an average of 0.45. What is the probability of a randomly selected item having more than 1 defect in the surface finish?
   A. 0.0755        B. 0.2869   C. 0.6376   D. 0.3624

83. If Events A and B are independent, then
   A. P(B/A)=P(A)        B. P(A/B)=P(B)   C. P(B/A)=P(B)   D. A and B above
84. On average, a company hires 4 people per month. In a given month, what is the probability that exactly 7 people will be hired?
A. 0  B. 0.0595  C. 0.4487  D. 0.0087

85. If a distribution is skewed to the left
   A. The mode is between the median and the mean.
   B. The mean is between the mode and the median.
   C. The mode is greater than the median.
   D. A and B above.

86. The term poka-yoke refers to
   A. The mistake - proofing of a process.
   B. As close to zero defects as possible.
   C. The institution of just-in-time procedures.
   D. The control of product flow via colored markings.

87. Consider the linear relationship between two variables in the figure below. Which of the following are true statements regarding the regression line shown?

   ![Linear Relationship Diagram]

   I. The regression line should always go through the origin and this one doesn't.
   II. Both the x and y intercepts will show positive values.
   III. There is fairly strong correlation between the two variables.
   IV. The relationship between the two variables reflects a "negative" slope.

   A. I, II and III only  B. III and IV only  C. II, III and IV only  D. I, II, III and IV
88. Which of these quality tools would NOT be expected to be used during the results confirmation stage of a problem solution?

89. Reengineering is BEST described as
   A. Studying a business that is a leader in their field and using some of their activities.
   B. Rethinking and radically redesigning the business.
   C. Installing state of the art equipment and processes.
   D. Improving the design of products.

90. The descriptive name for a fishbone or Ishikawa diagram is which of the following?
   A. Flow charts.       B. Cause and effect diagrams.
   C. Pareto diagram.       D. Scatter diagram.

91. Which of the quality tools below is BEST suited for directing attention to problems in a systematic manner?

92. Which of the following terms apply to control charts?
   I. Process median.
   II. Process average.
   III. Upper control limit.
   IV. Process standard deviation.
   V. Variable correlation.
   A. I, II, III, IV and V       B. II, III and IV only       C. II and V only       D. I, III and IV only
93. For the normal probability distribution, the relationships among the median, mean and mode are that
   A. They are all equal to the same value.
   B. The mean and mode have the same value but the median is different.
   C. Each has a value different from the other two.
   D. The mean and median are the same but the mode is different.

94. A successful quality team program should produce all of the following benefits EXCEPT
   A. Improved worker morale.
   B. Decreased need for management efforts to maintain quality.
   C. Improved communication between managers and quality team members.
   D. Cost savings from participative problem solving.

95. The primary reason for evaluating and maintaining surveillance over a supplier's quality program is to
   A. Perform product inspection at the source.
   B. Eliminate incoming inspection costs.
   C. Motivate suppliers to improve quality.
   D. Make sure the supplier's quality program is functioning effectively.

96. Technical service to suppliers is
   A. A great public relations gesture when personnel are available.
   B. A greater benefit to the company than it is to the supplier.
   C. A support feature for which suppliers are normally charged.
   D. An optional luxury which is not a company responsibility.

97. The audit team normally advises the auditee immediately upon the discovery of a finding during an
    audit. Which of the following items is (are) valid reasons for taking this action?
    I. If corrected immediately, the findings may be eliminated from the audit report.
    II. If corrected immediately, it shows genuine auditee interest in the objectives of the audit.
    III. If corrected immediately, it demonstrates the strength of an ongoing audit program.
    A. I only            B. III only            C. II and III only           D. I, II and III
98. A quality systems audit is generally MOST effective if
   I. It is initiated because of a recent customer complaint.
   II. It has defined management objectives.
   III. It checks system elements on a scheduled ongoing basis.
   IV. It is the result of a widely recognized internal product quality issue.
   
   A. II and IV only  B. I and III only  C. II and III only  D. I, II and IV only

99. Which of the following parties, traditionally initiates an audit?

100. During the performance of an audit, which of the following are key considerations?
   I. What sampling plans may be necessary?
   II. Is the audit schedule progressing as planned?
   III. Is there a need for a technical specialist?
   IV. Is the level of compliance satisfactory?
   
   A. I, II and III only  B. II and IV only  C. I and IV only  D. I, II, III and IV

101. Which of the following statements CANNOT be made regarding a process audit?
   I. They can be helpful in improving the process in question.
   II. They are more formal than a system audit.
   III. They require less planning than a systems audit.
   IV. They may be performed internally or externally.
   
   A. II only  B. II and III only  C. I, II and IV only  D. II and IV only
102. What is the meaning of the G D & T symbol below?

A. Maximum material condition.  
B. Regardless of feature size.  
C. Least material condition.  
D. Projected tolerance zone.

103. The best argument(s) to avoid unnecessary accuracy in dimension measurement is(are) which of the following?
   I. The measuring instrument may be more expensive.  
   II. The total measurement process may be more expensive.  
   III. More measurement time may be required.

A. II only  
B. I and II only  
C. II and III only  
D. I, II and III

104. When non-conforming product is encountered, a materials control plan must have procedures to control which of the following events?
   I. Identification.  
   II. Segregation.  
   III. Disposition.

A. I and II only  
B. I and III only  
C. II and III only  
D. I, II and III

105. Which of the following would be the most important considerations when establishing inspection points within a production operation?
   I. Inspection to prevent defects from entering the system.  
   II. Inspection after all operations (both manual and automated).  
   III. Inspection prior to a painting or masking operation.

A. I only  
B. I and II only  
C. I and III only  
D. I, II and III
106. Inspection operations typically
A. Help in assuring satisfactory quality.
B. Reduce the usability of the product or service involved.
C. Require precise equipment in most instances.
D. Occur between all manufacturing operators.

107. The duties of a materials review board (MRB) do NOT include
A. Development of corrective action plans to correct non-conformities.
B. A review of non-conforming product.
C. Disposition of any set-aside non-conforming products.
D. Monitoring the effectiveness of the quality system.

108. Which of the following is an advantage of automated inspection over conventional inspection?
A. Greater mobility.
B. Greater flexibility.
C. Lower initial costs.
D. Shorter inspection times

109. Compared to traditional inspection, which of the following would be considered advantages of automated inspection systems?
I. Greater accuracy.
II. Faster report generation.
III. Lower operating costs.
IV. Shorter inspection times.
A. II and III only
B. I and III only
C. II, III and IV only
D. I, II, III and IV
110. The use of standards traceable to NIST provides assurance that the measuring equipment is
   I. Valid.
   II. Precise.
   III. Accurate.
   IV. Sensitive.
   A. II only       B. III only       C. I, II and III only      D. I, II, III and IV

111. Most of the base units of the SI measurement system can be produced via laboratory
     experimentation. An exception to this rule is the category for

112. The most essential value of a surface plate in precision measurement application is which of the
     following?
     A. It provides a flat working surface.
     B. It provides a surface free of minor vibration.
     C. It provides an accurate reference surface.
     D. It provides a chemically resistant work surface.

113. The use of a magnifying lens on an optical comparator helps ensure
     I. Greater sensitivity and reproducibility in the measurement.
     II. An expanded display of surface roughness and surface defects.
     III. More illumination of the edge of the test object.
     A. I only       B. I and II only     C. II and III only       D. I, II and III
114. The typical responsibilities of a calibration department would include which of the following?
   I. Ensuring traceability of all calibrations to a standard laboratory.
   II. Maintaining an adequate record system.
   III. Suspending measuring equipment from use when conditions warrant.
   IV. Identify equipment with a label indicating calibration status.

A. I, II and III only    B. I, II and IV only    C. I, III and IV only    D. I, II, III and IV

115. Which of the following are true statements regarding the use of visual inspection?
   I. Reference standards can be used.
   II. It provides consistency between inspectors.
   III. It is relatively expensive.
   IV. It can be quickly performed.

A. I and IV only    B. I, II and IV only    C. II and IV only    D. I, II, III and IV

116. Consider the following incomplete list of liquid penetrant steps
   1. A liquid penetrant is applied.
   2. Excess penetrant is washed off the test piece.
   3. The test piece surface is cleaned.
   4. An accept/reject decision is made.
   5. The acceptable parts are post-cleaned.
   6. The developer is applied to the part.

A. 3, 1, 2, 6, 4, 5    B. 3, 1, 6, 2, 4, 5    C. 1, 3, 2, 6, 5, 4    D. 1, 3, 6, 2, 4, 5

117. Which of the following is the BEST statement to make regarding the relationship between product precision and product production?
   A. With too little precision, production costs increase.
   B. With too much precision, production costs increase.
   C. Precision costs and performance are related.
   D. With little precision, performance will improve.
118. Calibration intervals of "Measuring & Test Equipment" must be based upon (per MIL-STD-45662):
   A. Intervals assigned by the Department of Defense.
   B. Corporate rules and procedures.
   C. Equipment stability, purpose, and degree of usage.
   D. Predetermined intervals.

119. Measurement gaging is preferable to go, no-go gaging of a quality characteristic because
   A. It is more scientific.
   B. It provides the most information per piece inspected.
   C. It requires greater skills.
   D. It requires a larger sample than go, no-go gaging does.

120. The Dodge-Romig sampling tables for AOQL protection
   A. Require sorting of rejected lots.
   B. Are the same in principle as the table.
   C. Do not depend upon the process average.
   D. Require larger samples than ANSI/ASQ Z1.4 for equivalent quality assurances.

121. A single sampling plan calls for a sample size of 80 with an acceptance number of 5 and a rejection number of 6. If the quality of the submitted lots is ten percent defective, then the percent of lots expected to be accepted in the long run is approximately
   A. 6%   B. 10%   C. 20%   D. 30%

122. Two quantities which uniquely determine a single sampling attributes plan are
   A. AQL and LTPD.   B. Sample size and rejection number.
   C. AQL and producer's risk.   D. LTPD and consumer's risk.
123. A system was designed with 3 capacitors. When the system is first activated all capacitors are operating. The system continues to operate as long as at least 1 capacitor is operating. This is an example of
A. Redundancy.  
B. A series system.  
C. An active parallel system.  
D. A standby parallel system.

124. The Shewhart or Deming cycle is often referred to as
A. The cause and effect diagram.  
B. The affinity diagram.  
D. Problem solving flow chart.

125. Variables control charts are designed with which of the following objectives?
A. To reduce sample size.  
B. To fix the risk of accepting poor product.  
C. To decide when to investigate causes of variation.  
D. To establish an acceptable quality level.

126. What is the corrective action sequence for the options below?
I. Assign an investigator to the problem.  
II. Assess the importance of the problem.  
III. Analyze the problem.  
IV. Install necessary controls.
A. II, III, I, IV  
B. II, I, III, IV  
C. I, III, II, IV  
D. I, II, III, IV

127. The quality tool widely used to analyze the relationship between two variables is
A. Scatter diagram.  
B. Pareto diagram.  
C. Run charts.  
D. Cause and effect diagram.

128. A number derived from sample data, which describes the data in some useful way, is called a
A. Constant.  
B. Statistic.  
C. Parameter.  
D. Critical value.
129. Estimate the variance of the population from which the following sample data came
22, 18, 17, 20, 21
A. 4.3  B. 2.1  C. 1.9  D. 5.0

130. Given 6 books, how many sets can be arranged in lots of 3 but always in a different order?

131. In statistical quality control, a parameter is
A. A random variable.  B. A sample value.  C. A population value.  D. The solution to a statistical problem.

132. Which of the following measures of variability is NOT dependent on the exact value of every measurement?

133. A box contains 27 black and 3 red balls. A random sample of 5 balls is drawn without replacement. What is the probability that the sample contains one red ball?
A. 0.108  B. 0.270  C. 0.369  D. 0.500

134. Which one of the following is a true statement of probability?
A. \( P(E \text{ and } F) = P(E) + P(F) \)  B. \( P(E \text{ or } F) = P(E) + P(E|F) \)
C. \( P(E \text{ or } F) = P(E) + P(F) - P(E \text{ and } F) \)  D. \( P(E \text{ and } F) = P(E) + P(F) - P(E \text{ and } F) \)
135. A p-chart has exhibited statistical control over a period of time. However, the average fraction defective is too high to be satisfactory. Improvement can be obtained by
   I. A change in the basic design of the product.
   II. Instituting 100% inspection.
   III. A change in the production process through substitution of new tooling or machinery.

A. I only       B. I and III only       C. II and III only       D. I, II and III

136. Basic assumptions underlying the analysis of variance include
   I. Observations are from normally distributed populations.
   II. Observations are from populations with equal variances.
   III. Observations are from populations with equal means.

A. I and II only       B. I and III only       C. II and III only       D. I, II, and III

137. You have just conducted a designed experiment at three levels A, B, and C yielding the following "coded" data:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

As a major step in your analysis, you calculate the degree of freedom for the "error" sum of squares to be

A. 7       B. 9       C. 6       D. 3

138. Which of the following statements concerning the coefficient of simple linear correlation, r, is NOT true?
   A. \( r = 0.00 \) represents the absence of a relationship.
   B. The relationship between the two variables must be nonlinear.
   C. \( r = 0.76 \) has the same predictive power as \( r = -0.76 \).
   D. \( r = 1.00 \) represents a perfect relationship.
139. Formation of a quality council is a logical first step when an organization launches a quality improvement program
   I. Because improvement is a strategic goal.
   II. Because improvement needs to be monitored.
   III. Because improvement teams need to be well prepared and equipped.

A. I only.  B. I, III only.  C. II, III only.  D. All of the above.

140. An organization quality council is usually composed of
   I. The workforces.
   II. The upper managers.
   III. The middle managers.

A. I only.  B. II only.  C. II, III only.  D. All of the above.

141. Project improvement team members normally have
   A. Narrow skills and experiences.
   B. Diverse skills and narrow experiences.
   C. Diverse experiences and narrow skills.
   D. Diverse skills and experiences.

142. The facilitator should have special training in improvement techniques in order to
   I. Keep the process on track.
   II. Assist with complex data analysis.
   III. Train team members in the improvement process.

A. I only.  B. I, II only.  C. I, III only.  D. All of the above.

143. A self-directed team is appropriate for which of the following activities?
   A. Implementing a new company-wide phone system.
   B. Defining purchase order requirements.
   C. Resolving labor union issues.
   D. Solving a departmental procedural problem.
144. Rate the following actions or activities from short terms to long term
   I. Containment actions.
   II. Temporary actions.
   III. Continuous improvement.
   IV. Preventive actions.


145. The major reason for using a control chart is to
   A. Discover inherent variation in the process.
   B. Discover the root cause of nonconforming quality characteristics.
   C. Find nonconformities.
   D. Detect nonrandom variation.

146. Which of the following problem-solving tools is a column graph which displays a static picture of the process?
   A. Pareto chart.       B. Control chart.       C. Histogram.       D. Fish bone chart.

147. Correlation coefficients are generated from which of the following graphs?

148. The quality audit could be used to judge all of the following EXCEPT
   A. A prospective vendor's capability for meeting quality standards.
   B. The adequacy of a current vendor's system for controlling quality.
   C. The application of a specification to a unique situation.
   D. The adequacy of a company's own system for controlling quality.
149. Review of purchase orders for quality requirements falls into which one of the following quality cost segments?

150. Communication with vendors on quality problems
   A. Should be initiated by the vendor's quality control department.
   B. Should be initiated by the vendee's purchasing department.
   C. Should be initiated by the vendee's engineering department.
   D. Can be resolved only through personal visits between vendor and vendee.

151. What does "the voice of the customer" refer to?
   A. Customer call ins.  B. Analysis of complaint cards.
   C. Listening to the customer.  D. Internal option polls.

152. It is generally easier to find a benchmarking partner in which of the following area?

153. If qualitative data were being considered, what quality improvement tools could be utilized?
   I. Control charts.
   II. Affinity diagrams.
   III. Pareto diagrams.
   IV. Flowcharts.
154. The advantages of a quality cost system would NOT include which of the following?
   A. Aligns quality and company goals.
   B. Provides a prioritization system for the allocation of resources.
   C. Insures the resolution of specific quality problems.
   D. Provides a manageable overview of quality.

155. Your company produces one, two, or three automated assembly systems per order. Each system is
custom built for the customer’s application. The system are very complex and include computer controls,
mechanical components, and pneumatic actions. Each system can have multiple problems which are found
at final inspection. The most appropriate control chart for this process is which of the following?
   A. c chart. 
   B. np chart. 
   C. u chart. 
   D. MX bar - MR chart.

156. An X bar-R chart has been established based on 30 sets of 5 samples taken at 15 minute intervals.
The next 20 sets of samples all had averages within the control limits, with no apparent trends or
patterns. The range values have been within control limits as well, with no apparent trends or patterns.
Which of the following statements may NOT be true?
   A. 100% of the parts meet specifications.
   B. The process is in control.
   C. The sample average are normally distributed.
   D. The process has shown no assignable causes.

157. Which statement is (are) TRUE regarding the correlation coefficient?
   I. It varies from 0 through 1.
   II. A negative relationship is indicated if X increases and Y decreases.
   III. It is always a positive number.
   A. I 
   B. III 
   C. II 
   D. I, II, III

158. Which of the following quality tools would be LEAST important in the problem definition phase?
   A. Fishbone diagrams.
   B. Control Charts.
   C. Process flow diagrams.
   D. Pareto diagrams.
159. An X bar and R chart can be helpful in controlling a process when
   I. The machine capability is wider than the specification.
   II. It is necessary to know when to investigate a process for cause of variation.
   III. The machine capability is smaller than the specification.
   IV. A reduced sample size is needed.
   V. An acceptable quality level must be established.

   A. I, II  B. II, III  C. III, IV  D. III, V

160. An "empowered" team is able to
   A. Terminate employment of nonproductive employees.
   B. Request information from all organizational levels.
   C. Represent the organization in legal affairs.
   D. Purchase up to $100,000 of incidents.
<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D</td>
<td>B</td>
<td>D</td>
<td>C</td>
<td>B</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>B</td>
<td>D</td>
<td>A</td>
<td>D</td>
<td>A</td>
<td>C</td>
<td>B</td>
</tr>
<tr>
<td>1</td>
<td>D</td>
<td>16</td>
<td>A</td>
<td>31</td>
<td>B</td>
<td>46</td>
<td>B</td>
<td>61</td>
<td>D</td>
<td>76</td>
<td>A</td>
<td>106</td>
<td>A</td>
<td>D</td>
<td>151</td>
</tr>
<tr>
<td>2</td>
<td>B</td>
<td>17</td>
<td>A</td>
<td>32</td>
<td>C</td>
<td>47</td>
<td>A</td>
<td>62</td>
<td>C</td>
<td>77</td>
<td>B</td>
<td>107</td>
<td>A</td>
<td>D</td>
<td>152</td>
</tr>
<tr>
<td>3</td>
<td>D</td>
<td>18</td>
<td>B</td>
<td>33</td>
<td>C</td>
<td>48</td>
<td>B</td>
<td>63</td>
<td>C</td>
<td>78</td>
<td>A</td>
<td>108</td>
<td>D</td>
<td>C</td>
<td>153</td>
</tr>
<tr>
<td>4</td>
<td>C</td>
<td>19</td>
<td>D</td>
<td>34</td>
<td>D</td>
<td>49</td>
<td>D</td>
<td>64</td>
<td>C</td>
<td>79</td>
<td>B</td>
<td>109</td>
<td>D</td>
<td>C</td>
<td>154</td>
</tr>
<tr>
<td>5</td>
<td>B</td>
<td>20</td>
<td>A</td>
<td>35</td>
<td>D</td>
<td>50</td>
<td>A</td>
<td>65</td>
<td>C</td>
<td>80</td>
<td>C</td>
<td>110</td>
<td>A</td>
<td>D</td>
<td>155</td>
</tr>
<tr>
<td>6</td>
<td>D</td>
<td>21</td>
<td>C</td>
<td>36</td>
<td>C</td>
<td>51</td>
<td>C</td>
<td>66</td>
<td>D</td>
<td>81</td>
<td>D</td>
<td>111</td>
<td>C</td>
<td>D</td>
<td>156</td>
</tr>
<tr>
<td>7</td>
<td>A</td>
<td>22</td>
<td>A</td>
<td>37</td>
<td>A</td>
<td>52</td>
<td>A</td>
<td>67</td>
<td>A</td>
<td>82</td>
<td>A</td>
<td>112</td>
<td>C</td>
<td>A</td>
<td>142</td>
</tr>
<tr>
<td>8</td>
<td>B</td>
<td>23</td>
<td>A</td>
<td>38</td>
<td>D</td>
<td>53</td>
<td>B</td>
<td>68</td>
<td>C</td>
<td>83</td>
<td>C</td>
<td>113</td>
<td>B</td>
<td>D</td>
<td>158</td>
</tr>
<tr>
<td>9</td>
<td>B</td>
<td>24</td>
<td>B</td>
<td>39</td>
<td>C</td>
<td>54</td>
<td>C</td>
<td>69</td>
<td>B</td>
<td>84</td>
<td>B</td>
<td>114</td>
<td>D</td>
<td>C</td>
<td>159</td>
</tr>
<tr>
<td>10</td>
<td>D</td>
<td>25</td>
<td>C</td>
<td>40</td>
<td>B</td>
<td>55</td>
<td>A</td>
<td>70</td>
<td>B</td>
<td>85</td>
<td>C</td>
<td>115</td>
<td>A</td>
<td>D</td>
<td>160</td>
</tr>
<tr>
<td>11</td>
<td>A</td>
<td>26</td>
<td>D</td>
<td>41</td>
<td>C</td>
<td>56</td>
<td>A</td>
<td>71</td>
<td>D</td>
<td>86</td>
<td>A</td>
<td>101</td>
<td>A</td>
<td>A</td>
<td>146</td>
</tr>
<tr>
<td>12</td>
<td>A</td>
<td>27</td>
<td>D</td>
<td>42</td>
<td>C</td>
<td>57</td>
<td>D</td>
<td>72</td>
<td>C</td>
<td>87</td>
<td>C</td>
<td>102</td>
<td>B</td>
<td>C</td>
<td>147</td>
</tr>
<tr>
<td>13</td>
<td>C</td>
<td>28</td>
<td>C</td>
<td>43</td>
<td>A</td>
<td>58</td>
<td>C</td>
<td>73</td>
<td>B</td>
<td>88</td>
<td>A</td>
<td>103</td>
<td>D</td>
<td>C</td>
<td>148</td>
</tr>
<tr>
<td>14</td>
<td>D</td>
<td>29</td>
<td>C</td>
<td>44</td>
<td>A</td>
<td>59</td>
<td>D</td>
<td>74</td>
<td>D</td>
<td>89</td>
<td>B</td>
<td>104</td>
<td>D</td>
<td>B</td>
<td>149</td>
</tr>
<tr>
<td>15</td>
<td>B</td>
<td>30</td>
<td>D</td>
<td>45</td>
<td>B</td>
<td>60</td>
<td>D</td>
<td>75</td>
<td>C</td>
<td>90</td>
<td>B</td>
<td>105</td>
<td>C</td>
<td>A</td>
<td>150</td>
</tr>
</tbody>
</table>
CQE Sample Test #2 : Solutions.

1. D
The elements of project management are: Planning, Scheduling, and Controlling. This can be stated as 1) deciding what to do, 2) deciding when to do it, and 3) assuring that desired results are obtained. Setting the objectives is an important step in the project process. However, the elements of the project management process are II, III and IV. Answer D is correct.

2. B
The wording of this question is somewhat tricky. One might argue that organizational roadblocks are due to all four factors listed above. Upper management approves the project and thereby supports the project. At the same time, upper management may create organizational roadblocks to the project by making changes in the project objective, after the project has started. They may also start too many projects at the same time, creating competition for the same resources. Finally, project team members may not accept reporting to a project manager whose hierarchical position is lower than theirs. Answer B is correct.

3. D
The work breakdown structure (WBS) is a detailed plan which expands the statement of work into the detailed listing of activities required to complete the project. The project manager is responsible for completion of the work breakdown structure, including assignment of responsibility for each task to an individual or organizational group. Answer D is correct. References: CQE Primer, Section II and Kerzner, H., Project Management A Systems Approach to Planning, Scheduling and Controlling, 3rd ed., pp. 597-607.

4. C
The critical path is the task sequence which requires the greatest expected time.

5. B
Strategic goals could exist without a quality element. Therefore, answer A is not correct. Answer B, lack of emphasis, can occur. The total quality effort would possibly suffer if it is not part of the strategic plan. The quality effort needs commitment from top management. Therefore, answer C is not a correct statement. Quality department goals (answer D) would not be strategic in nature. The best choice is B. Answer B is correct.
6. D
Delegated means to be assigned goals (answer A). Distributed means to be given goals (answer B). Accountable means to be responsible for the goals (answer C). Deployed means to have the goals spread out into attainable portions. Answer D is the best choice. Answer D is correct.

7. A
Logic indicates that the CEO should study the gurus first (item II), this action should be followed by the total management team (item I). The decision on a plant philosophy should be undertaken only after a thorough management understanding. Item IV should be last, which makes answer A the best choice. Answer A is correct.

8. B
Answers A, C and D are true statements in many circumstances. They explain or expand some of the weaknesses or facts present during product inspection. However, answer B explains the question best. If quality is built into the product then it doesn't matter if inspection misses a defect. The defect isn't there. Inspection to improve quality is too late, ineffective and costly.

9. B
One of the fundamental steps in dealing with a vendor is to familiarize them with the basic requirements. If the requirements are not understood, then quality manuals, plant visits and incoming inspection will be futile.

10. D
Product audits (Answer A) and source inspection (Answer B) can be effective tools. A certification of analysis (Answer C) can indicate the composition of a product. This analysis is straightforward. If laboratory instrumentation has been calibrated properly, the results should be valid. A certificate of compliance (Answer D) can be shaky. If the vendor does not conduct effective internal audits then the certificate of compliance can become routine and worthless. Answer D is the correct, incorrect, choice.

11. A
A. An evaluation of a supplier's quality history is the best answer. It reflects a supplier's performance over a longer period of time in a number of areas (quality reliability, responsiveness, etc.).B. A survey evaluation is a valid answer. However, it is a snapshot of the supplier at one point in time.C/D. These two answers are very weak. A supplier will present themselves in the best possible light in a questionnaire or over the phone.
12. A
Configuration management requires documentation, but it is more than documentation. Changes are a part of the system, but other information is also needed. Answer D is also an incomplete answer. Configuration management will manage the evolution of a product from development to final product retirement. Answer A is correct.

13. C
Given that an aerospace company is indicated, all fabricated parts for the customer must be considered critical. The basic need is for the company to be ISO 9000 registered which includes having a Quality Manual. Process capability indices on key processes, that will fabricate the part, are a definite necessity. MIL-STD-45208A is inferior to the ISO 9000 standards and would not be necessary. Therefore, items I, II, & IV are required. Answer C is correct.

14. D
Training records would be needed to meet ISO 9000 requirements (item I) and possibly an audit requirement (item IV). OSHA and Malcolm Baldrige audits may also require training documentation. Thus, answer D is the best choice. Answer D is correct.

15. B
Answers C and D contain elements of good quality service, but they are incomplete answers. Answer A, product quality, brings the customer to you. Answer B, service quality, encourages the customer to stay. Answer B is correct.

16. A
The hierarchy of customer expectations follow the stages of basic (II), expected (I), desired (IV) and unanticipated (III). Only answer A starts with II, and continues with the correct sequence. Answer A is correct.

17. A
For a partnership to work, there is joint cooperation and sharing of much information. Answers B, C and D are restrictive in their wording. Answer A indicates a sharing of critical information, which is needed for successful partnerships. Thus, answer A is the best choice. Answer A is correct.
18. B
There are companies that maintain that the customer is always right (answer A). This is a good principle and it works for some companies. The process should not embarrass either party, (answer B), is an even better principle. Answer C maintaining the company position and answer D, strict steps, are both poorer choices. The best selection is B. Answer B is correct.

19. D
Answers A and B can be eliminated. These two types of charts contain elements on two planes (X and Y axis). The Y-type matrix is in three planes and is the proper choice here. The C-type matrix is a more complicated set of Y-type matrices projected into three dimensional space. This latter choice would seem to stretch the intent of the question. Answer D is correct.

20. C.

21. C
The scatter diagram and process flow diagram are totally different problem solving tools. Answer C which includes both the cause and effect diagram and the fishbone diagram is the correct answer. Answer C is correct.

22. B
Pert charts (III) and Gantt charts (IV) are project time management tools, they are not tally sheets. Both checksheets (II) and measles charts (I) are, or can be, used as tally sheets. Answer A is correct.

23. A
Answer B best describes a normal distribution. Answer C describes any distribution that has had a portion of readings removed; such as by inspection. Answer D is incorrect because it is multi modal. A bimodal distribution has two modes or peaks. Answer A is correct.

24. B
Answer A is incorrect because a scatter diagram shows whether there is the possibility of a relationship between one or more variables. Answer C is incorrect because it shows a static picture of the process. Answer D shows how various causes can possibly interact. Cumulative lines can be used with the Pareto diagram. Answer B is correct.
25. C
The others category is an accumulation of the trivial many and therefore is placed at the end of the diagram as the last category. Answer C is correct.

26. D
If two events are mutually exclusive, the sum of their probabilities is 1. For example, on 1 flip of a coin, obtaining a head and obtaining a tail are mutually exclusive. It is impossible to have a head and a tail on 1 flip of a coin, but it is certain that either a head or a tail will be obtained. If two events are independent, the outcome of one event has no effect on the other event. An example of this is tossing a coin twice. The result of the first toss does not impact the second toss. If two events are independent, their covariance is zero. Answer D is correct.

27. D
A statistic is a sample value. A parameter is a population value. Answer D is correct.

28. C
The author knows several ways to solve this problem (or at least approximate the right answer). Perhaps the most straight forward is by use of the multiplicative law of probability.

29. C
This is a binomial probability problem.

30. D
Without the word cumulative in the question, a good case could be made for answers A, B and C. The best of these answers would be B. When cumulative is included, then D becomes the correct choice. Answer D is correct.

31. B
Item I describes the median of a distribution. Item III describes the mode of a distribution. Answer B is correct.
32. C
This question requires the backward use of the Poisson table. Note the phrase "at least one defect will be found". For the sample to contain one or more defects with a 95% probability, the table must be used to determine a 5% probability of zero. \( Np = 3.0 \) There must be three defects in the scoop of 100. Note that, if the scoop contained twenty units, there still must be three defects in it. Answer C is correct.

33. C
The standard deviation of the average of a sample of 10 is equal to the standard deviation of the individuals divided by the square root of the sample size. In this case, the standard deviation of the average with a sample of 10 is 2.53. Using the equation below, this can be transformed to standard normal (mean = 0 and standard deviation = 1). The standard normal deviate is \( z = (77-75)/2.53 = 0.7906 \). The area under the standard normal curve to the right of 0.7906 is 0.2146.

34. D

35. D
When a process is in control, there will be random variation. If the process is out of control, some "assignable cause" is adding more variability to the process. A control chart is used to distinguish between random variation, and variation due to an out of control condition. If the process is out of control, the process should be stopped, and the "assignable cause" fixed. The correct response is to detect non-random variation in processes. Answer D is correct.

36. C
The primary purpose of a control chart is to detect changes in the process that are assignable. Answer C is correct.

37. A
The expression for computing a confidence interval for the mean, given the population is normal and the standard deviation is known is Sigma is the population standard deviation, \( n \) is the sample size, and \( z \) is the standard normal deviate. A 90% confidence interval means that given the sample data, there is a 90% chance that the true population mean is contained in the interval. Thus, the wider the interval, the greater the confidence. Confidence is also increased by increasing the sample size. The size of the population does not enter into this equation.
38. B

39. C.

40. A

41. A

42. C.

43. B

44. D

45. B

46. D

47. A

48. B

49. D

The Risk Priority Number is part of a Failure Mode and Effects Analysis (FMEA). It is the product of the measures of occurrence, severity, and detection. Answer D is correct.
50. A
A fault-tree is a graphical method for modelling the reliability of complex systems. FMEA (failure modes and effects analysis) is used to identify failure modes, not predict reliability. MIL-STD-217 is a standard for prediction of reliability for ELECTRONIC equipment. Vector space analysis does not apply to reliability. Fault-tree is the correct response. Answer A is correct.

51. C
Audits, ideally, are not conducted to find root causes of problems. The audit team may not be sufficiently knowledgeable to accomplish this objective. This action would also compromise the independence of the audit function. Answer C is the correct, incorrect, choice.

52. A
Answer A is the correct description of a reference dimension. The other answers are filler. Answer A is correct.

53. B
This is a non-standard and meaningless tolerance. If followed, various individuals might conclude that conditions like answers A, C and D apply. Answer B is correct.

54. C
The average weight is 115 grams. The variation of the final product is determined by the equation below Answer C is correct.

55. A
The existence of a quality control manual simply implies that at some point a quality system has been developed. There is insufficient information in the question to assume that the quality system has been implemented. The firm may or may not be quality conscious. They may have fired the quality manager for developing a quality manual that interfered with production. Answer A is correct.
56. A
A quality audit should be done on a scheduled basis. This allows a schedule to be developed to correct deficiencies. Answer A is the correct, incorrect, choice.

57. D
All of the choices I, IV should be included in the final audit report. Answer D is correct.

58. C
Answer choices A and D are very weak selections. Answer B may have some validity, but the best selection is answer C. Answer C is correct.

59. D
If the specification limits are wider than the control limits, no conclusions can be drawn unless the sample size is known. For example, if the plotted points are based on a sample of 100, then the standard deviation of the process is 10 times as great as the standard deviation of the sampling distribution being plotted on the control chart. Remember that the standard deviation of the sampling distribution is inversely proportional to the square root of the sample size. This is shown in the equation used to compute control charts limits below. Answer D is correct.

60. C

61. B
62. B

63. D

64. A

65. B
Items I and III are poor choices for source inspection. They are, however, very good reasons to select another supplier. Items II and IV could be valid reasons for source inspection. Answer B is correct.

66. D
The description fits that of a major seriousness characteristic. Answer D is correct.

67. A
Answer A is the objective of inspection. The other answers (B, C and D) are all part of the detailed inspection instructions. Answer A is the correct, incorrect, choice.

68. C
Since no lot size is given, it is assumed that the population size is sufficiently large as to mimic sampling with replacement. Thus, the binomial distribution can be used. The probability of obtaining exactly \( x \) successes in a sample of \( n \) items from a population with a fraction defective of \( p \) is given by the equation below.
69. C
   From ANSI/ASQ Z1.4 (Sample Size Code Letters), code letter D is the proper choice. The table is shown in the figure below.

70. B
   The Dodge-Romig plans were developed in the 1920s. Answer B is the correct, incorrect, choice.

71. D
   The Sample Size Code Letter table for ANSI/ASQ Z1.9 is shown in the figure below. The intersection of inspection level II and lot size 500 gives letter I. Answer D is correct.

72. C
   The PERT chart requires time estimates for each activity in the network. The critical path is the sequence of tasks which require the greatest expected time, and events on the critical path have a slack time of zero. The Gantt chart can be constructed with minimal data. The critical path is calculated after analysis of the network, not before, so answer A is incorrect. Slack times are for events not on the critical path, so answer B is also incorrect. The Gantt chart can be constructed with less data than is required for the PERT chart, so answer D is incorrect. Time estimates are required for each activity in the PERT network. Answer C is correct. Answer C is correct.

73. B
   The first and most important project planning phase is the definition of the project objective. For some projects, the objective is determined by upper management, while on other projects, the project objective is defined by a champion of the desired outcome for the project. A logical sequence for the project steps listed as possible answers would be B-C-A-D. Step D could be done before step A. All of the project activities are intended to achieve the project objective. If the objective is poorly defined, the project may or may not have the desired outcome. Answer B is correct.
74. D
Project planning is completed as a series of phases, each defining the project with greater detail. The phases of project planning are: objective, statement of work, work breakdown structure, and project budgets. Following the sequence for project planning phases, the correct order is III, II, IV, I. Each phase may only be completed after the information is available from the previous phase. Answer D is correct.

75. C
This question requires a general familiarity with the teachings of major quality gurus and an answer review. Dr. Juran refers to quality improvement as part of his quality trilogy. Dr. Deming's point 5 discusses the need for constant improvement to the process of planning, production and service. Philip Crosby's 14 step approach lists quality improvement teams. Answers A, B and D could be viewed as subsets of answer C, which is the best choice. Answer C is correct.

76. D
The appropriate concept and corresponding guru match is shown below: I. Ishikawa, II. Juran, III. Deming, IV. Taguchi, V. Crosby, VI. Feigenbaum. The concepts of Dr. Covey are not identified. Answer D is the correct, incorrect, choice.

77. C
Increasing employee incentives indicates that one believes that incentives are a way to guarantee success (answer A). It is a very specific solution and may not be correct. Increase training is a good choice (answer B), but not the best choice. Answer C, having employees understand how they can make a difference, is a basic step toward success. Answer D, is another specific and somewhat restrictive solution. The best answer is C. Answer C is correct.
78. C
Scatter diagrams, Pareto diagrams and force field analysis are analytical tools which may be useful in the problem solving cycle. However, brainstorming is required to compliment the 4-M or fishbone diagram. Potential causes are brainstormed into the fishbone without the scrutiny of initial criticism. Answer C is correct.

79. C
Answers A and B describe the Pareto diagram. Answer D is one advantage of control charts (perhaps histograms as well). A scatter diagram depicts the relationship between variables. Specifically, an input variable may have an effect on an output variable. Answer C is correct.

80. A
Answers C and D do not apply. If the question stated common cause versus assignable causes, then B would be correct. However, the terms significant few (chronic) and the trivial many (less significant) refer to the Pareto diagram. Answer A is correct.
81. D
Answer choices I, II and III are all clearly parts of a process flow review. Answer choice IV, the use of Pareto diagrams, is not used as part of this technique and is the correct wrong answer. Answer V may be used in some cases. Answer D is the correct, incorrect, choice.

82. A
The Poisson distribution is used to model rates. The probability of exactly x events occurring can be computed using the Poisson distribution shown below. Entering this equation with \( x = 0 \) and \( m = 0.45 \) gives the probability of exactly zero defects, 0.6376. Entering this equation with \( x = 1 \) and \( m = 0.45 \) gives the probability of exactly 1 defect, 0.2869. Thus, the probability of less than 2 defects is 0.6376 + 0.2869 = 0.9245. Thus, the probability of more than 1 defect is 1-0.9245 = 0.0755. Answer A is correct.

83. C
If two events are independent, gaining information about one provides no information about the probability of the other event occurring. Thus, the probability of Event B occurring given Event A has occurred \( P(B/A) \), is equal to the probability of Event B occurring, \( P(B) \). Answer C is correct.

84. B
This is an application of the Poisson distribution. The probability of exactly x defects is Entering this equation with \( x = 7 \) and \( m = 4 \) gives the probability of 7 people will be hired, 0.05954. This answer can also be determined quickly from a Poisson Table. In this case, \( np=4 \). The probability of 7 or less (.949) minus the probability that 6 or less (.889) yields the answer 0.06.

85. C
If a distribution is skewed to the left, the median is between the mode and the mean, and the mode is greater than the median.

86. A
Poka-yoke consists of applying simple mechanical and electrical devices to minimize human error in a process. Answer A is correct.
87. B
Item I is clearly an incorrect statement. Item IV is clearly a correct statement. Item II is probably false because the chart is not scaled or identified. The intercepts may both be negative values (although by convention they are both headed in more positive directions). There is a fairly strong "apparent" correlation between the two values. The writers would tend to count item III as a true statement, although more information would be desirable to confirm the relationship. Answer B is considered correct.

88. A

89. B
Studying the leader's business and copying some of their activities is benchmarking. Answer A is incorrect. Installing state of the art equipment and processes and improving the design of products are some actions that might be taken in reengineering, but not necessarily. Neither C nor D are the best choices. Answer B is correct.

90. B
Flow charts visually present a process showing the main steps, branches, and outcomes of that process. A Pareto diagram is used to show all categories by rank, separating the vital few from the trivial many. A scatter diagram visually displays correlation between two or more variables. Answers A, C and D are incorrect. Fishbone diagrams, sometimes called Ishikawa diagrams, are also referred to as cause and effect diagrams. Answer B is correct.
91. A
The Pareto diagram is best suited to direct attention to problems in a systematic manner, especially when limited resources are available. The cause and effect diagram helps categorize ideas. The scatter diagram shows relationships between variables. The control chart is used to analyze process variation. The correct answer is A.

92. B
Control charts can use process average, an upper control limit, and process standard deviation. The correct answer is B.

93. A
This question requires a review of the definitions of the terms of central tendency (mean, mode and median) and a comparison with the answers.

94. B
With quality teams there should be improved worker morale, increased communications between team members and management, and problem solving cost savings. Management must still maintain their quality efforts. Answer B is the correct, incorrect, choice.

95. D
A. False. There may or may not be a need for source inspection B. False. The principal reason for a supplier audit is not to replace inspection C. False. Audit surveillance is not a threat to motivate suppliers D. True. A vendor audit is conducted to ensure that the supplier’s quality program is functioning properly. Answer D is correct.

96. B
Although technical service is a good public relations gesture, (A), and a nice support feature for suppliers,
they are not the main reasons for providing this service. Smart companies should not see technical service as an optional luxury, (D), but as a valuable resource to help insure the quality of incoming products. Answer (B), greater benefit to the company than it is to the supplier, is the best choice. Answer B is correct.

97. C
Answer choice I is not valid, the finding must be included in the audit report. Answer C is the proper selection.

98. C
Answer choices I and IV are poor reasons for initiating quality systems audits. There may be a need for corrective action and follow up in these cases. However, II is the best answer choice and III is also valid. Answer C is correct.

99. A
The proper answer to this question is A. Under some conditions, the plant manager may be the client. However, other parties may be the client; making answer B a subset of answer A. The lead auditor and auditee are participants in the audit but do not initiate it. Answer A is correct.

100. B
Answer choices I and III are considerations that should have been resolved during the planning and preparation phase of the audit. Answer B (which includes choices II and IV) represents principal concerns during the execution of the audit. Answer B is correct.
101. A
Statements I, III and IV are generally true descriptions of the process audit. Answer A is the correct, incorrect choice.

102. C

103. D
Answer II may be the very best choice. However, answers I and III are also valid. Answer D is the best choice.

104. D
All of the items I - III are important factors in the effective control of non-conforming product. Answer D is correct.

105. C
Item II is incorrect. It is not necessary to inspect after all operations. Answer C is the correct choice.

106. A
Answers B, C and D are only partially correct. Answer A is the best choice.

107. A
The MRB can recognize and suggest the need for corrective action but will not necessarily develop the corrective action plan. Answer A is the correct, incorrect, choice.
108. D

109. D
When properly set-up and maintained all of items I - IV are automated inspection advantages. Answer D is correct.

110. B
The use of appropriate standards only ensures accuracy. Answer B is correct.

111. C
This question is looking for an incorrect choice. The standard unit of mass is a cylinder of platinum iridium alloy kept by the International Bureau of Weights and Measures at Sevres, France. The kilogram is the only base unit still defined by an artifact. Answer C is correct.

112. C
The key phrase in this question is "MOST ESSENTIAL". Answer C is correct. The other answers are of varying lesser importance. Answer C is correct.
113. A
Item I is correct, a magnifying lens will affect all characteristics of accuracy and precision. Items II and III are filler. Answer A is correct.

114. D
All of the listed items I - IV are calibration department responsibilities. Answer D is correct.

115. A
Items I and IV are correct statements. Items II and III are false statements. Answer A is the proper choice.

116. A
A review of the listed items indicates that number 3 should be first and number 5 should be last. Additionally, item 2 should precede item 6. Answer A is the correct choice and it checks with reality.

117. C
Based on the circumstances, precision may positively or negatively affect cost and performance. The proper answer is C.

118. C
The interval of calibration of measuring equipment should be based on stability, purpose and degree of usage. Answer C is correct.
119. B
Go, no-go gages are easier to use and require less skill than the measurement gages, making answer C incorrect. Measurement gaging provides more information per piece inspected than does go, no-go gages. Measurement (variable) gaging generally requires a smaller sample size than attribute gaging. Answer A is filler. Answer B is correct.

120. A
Answers B and C: ANSI/ASQ Z1.4 assumes no process average information. Dodge Romig tables do utilize process average information. Answer D: Dodge Romig tables require smaller samples than ANSI/ASQ Z1.4. 100% inspection is required for lots rejected by Dodge Romig sampling. Answer A is correct.

121. C
np for use with the Poisson table is (80)(.1) = 8. The probability of 5 or less is .191 or 19.1%. Please note that this is only an approximation of the binomial. Answer C is correct.

122. B
Three quantities describe an attribute sampling plan. Lot size, sample size and either accept or rejection number. The lot size is used to determine the sample size. The two crucial factors are sample size and Ac or Re. Answers A, C, and D are useful characteristics of various attribute plans but they do not exclusively describe any single attribute plan. Answer B is correct.

123. C
This is an example of an active parallel system. If the 2nd and 3rd capacitors were not operating until required, the system would be a passive parallel system. Answer C is correct.
124. C  
The Shewhart cycle is another name for Plan-Do-Check-Act. Answer C is correct.

125. A

126. D  
There are some other basic steps left off the list of items. The best correct sequence is contained in answer D. One elimination technique would be to place both items I and II ahead of item III. Answer D is correct.

127. A  
The wording of the question indicates a classic application of the scatter diagram. Answer A is correct.

128. B  
A constant is a fixed value, e, A2, etc. A parameter is a number derived from population data. A critical value is a table value with which a test statistic is compared to derive a population inference. A statistic is derived from sample data. Answer B is correct.

129. A  
The quickest way to solve this problem is to determine sample standard deviation and square it to give the variance. Note that this problem does make an inference about the population. Thus, n-1 must be used. Equations: Where $S =$ sample standard deviation $V =$ variance. By use of a statistical calculator: $S = 2.0736$, $V = 4.3$. Answer A is correct.
130. D
This question requires a permutation calculation and comparison to the answers. Equation: Where
\[ n = \text{number of distinct objects} \quad r = \text{number of objects taken per time}. \]
Solution: this problem does not imply distinct combinations therefore, a permutation calculation, not a combination calculation, is required. If the question asked for distinct combinations the answer would be: One example of the difference between the permutation and combination answers. Combination Permutation(ABC) = (ABC) + (ACB) + (BAC) + (BCA) + (CAB) + (CBA). Answer D is correct.

131. C
A statistic is a sample value. A parameter is a population value. Consider this definition from Statistics For Management and Economics Mendenhall, Reinmuth & Beaver: "Numerical descriptive measurements computed from population measurements are called parameters those computed from sample measurements are called statistics." Answer C is correct.

132. C
Variance, mean deviation and standard deviation require the exact value for every measurement. The range requires exact values for the highest and lowest measurements. Answer C is the correct, incorrect, choice.

133. C

134. C
This question requires a comparison of the answers with the additive and multiplicative laws of probability. Answer A would be correct.

135. A

136. B
137. B
138. A

139. D
The quality council consist of members of upper management because of the strategic nature of the improvement process. Among other duties, the council monitors progress and provides resources to the improvement teams.

140. B
Normally the organization's quality council consist of members of upper management.

141. D.
Project teams may have a composite membership of technicians, engineers, supervisors, mechanics, operators, etc. These individuals would normally have diverse skills and experiences.

142. C
Facilitator should not be into complex data analysis. A facilitator does keep team progress on track. In some cases, the facilitator will provide training. Item I and III are the best choices.

143. D
Self-directed teams traditionally work on inter-departmental issues. Answer A, B and C are interdepartment issues that could be best addressed by project or cross functional teams.
144. B
This question requires knowledge of various corrective action and preventive action techniques and a review of the answers. Normally, immediate of containment actions are considered the first short term correction. Continuous improvement is a long term activity. Answer B begins with item I and ends with item III. The other two items are also in the proper order, item II followed by item IV.

145. D

146. C
This question requires basic quality tool knowledge. Pareto charts are used to prioritize problems. A control chart shows an ongoing dynamic picture of the process. The fish bone chart shows how various causes could possibly interest. The histogram displays a static picture of the process.

147. B
Measles charts indicate where. Pareto diagrams show the "vital few" and the "trivial many." Control charts are used to statistically control a process. They don't have anything to do with correlation. Scatter diagrams can have a calculated correlation coefficient which measures goodness of fit.

148. C
The key question word is "EXCEPT." Answers A, B and D are valid reasons for the conduct of a quality audit. Answer C is the poorest choice. It's also not clear if an audit or a tolerance review is called for with this answer.

149. A
This is basic definition question. The review of purchase orders for quality requirements is a preplanning preventative activity which may avert many appraisal and failure costs later.

150. B
Although companies have different structures and responsibilities, the most common method of formally
communicating a vendor quality problem is through the purchasing department that place the order.