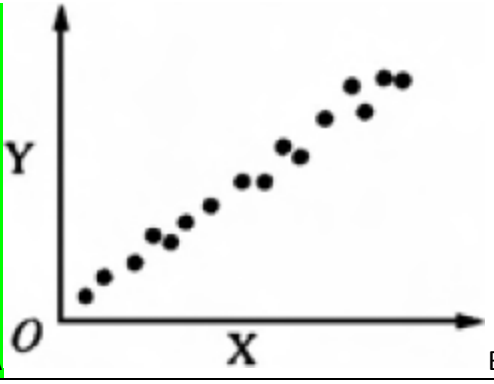
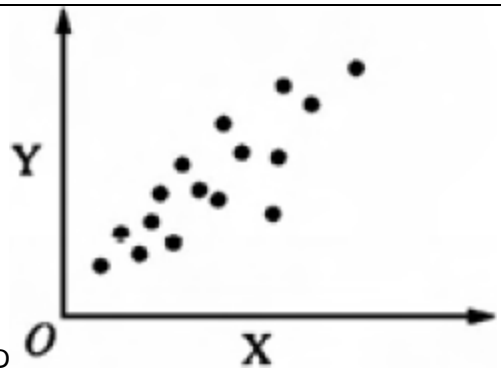
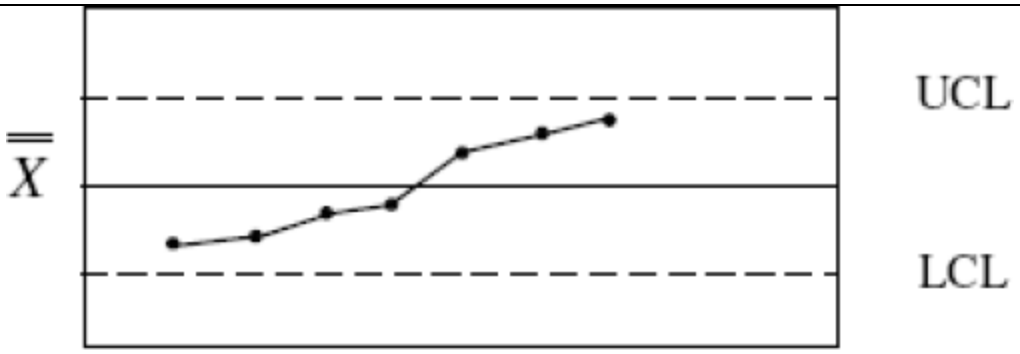
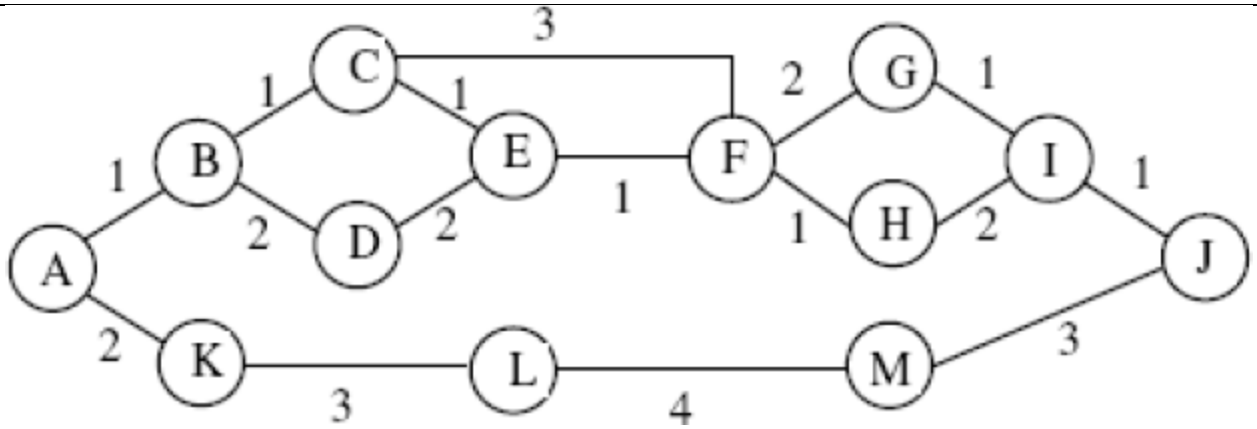
B	1	The following is a sample data set: 10, 8, 8, 6, 5 What is the variance of this data set? 3.0 3.8 7.3 7.4
B	2	An auditor should use a histogram in a quality audit to do which of the following? Provide objective evidence that the auditee uses statistical process control (SPC) Expose patterns that are normally difficult to detect Interpret data for a trend chart Create a stratified tally diagram
B	3	Comparing how a process is actually performed against the documented work instruction for that process is an example of which of the following techniques? Quantitative Qualitative Statistical Random sampling
B	4	Attribute sampling should be used when the data are measurements in metric units. a yes-or-no decision is to be made. the population has variability. a multi-stage sampling plan is needed.
B	5	Scatter diagrams are best described as histograms. correlation analysis. Pareto analysis. Ishikawa diagrams.
A	6	In which of the following diagrams does the input variable X have the highest positive correlation with the output variable Y? A  B 

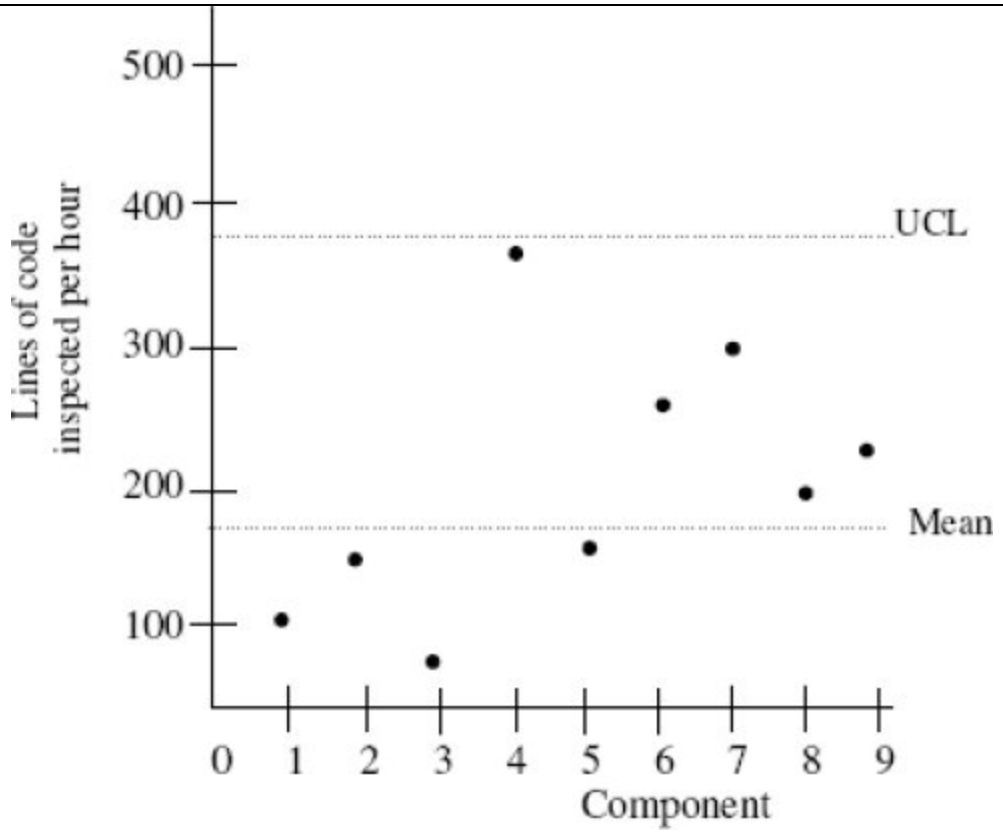
		C  D 
	7	
A	8	If data are plotted over time, the resulting chart will be a run chart histogram Pareto chart Poisson distribution
B	9	To determine who are or might be customers for a specific process, it would be most useful to create a Pareto chart flow diagram cause and effect diagram scatter diagram
A	10	A production line uses signs at specific points on the line to indicate when components or raw materialsneed to be replenished. This practice is an example of kanban poka-yoke checkpoints hoshin
D	11	Which of the following is a good tool for planning cycletime reduction and concurrent operations? A timeline A Pareto diagram An X and R chart A PERT chart
A	12	Attribute and variable data are best described as which of the following? Attribute | Variable Counted values | Measured values Counted values | Visual features Measured values | Counted values Visual features | Counted values
D	13	All of the following are common ways for people to react to conflict EXCEPT competing collaborating avoiding sabotaging

C	14	A quality manager has chosen to survey customer satisfaction by taking samples based on the categories of frequency of use, categories of use, and demographics. This technique is known as random sampling data collection stratification customer classification
D	15	Which of the following actions is NOT used to reduce process cycle time? Analyzing current processes Reducing queue times Setting priorities Implementing activity-based costing
A	16	A company' s accounts payable department is trying to reduce the time between receipt and payment of invoices and has recently completed a flowchart. Which of the following tools would be the best for them to use next? Fishbone diagram Scatter diagram Box and whisker plot Histogram
D	17	In a manufacturing company, the machine shop is what kind of customer in relation to the human resource department? Intermediate Hidden External Internal
D	18	The primary purpose of a project charter is to subdivide the project into smaller, more manageable components provide management with a tool for selecting a project that addresses business needs provide management with a tool to ensure that project deadlines are met provide the project manager with authority to apply organizational resources to project activities
D	19	Sample selection of parts for inspection must be selected at random to ensure a minimum sample size. the probability of not rejecting the lot. the probability of accepting the lot. finding typical characteristics of the lot.
D	20	Which of the following are bases for establishing calibration intervals? I. Stability II. Purpose III. Degree of usage I and II only I and III only II and III only I, II, and III

D	21	In a normal curve, approximately what percentage of the area is included within 3 standard deviations of the mean? 50.0% 66.6% 95.0% 99.7%
C	22	Specification limits are derived from which of the following? Process capability studies Process control charts Customer requirements Historical data
C	23	The primary purpose of a control chart is to set specifications and tolerances. compare operations. determine the stability of a process. accept or reject a lot of material.
D	24	When a control chart is used on a new process, capability can be assessed at which of the following times? Before the chart is first started After the first ten points are plotted When the plotted points hug the centerline After the process is shown to be in control
C	25	Precision is best described as a comparison to a known standard the achievement of expected outgoing quality the repeated consistency of results the difference between an average measurement and the actual value
C	26	The overall ability of two or more operators to obtain Consistent results repeatedly when measuring the same set of parts and using the same measuring equipment is the definition of repeatability precision reproducibility accuracy
B	27	Which of the following conditions must be met for a Process to be in a state of statistical control? Most of the product output by the process is in specification. All subgroup averages and ranges are within control limits. All variation has been completely removed. Previously optimal process settings are used.
C	28	Which of the following measures of dispersion is equal to the sum of deviations from the mean squared divided by the sample size? Range Standard deviation Variance Mode

A	29	An X and R chart is used to indicate process variation specify design limits interpret costs identify customer expectations
B	30	Which of the following is the most useful graphical tool for promoting an understanding of processcapability? A flowchart A histogram An affinity diagram An Ishikawa diagram
B	31	The type of chart that presents the value of items in descending order is a histogram Pareto chart u chart cusum chart
B	32	Measures of which of the following provide attributes data? Temperature in degrees Attendance at meetings Weight in pounds Length in metric units
C	33	A cause and effect diagram is a useful tool for doing which of the following? Determining the flow of a process Detecting shifts in a process Developing theories based on symptoms Arranging theories by defect count
A	34	The fraction of nonconforming products is plotted on which of the following types of control charts? p chart u chart np chart c chart
B	35	Which of the following statistics would best describe the central tendency of a sample of data? Mode Mean Standard deviation Range
D	36	Which of the following types of tools or techniques is considered qualitative? Histograms Frequency distributions Pareto charts Process observations

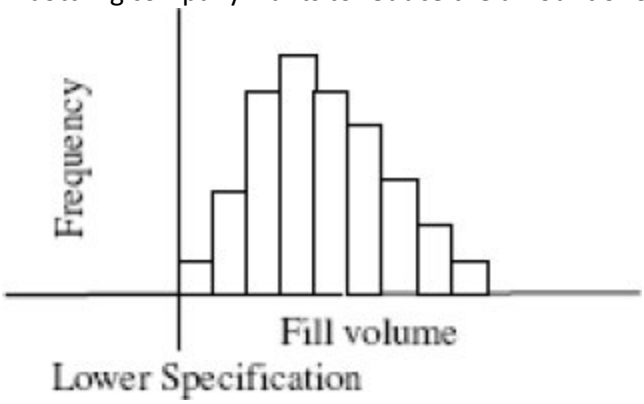
C	37	 The process information shown in the graph above is indicative of a cycle run trend shift
D	38	Which of the following techniques is most useful in narrowing issues and limiting discussion? Brainstorming Quality function deployment Cause and effect analysis Multivoting
B	39	Quality function deployment (QFD) is a methodology for removing bugs from code identifying and defining key customer demands measuring the reliability of a software product training employees in quality issues
D	40	 Which of the following is the critical path in the activity network above? A, B, C, F, G, I, J A, B, D, E, F, G, I, J A, B, D, E, F, H, I, J A, K, L, M, J

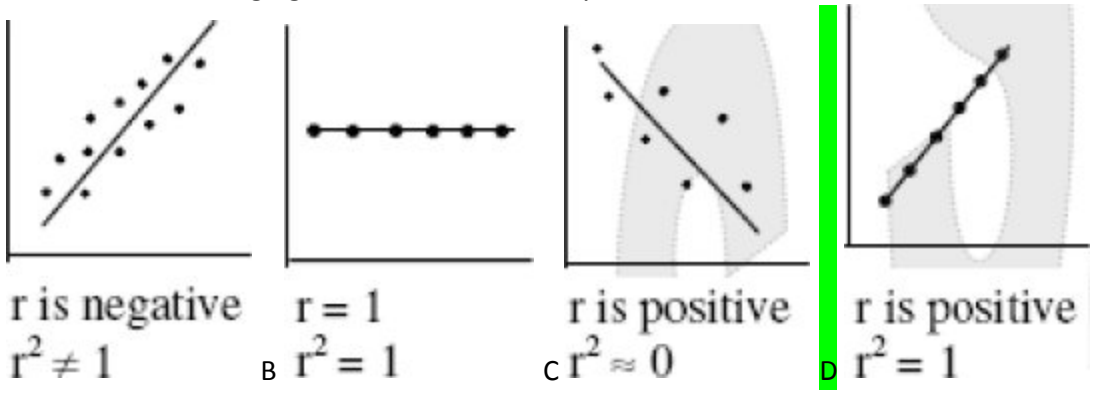
C	41	 On the basis of the control chart above, which of the following statements is true? Components 1, 2, 3, and 5 should be reinspected because they are below the mean. Only component 4 should be investigated because it is closest to the upper control limit. Components 4, 6, 7, 8 and 9 should be investigated because they are above the mean. No action is required; all data points are within acceptable statistical variance.
B	42	A customer satisfaction survey used the following rating scale: 1 = very satisfied 2 = satisfied 3 = neutral 4 = dissatisfied 5 = very dissatisfied This is an example of which of the following measurement scales? Nominal Ordinal Ratio Interval
A	43	Which of the following techniques is used in identifying underlying problems? Cause and effect analysis Prioritization matrix Force field analysis Pareto analysis
C	44	For a normal distribution, two standard deviations on each side of the mean would include what percentage of the total population? 47% 68% 95% 99%

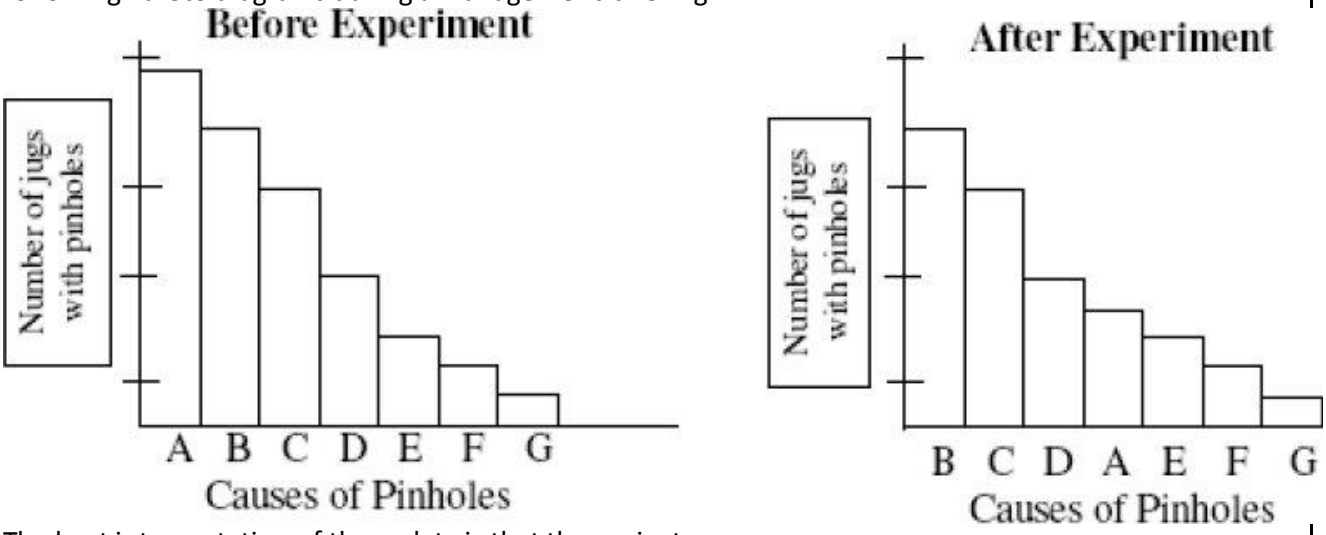
C	45	In measurement system analysis, which of the following pairs of data measures is used to determine total variance? Process variance and reproducibility Noise system and repeatability Measurement variance and process variance System variance and bias
B	46	Process data being used in the initial set-up of a process are assumed to have a normal distribution. If the nominal (target) is set at the center of the distribution, and the specification limits are set at ± 3 from the center, the Cpk is equal to -0.25 1.00 1.33 1.67
A	47	A green belt is going to monitor the number of defects on different size samples. Which of the following control charts would be most appropriate? u np c p
A	48	Correction, over-production, inventory, and motion are all examples of waste 5S target areas noise value-added activities
B	49	The primary factor in the successful implementation of six sigma is to have the necessary resources the support/leadership of top management explicit customer requirements a comprehensive training program
D	50	Which of the following types of variation is LEAST likely to occur in sequential repetitions of a process over a short period of time? Cyclical Positional Temporal Seasonal
C	51	The primary reason that most companies implement six sigma is to reduce defects improve processes improve profit increase customer satisfaction
C	52	The term used to describe the risk of a Type I error in a test of hypotheses is power confidence level level of significance beta risk

B	53	One characteristic of attributes data is that it is always continuous discrete expensive to collect read from a scale of measurement
C	54	Which of the following tests may be used to determine whether a sample comes from a population with an exponential distribution? t F Chi-square ANOVA
A	55	Which of the following tools are appropriate for a quality engineer to use in qualifying a process that has variable data? I. An and R control chart II. A histogram III. A c chart IV. A p chart I and II only II and III only III and IV only I, II, and IV only
B	56	The correlation coefficient for the length and weight of units made by a process is determined to be 0.27. If the process were adjusted to reduce the weight of each unit by 0.5 ounce, the correlation coefficient of the length and weight of the units made by the new process would be equal to 0.50 0.27 0.23 -0.23
D	57	A form, in either diagram or table format, that is prepared in advance for recording data is known as a cause-and-effect diagram Pareto chart flowchart check sheet
A	58	A major drawback of using histograms in process control is that they do not readily account for the factor of time are relatively difficult to construct and interpret require too many data points require
B	59	Which of the following tools would be of the greatest use for finding the most efficient path and realistic schedule for the completion of a project? Interrelationship digraph Activity network diagram Tree diagram Affinity diagram

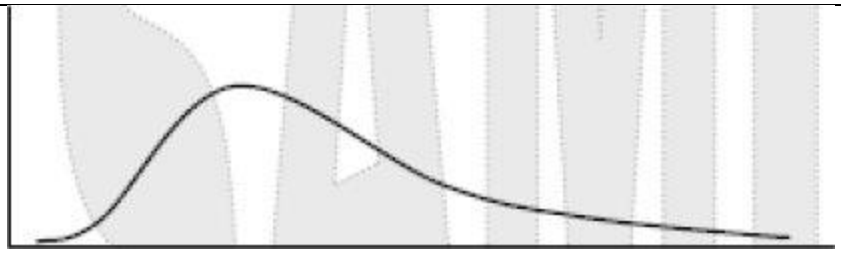
C	60	A control plan is designed to do which of the following? Supplement information contained in operator instructions Support the production scheduling system Provide a documented system for controlling processes Provide a method for tracking the design review process
B	61	To determine the average number of nonconforming parts over time, which of the following attributecontrol charts would be most appropriate? c chart np chart p chart u chart
B	62	Which of the following techniques is most appropriate for generating continuous improvement ideas? Tree diagram Brainstorming Prioritization matrix Interrelationship digraph
B	63	Which of the following tools is used extensively in quality function deployment (QFD)? Affinity diagram Matrix diagram Cause and effect diagram Activity network diagram
B	64	Which of the following tools is most likely to be used to organize a list of ideas generated during a brainstorming session? Activity network diagram Affinity diagram Histogram Process control chart
A	65	Which of the following tools would be most appropriate for collecting data to study the symptoms of a problem? A check sheet A flow diagram A force field analysis An activity network diagram
C	66	Kaizen is defined as re-engineering lean manufacturing continuous improvement error-proofing

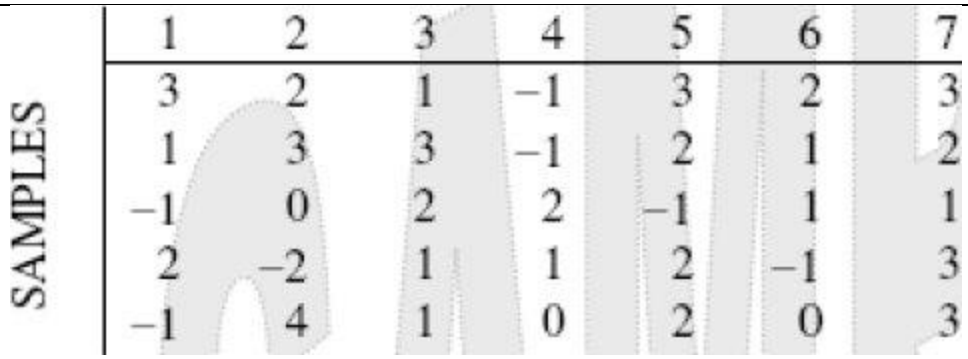
D	67	Legal requirements specify that a bottled product must contain no less than the volume printed on the label. A bottling company wants to reduce the amount of overfilled bottles.  On the basis of the data above, what is the most effective strategy to accomplish this task? Decrease the target fill volume only Decrease the target fill variation only First decrease the target fill volume, then decrease the target fill variation First decrease the target fill variation, then decrease the target fill volume
	68	
B	69	The LEAST informative of the four measurement scales is the ratio nominal ordinal interval
D	70	Which of the following can be used to determine the goodness-of-fit of a distribution to a data set? t test ANOVA F test Chi square test
D	71	When σ = 10, what sample size is needed to specify a 95% confidence interval of ±3 units for the mean? 7 11 32 43
	72	
B	73	A process capability analysis is NOT used to determine the ability of a process to meet specifications maintain a process in a state of statistical control establish new specifications prioritize competing processes
A	74	A type of line graph used to assess the stability of a process is called a control chart Pareto chart check sheet cause and effect diagram

B	75	A process produces nonconformities according to a Poisson distribution. If the mean of the nonconformities is 25, what is the standard deviation? 2.5 5.0 12.5 25.0
A	76	Five six-sided dice are rolled together 100 times. Two histograms are constructed: one for the 500 individual results and one for the 100 averages of five results. In this situation, the individual results follow a uniform distribution, while the averages follow which of the following distributions? Normal Student' s t Binomial Uniform
B	77	A calibrated micrometer was used to take 10 replicated measures of a reference standard. If X m = 0.073, and the true value of the reference standard is 0.075, what is the bias of the micrometer? 0.001 0.002 0.073 0.075
D	78	The power of a test for the difference between means is measured by α 1 – α β 1 – β
B	79	A process is stable and its output is normally distributed. The process has a specification of 16.73 ± 0.01. What is the maximum process standard deviation if the Cp must be ≥ 1.5 ? 0.0011 0.0022 0.0041 0.0133
	80	
D	81	Which of the following figures is labeled correctly? 

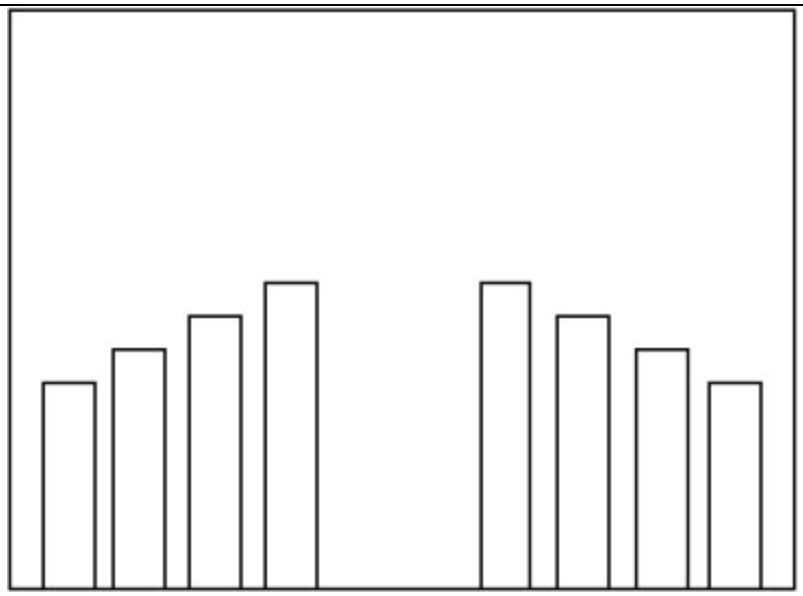
D	82	A quality improvement team that was assigned to decrease the number of pinholes in milk jugspresentedthe following Pareto diagrams during a management briefing.  The best interpretation of these data is that the project was not successful in reducing pinholes, since causes B, C, and D now occur more frequently than cause A successful in removing the primary cause of pinholes, and no further improvements are necessary successful, and tracking pinholes by cause A is no longer necessary successful in decreasing pinholes, and the team should work on cause B to further improve the process
	83	
B	84	The main advantage of a matrix diagram is that it displays all the possible causes related to a problem displays the strength of relationships between each paired combination of variables identifies, analyzes, and classifies the cause and effect relationships that exist among all critical issues identifies a sequence of actions and materials entering a process
D	85	Poka-yoke is best defined as improving machine efficiency reducing field failures to virtually zero capturing the voice of the customer preventing controllable defects
A	86	Which of the following describes the 95% confidence interval of a 20% absentee rate in a department with30 people? 6% to 34% 8% to 32% 13% to 27% 17% to 23%
B	87	Which of the following are needed to calculate the process capability index, Cp? The specification limits and the mean The specification limits and σ^ (Sigma Cap) The process mean and σ^ (Sigma Cap) The upper and lower specification limits

D	88	Repeatability and reproducibility are terms that operationally define bias accuracy discrimination precision
D	89	A method that classifies data without significantly reducing accuracy or precision is known as bias adjustment statistical efficiency blocking coding
B	90	If a process has a variance of 4 units and a specification of 96 ± 4, what is the process performance index (Pp)? 0.33 0.66 1.00 1.50
	91	
D	92	If a histogram has a distribution that is bimodal this indicates that the process is in control distribution is abnormal data collected is accurate data has two points
C	93	Which of the following best describes how an affinity diagram is used? Grasping organizational performance relative to contrasting data Prioritizing data from most significant to least significant Grouping ideas that are created during brainstorming Identifying when a process is in control
B	94	Warranty claims are classified in which of the following cost of quality groups? Internal failure External failure Appraisal Prevention
C	95	At what stage of the problem-solving process would a team most likely use a cause-effect diagram? Description of the process associated with the problem Definition of the problem and its scope Organization of possible problem causes Collection of data to identify actual causes
C	96	Steel bars are cut to cylindrical shafts by means of a lathe. The diameter and allowable tolerance of the shaft is 2.000 ± .001 inch. A control chart is used to monitor the quality level of the process. Which of the following plots on the control chart might indicate a problem of wear on the lathe? The diameter of a single shaft above 2.001 inch The diameter of a single shaft below 1.999 inch An apparent increasing trend in the shaft diameters Erratic in-tolerance or out-of-tolerance diameter measurements

B	97	A sample consists of one or more units of product drawn from a lot or batch on the basis of defect of the product random selection size of the product when the inspection process was completed
D	98	What is the percent yield for a normally distributed process in which the item length specification is 5.750 ±0.004, X is 5.752, and the standard deviation is 0.002 ? 15.73% 19.15% 47.72% 83.99%
C	99	In preparation for construction of a cause and effect diagram, it is important to plot separate charts for each source focus only on what makes things go wrong record everything people suggest validate possible root causes
C	100	A quality technician uses a c chart to monitor the number of defects in a square foot of material. After the initial startup period, the mean number of defects is calculated at 13.5. What should the control limits be for the c chart? LCL | UCL 0.00 | 54.00 0.00 | 27.00 2.48 | 24.52 9.83 | 17.17
C	101	 The shape of the distribution above is best described as normal multi-modal positively skewed negatively skewed
C	102	If a distribution is normal, with μ = 50 and σ = 15, what percentage of data will be less than 30? 59.18% 40.82% 9.18% 1.33%
D	103	A company is receiving an unusually high number of returns from various customers. The first step in investigating the problem would be to check the inspection records establish the correlation of the returns to shipments brainstorm the potential causes classify the returns by type and degree of seriousness

D	104	Which of the following activities would NOT contribute to the effective functioning of a team? Eliminating unnecessary activities Developing team performance measures Defining processes in detail Monitoring each member's performance
C	105	Which of the following is the best definition of a flow chart? A diagram used to structure ideas into useful categories An illustration used to analyze variation in a process A picture used to separate steps of a process in sequential order An analytical tool used to clarify opposing aspects of a desired change
A	106	What is the standard deviation of the population below? 10, 4, 16, 12, 8 4.00 4.47 16.00 20.00
B	107	The extent to which an instrument replicates its result when measurements are taken repeatedlyonthesame unit is called real bias precision accuracy true value
	108	
B	109	 On the basis of the control chart sample above, what is the upper control limit (UCL) for the average? 1.23 3.21 3.43 7.25
C	110	Which of the following measures is a sufficient statistic for the parameter μ⍰? Median Mid-range Mean Mode

SAMPLES	1	2	3	4	5	6	7
	3	2	1	−1	3	2	3
	1	3	3	−1	2	1	2
	−1	0	2	2	−1	1	1
	2	−2	1	1	2	−1	3
	−1	4	1	0	2	0	3

C	111	What is the recommended minimum number of subgroups necessary to calculate the limits for a control chart? 10 15 25 35
A	112	 The distribution above most likely implies that the elements measured represent the extremes of a single process a collection of two processes with normal distributions random variations the modes of a single process
D	113	Which of the following describes the Deming method for continuous improvement? Cost of quality analysis Process map Tree diagram Plan-do-check-act cycle
A	114	Which of the following is the formula for calculating the number of permutations of x units taken y at a time? A $\frac{x!}{(x-y)!}$ B $\frac{(x-y)!}{x-y}$ C $\frac{x!}{y!(x-y)!}$ D $\frac{(x-y)!}{(x)y!}$
D	115	In an analysis of variance, which of the following distributions is the basis for determining whether the variance estimates are all from the same population? Chi square Student's t Normal F

C	116	Which of the following statements best describes the set of all values of a random variable? It is finite. It is an interval. It can be discrete or continuous. It can be tracked by using control charts or scatter plots.
B	117	Which of the following is the best description of randomization? A technique used to increase the precision of an experiment A means of assuring representative sampling The repetition of an observation or measurement The relationship between two or more variables
A	118	When the order of items is not important, which of the following is the method to use to determine the number of sets and subsets of items? Combination Permutation Factorization Simulation
B	119	A fair coin is tossed 10 times. What are the expected mean and variance of the number of heads? Mean | Variance 0.5 | 0.025 5.0 | 2.500 5.0 | 5.000 10.0 | 5.000
A	120	In statistics, an estimation error that is persistent or systematic is called bias sensitivity random shift
C	121	Which of the following is the most effective technique for prioritizing critical factors for problem-solving? Venn diagram Scatter diagram Pareto diagram Cause and effect diagram
C	122	Which of the following tools should be used when a team is generating and prioritizing a list of options that include highly controversial issues? Brainstorming Affinity diagrams Nominal group technique 5 whys
	123	
A	124	Which of the following tools would be most appropriate for collecting data to study the symptoms of a problem? Check sheet Flow diagram Force-field analysis Activity network diagram

B	125	Positional, cyclical, and temporal variations are most commonly analyzed in SPC charts multi-vari charts cause and effect diagrams run charts
	126	
A	127	Which of the following is most important in evaluating and understanding design intent? Identifying the functional requirement Brainstorming failure modes Conducting computer simulations Developing FMEA
B	128	Which of the following activities is value-added? Setup Process Storage Inspection
C	129	A Green belt plans to test the performance of workers before and after training. Which of the following hypothesis tests should be used to determine whether the training actually improved the workers' performance? 2-sample z test 2-sample t test Paired t test F test
B	130	The purpose of using control charts is to determine if the process is performing within specifications the process capability how to re-create the process the cause of nonconformities
	131	
B	132	Which of the following is defined as continuous, incremental improvement? Kanban Kaizen JIT Kaikaku
B	133	Which of the following is the best way to enhance the long-term availability of a machine? Machine repair Total productive maintenance Computerized SPC systems Increased operator training
B	134	Typically, which of the following activities is done earliest in the formation of a project team? Select the team Identify the objective Identify the sponsor Allocate the resources

D	135	A Green belt is developing a failure mode and effects analysis (FMEA) for the hamburger preparation station in a fast-food restaurant. The following ratings were developed for the low-heat temperature failure mode. Severity = 9 Occurrence = 2 Detection = 1 What is the risk priority number (RPN) for this FMEA? 4 6 12 18
C	136	Which of the following statements is true about the theory of constraints? It views a system in terms of discrete processes Most constraints are physical Most constraints are the result of policies It focuses on continuous improvement
	137	
	138	
A	139	A measurement system analysis is designed to assess the statistical properties of gage variation process performance process stability engineering tolerances
C	140	For a process, X double bar = 35.0 and σ = 5.00. If the subgroup size is n = 5, what is the value for the upper control limit for the process? 37.24 37.89 41.71 52.50
	141	
B	142	A six sigma project to reduce billing statement expenses has shown the need to hire two additional mailroom clerks. Based on this information, which of the following metrics should be used to measure the financial benefits of the project? Cost of poor quality Return on investment Net present value Internal rate of return
	143	
A	144	Which of the following is a component of a visual factory? Product specifications Zero defect policies Just-in-time policies Equipment service manuals
	145	

A	146	Which of the following is the best technique for improving the precision of a designed experiment whenthe experimental material is not homogeneous? Blocking Confounding Randomization Fractionalizing
A	147	A six sigma team has been formed to improve an existing process. Which of the following tools should the team use first to gain a clear understanding of the current process? Flowchart Pareto chart Process FMEA Latin square DOE
	148	
	149	
	150	
A	151	A company's accounts payable department is trying to reduce the time between receipt and payment of invoices. If the team has just completed a flowchart of the process and identified the critical steps, which of the following tools should be used next? Fishbone diagram Scatter diagram Box and whisker plot Histogram
C	152	When a team consists of five black belts and eight quality engineers, how many unique meetings could be held consisting of one black belt and two quality engineers? 40 80 140 280
	153	
	154	
A	155	A six sigma team has been chartered to improve the way in which a company takes orders for its products. Which of the following tools should the team use to determine all of the potential pitfalls and the actual defects that occur? Process failure mode and effects analysis Process map Design for six sigma Supplier input process output control
C	156	According to Juran, anyone is a customer of a product or service if that person purchases it uses it is affected by it produces it
A	157	For an F-test to be inferentially valid, all of the following assumptions must be true EXCEPT the populations must be discrete distributions populations must be normally distributed samples must be independent samples must be randomly selected from the population

C	158	"Forming, Storming, Norming, and Performing" are terms that describe process variation reduction and improvement phases root cause identification and corrective action stages of team growth steps of the brainstorming process
B	159	The process of having a six sigma team develop a problem statement helps the team agree on key dates associated with completing major project phases achieve consensus and ownership of the process determine solutions determine how often it should meet
A	160	Which of the following is an element of standard work? Takt time Product cost Product value Maximum inventory
B	161	An important aspect of data collection is that the data collector should determine the dispersion of the data know how the data are to be used use a control chart to analyze the data use a stratified sampling plan
	162	
B	163	Which of the following charts plots the mean of a set of values and recalculates the mean with each new value? Moving range Moving average X and s c
A	164	In order for a problem to be solved correctly, which of the following must occur first? The problem must be defined. Relevant data must be gathered. The measurement system must be validated. The process must be mapped.
A	165	In comparison to a full-factorial design of experiment (DOE), a traditional, one-at-a-time approach will miss interactions gain efficiencies save time cost less
	166	
C	167	Which of the following techniques is NOT effective when a team leader is giving feedback to the team? Describing the behavior in context Describing the reasons for giving feedback Giving feedback when it is convenient Providing actionable guidance

B	168	Which of the following methods is used to develop an exhaustive list of ideas about a subject? Benchmarking Brainstorming Goal-setting Problem-solving
A	169	Which of the following techniques would help increase process stability when the cause of variation is a cluttered work station? 5S SMED Preventive maintenance Visual factory
A	170	Which of the following tools is commonly used in the define phase of a project? Affinity diagram Control chart Failure mode and effects analysis Data collection checklist
	171	
D	172	Which of the following best describes internal failure costs? The economic costs associated with a catastrophic failure of an internal subsystem. The unavoidable quality system costs associated with the production of any product or service. The opposite of external failure costs. The costs resulting from a nonconformance detected before a product or service is provided.
C	173	According to Juran, when a major quality improvement project is launched, which of the following describes the desired change in performance level? Six sigma Continuous Breakthrough Sporadic
B	174	According to Deming, which of the following is NOT a key element of quality leadership? Established organizational goals to meet or exceed customer needs The use of displays and awards to promote employee motivation Continual education and training that elevate the level of technical and professional expertise Elimination of barriers and distrust to create an organizational culture that fosters teamwork

b	1	An organized and disciplined approach to problem solving in most six sigma organizations is called: SIPOC DMAIC PDCA DPMO
c	2	Using six sigma methodology, a company at 4.5 sigma would have a failure rate of: 3.4 ppm 233 ppm 1350 ppm 6210 ppm
a	3	From an upper management perspective, what has been the principal motivating factor in embracing six sigma? Bottom line results Market share growth Defect reductions Customer focus
a	4	The advantages of training managers in six sigma concepts before line workers include all of the following EXCEPT: Managers have more time available for training Managers must lead the deployment of six sigma Managers must understand the concepts if their full support is expected Managers will validate the overall impact of the training
a	5	In highly effective six sigma companies, most employees receive some training. What group is most likely to receive sponsorship training? Senior management Master black belt candidates Black belt candidates Green belt candidates
c	6	A company struggling with low performance in terms of quality, profitability and productivity isconsidering a six sigma initiative. A decision to proceed would be considered: Smart, they have a lot of low lying fruit Unwise, they probably can't afford the effort Unwise, they need to attend to basic activities first Smart, they obviously need the six sigma structure
b	7	One of Dr. Deming's 14 points for management states, "Cease dependence upon Inspection as a way to achieve quality." The underlying tenet of this statement is which of the following? Many American companies employ too many inspectors; perhaps 5% - 10% of the work force Quality should be built into the product, not inspected in In most cases, the worker should perform his/her own inspection and not rely on someone else Most manual inspection will miss 10% - 20% of defects under typical working conditions
c	8	Which of the following quality luminaries would be most clearly identified as a proponent of Improvement and breakthrough projects? Ishikawa Deming Juran Crosby

b	9	Identify the quality guru who believed that the best approach to understanding the purpose of a quality system would be the four absolutes of quality management. Dr. Faigenbaum Phillip Crosby Dr. Deming Dr. Juran
d	10	If one chose to look at any business enterprise on a main level basis, which of the following categories would NOT have either KPIV (key process input variables) or KPOV (key process output variables)? Process Operations Business Technological
b	11	Why has six sigma been so successful for many organizations? I Bottom line results are enhanced II A ± 1.5 sigma shift is included III A disciplined approach is used IV A sound statistical approach is used I, II and III only I, III and IV only I, II and IV only II, II and IV only
b	12	Why is six sigma called TQM on steroids? Because of the extensive training element required Because of the inclusion of statistical and lean tools Because of the heavy impact of top management support Because of the impact of cost savings on the bottom line
c	13	In what areas would upper management be most helpful in the initiation of a six sigma effort? Providing direct training to black belts Standardizing business operations Providing key resources to the organization Directing the improvement projects
d	14	According to Pande, which of the following is a legitimate reason for embracing a six sigma effort? The company currently has an effective improvement effort Current changes are overwhelming the company resources The potential gains aren't sufficient to fund six sigma There are difficulties in meeting customer requirements
c	15	The concept behind PDCA is: The Deming/Showhart cycle Process flow Continuous improvement Satisfying suppliers
a	16	Why is the PDCA cycle so readily accepted by most American teams and individuals? It is the natural way that most people already approach problems It was promoted by Dr. Deming who has a wide American following It has been widely used in Japan with success It requires much less work than comparable improvement techniques

d	17	The term “metrics” most frequently refers to: A unit of measurement The metric system The science of weights and measurements An evaluation method
c	18	Short-term tactical plans are: Usually defined by customer Set before objectives can be determined Supportive of strategic objectives Normally opposite to long range objectives
b	19	If a metrics format were being developed to track marketplace response, which of the following items would be included? Cost of quality Customer retention Cycle time reduction Profit margin on sales
a	20	Which of the following metrics would be the most inappropriate to measure the effective use of resources? Customer courtesy ratings Cost of quality Percentage of defects generated Reduction in product or service variation
c	21	The risk priority number (RPN) is the measure of risk related to a particular failure mode. The ratings for each category (severity, occurrence, and detection) are on a 1 to 10 scale. If a FMEA has 10 failure modes with RPN numbers ranging from 50 to 300, an improvement team’s recommended actions should focus on which of the following? Work on those failure modes with RPNs greater than 50 Use the Pareto principle to prioritize the highest RPNs Identify failure modes with high severity rankings, followed by high RPN numbers Use the Pareto principle and start with the top 20% of the failure modes
a	22	Upon completion of a FMEA, what critical event should be established next? Ensure that a process owner is in charge of the FMEA Designate an engineer to follow-up on the recommended actions Review the documents at regularly scheduled intervals Have cross functional teams assigned to each FMEA for review activities
b	23	A process FMEA is generally performed: Just after the design FMEA is completed Just before the production tooling is authorized Just after the design drawings are finalized As soon as a manufacturing defect is uncovered
c	24	Why is DFSS called the future of six sigma? There are few remaining DMAIC projects available in most companies DFSS roadmaps are more attractive than DMAIC tools DFSS better serves the current innovation initiatives of many companies DMAIC projects do not achieve six sigma levels without DFSS

c	25	Which of the following is NOT a DFSS technique? IDOV DMADV SPC QFD
a	26	Which IDOV phase defines overall product requirements, quantifies marketing information and customer feedback, and creates the first set of CTQ (critical to quality) features. Identify Design Optimize Validate
d	27	Which of the following is NOT a goal of TOC? Increase throughput Reduce inventory Reduce operating expenses Balance capacity with demand
a	28	What is the best definition of takt time? It is a calculated time element that equals customer demand It is the speed at which parts must be manufactured in order to satisfy demand It is the heartbeat of any lean system It is the application of Kaizen to continuous flow manufacturing
a	29	The production of product in large lots has all of the following disadvantages EXCEPT for Maximization of machine efficiencies Longer customer delivery lead times Additional product transportation expenses Potential product damage or deterioration costs
c	30	Which of the following forms of muda is LEAST likely to result in poor product quality? Overproduction Inventory Waiting Transport
c	31	Identify a non-value added activity that would be considered a form of processing muda: Any and all forms of transportation An ergonomically unsound workplace Reshaping a product due to poor dies Producing more than needed by the customer
d	32	One would say that the Kanban method would be most closely associated with: The elimination of non-value added activities in the process The development of a future state process stream map Making problems visible in a process, thus clarifying targets for improvement The control of material flow

d	33	The essence of Kanban concepts includes all of the following, EXCEPT: Delivery of components and products only when needed Minimal storage in production areas Distress throughout the production system when a machine failure occurs Wide applicability to repetitive and non-repetitive production plants
d	34	Poka-yoke uses a number of devices to mistake proof a process. Which of the following would NOT be included? Fixture templates Electric relays Buzzer or light signals Self-check inspections
a	35	Consider the following definition: “The best combination of machines and people working together to produce a product or service at a particular profit in time.” What lean concept is being described? Standard work A future state map The value stream Ultimate cycle time
c	36	Which of the following techniques is most effective for incorporating desired attributes into the earliest stages of product design? FTA FRACAS QFD FMEA
c	37	The analysis of risk involves two measures of failure. These measures are: Failure analysis and failure effects Failure mode and failure method Failure severity and failure probability Failure mechanism and failure mode
b	38	The term severity in a FMEA describes the: Difficulty of completing the FMEA form Possible impact to a system user of a low level failure Likelihood of a failure Time for which the system is expected to be down
a	39	Which of the following Japanese techniques is most clearly identified with small incremental change? Kaizen Kanban Poka-yoke 5S strategy
c	40	As with the seven quality management tools, the Japanese concept of workplace organization, 5S, has been Americanized. Of the five original tools, which is the hardest to find in the American system? Seiri Seiton Shitsuke Seiso

b	41	Overproduction, scrap, waiting, and excess motion are all forms of: TPM Muda Kanban CFM
a	42	The tool/technique most widely used by a number of automotive manufacturers that supply products is called: Kanban Muda Poka-yoke An Andon board
b	43	American visitors to an aluminum plant in Japan were given white gloves to wear. What category of the 5S program was being displayed? Sort Scrub Straighten Standardize
a	44	An attempt to minimize the impact of human error in a process is called: Poka-yoke Jidohka Kaizen Muda
d	45	Which of the following techniques does NOT necessarily compliment the visual factory concept? Kanban Tool boards 5S Poka-yoke
b	46	Review the following 5S elements and identify the step that is being referenced. -Determine who has missing items -Create a name and location for everything -Use aisle and material placement markings -Use labels, tool boards and color codes Sort Straighten Scrub Systematize
d	47	The theory of constraints concentrates mainly on: Understanding customer needs Developing a value stream map Achieving on-time goals Removing process bottlenecks
c	48	In a production factory, which utilizes the pull system, which of the following may NOT be achieved? Reduced raw material inventory Reduced in-process inventory Increased prices Reduced finished goods inventory

d	49	Identify the business element that might NOT reduce cycle time? Utilizing problem solving tools Implementing 5S Practicing SMED Supervising people
b	50	Identify the most difficult limitation in achieving continuous flow. Untrained employees Existing equipment Employee culture Middle management involvement
d	51	A value stream map does NOT normally provide data on: Changeover time Cycle time Work in process inventory Supplier's finished goods inventory
d	52	Which of the following is a non-value added activity? Design reviews Vendor assessments Inventory reductions Receiving inspection to ensure incoming quality
b	53	Identify the best way to error proof activities? By corrective actions By preventive actions By containment actions By temporary actions
a	54	Lean enterprise may be summarized as: An entire organization involved with improvement Implementation of SMED cycle time techniques Poka-yoke techniques in action Ergonomic principles in the workplace
a	55	The most effective and efficient method of solving quality problems for a product is to concentrate efforts in the areas of: Design Production Quality improvement Lean techniques
c	56	Six sigma design uses the following sequence in the creation of new products: I Define II Verify III Design IV Analyze V Measure II, I, V, IV, and III I, V, II, IV, and III I, V, IV, III, and II I, V, IV, and III only

d	57	The house of quality is used to translate customer wants into engineering design variables. The linking or prioritizing of customer wants into engineered values occurs in what element? Competitive analysis Conflict analysis Technical review Relationship matrix
a	58	Quality function deployment, also known as the house of quality, is used in the design process. It has various benefits, the most critical being: People are aligned and think together Designers have access to the right technical specs Customers put their wants down on paper Competitive analysis is developed objectively
b	59	Reduced cycle times for a product can result in reduced work in progress, reduced waste, and: Increased product costs Improved operations Excess inventories Longer takt times
a	60	PM in relationship to the lean enterprise system means: Total productive maintenance to maximize equipment usage Total preventive maintenance to reduce total costs Total process management to manage process costs Total preventive maintenance to minimize downtime
b	61	The right hand side of a completed “house of quality” (HOQ) displays rankings and values for: Customer needs or desires Competitive assessments or comparisons Design feature measurements and importance Design feature interactions
d	62	Which of the following techniques has proven useful in translating customer needs into product design features? Changing perceptions Customer service principles Confrontation and problem solving Quality function deployment
b	63	The SIPOC business model helps everyone in the company see the business from an overall process perspective. However, it does NOT: Provide a framework applicable to processes of all sizes Restrict access to customer data Have supervisors available to answer more questions Utilize employee involvement
d	64	The organization’s customer service program can be enhanced in many ways. One of the ways would be: Provide better procedures for customer service personnel Restrict access to customer data Have supervisors available to answer more questions Utilize employee involvement

d	65	Having extensive industry knowledge makes upper management “experts” in customer needs anddesires. To win in the marketplace they should: Authorize many new products as soon as possible Start with a new marketing plan fitting customer needs Develop a strategic plan for new products Ask for help, because they often don’t really know the customer
a	66	A customer satisfaction program was started on the right foot and has gone very well for the last year or so. The company should: Look to improve the program, with new customer input Do nothing with the program, it’s not broken Form a manager’s group to add new wrinkles to the program Concentrate on long term customers
a	67	A six sigma improvement team may be required to analyze customer data in order to define a project of the results of an improvement. Which of the following tools would be of LEAST value? Conflict resolution Statistical analysis Matrix diagrams Pareto analysis
a	68	Customer expectations follow which hierarchy of needs, from low to high? I Expected II Basic III Unanticipated IV Desired II, I, IV, III III, I, II, IV IV, II, I, III I, II, III, IV
a	69	During the team building phase, which of the following best describes the actions of the team? The group is uncertain of their duties Members prioritize and perform tasks Member cooperation is evident The team leader usually delegates duties
c	70	In most cases, an improvement team receives the least control and direction during which of the following stages: Building Storming Performing Alarming
a	71	Excessive conflict within an improvement team: Has a negative effect on team members and should be avoided Has a positive effect on creating solutions Most often results in win-win situations Promotes equal participation among members

c	72	Good improvement team members will: Provide valid excuses when they miss a meeting Agree with the team even when it is wrong Encourage participation by other team members Withhold unpopular information from the team
a	73	Which of the following describes poorly functioning teams? Members act independently without inter-dependency Objectives are realistically set and met Team members listen to what is being said Facts and opinions are distinguished
b	74	Effective team mechanics would typically NOT include which of the following? The development of an agenda The support of upper management The distribution of minutes The meeting time, frequency and location
c	75	When giving instructions to those who will perform a task, the communication process is completed: When the worker goes to his work station to do the task When the person giving the instruction has finished talking When the worker acknowledges these instructions by describing how he/she will perform the task When the worker says that he/she understands the instructions
c	76	Understanding, controlling and improving an organization's processes to create value for all stakeholders would be called: The SIPOC diagram Process performance metric Business process management The establishment of KPIVs and KPOVs
b	77	As an alternative to QFD, the plotting of items of customer importance versus the customer'scorresponding satisfaction level, using a form of Likert scale would most appropriately be called: A matrix diagram A perceptual map A cause-and-effect matrix A correlation chart
d	78	One would say that, from an overall perspective, the activities of a company are tied together by: Customers Stockholders Suppliers Process management
d	79	If a company fails to meet their quarterly projected sales and profit forecasts, which of the following stakeholder groups would be LEAST affected? Suppliers Stockholders Employees Society

d	80	The key difference between internal and external customers is: Their interest in the product or service Internal customers can influence the design of the product External customers usually influence the design of the product External customers best determine the true quality of the product
c	81	On surveys from customers, what do high customer satisfaction numbers NOT indicate? Customer satisfaction Customer service Customer loyalty Product quality satisfaction
b	82	The fundamental purpose of establishing teams is to: Provide team members a form of job enrichment and broadening Improve the internal efficiencies of the organization Teach team members new problem solving skills Avoid spending money on outside consultants
b	83	Which six sigma role is most likely to define objectives for an improvement team? Leader Sponsor Facilitator Member
b	84	The key attribute for individual team members is: That they are able to work schedules to accommodate team activities That they believe in the value of the team process That they have extensive experience within the organization That they understand the full scope of the problem at hand
a	85	A team sponsor or champion typically: Is a liaison between the team and upper management Attends all team meetings Directs the team on implementing solutions Fulfills the facilitator role
b	86	A project team has been functioning very well for about two months. One member has suggested a different approach to solving the problem they have been working on. The other members strongly reject the ideas. This is an example of: Wanderlust Groupthink Floundering Active-passive behavior
a	87	Techniques useful for team facilitators when narrowing a list of potential problem areas to investigate include all of the following, EXCEPT: Brainstorming Nominal Group Technique Voting Multivoting

c	88	One way communications within an organization would include: Upward and downward Horizontal and informal Emails and letters Rumors and gossip
c	89	Effective communications ensure all of the following EXCEPT? That business objectives are understood That the strategic plan is disseminated That business success is assured That customer requirements are known
c	90	What primary activities take place during most team meetings? Conflict between the facilitator and the team members Taking detailed minutes and publishing the information promptly Learning the teamwork process and improving the work processes Consensus building and conflict resolution
c	91	When two team members express strong opposite views, the remaining team members should: Ask both members to leave Vote that the leader stop the discussion Have the two clearly state their positions Use the sponsor to clarify the situation
c	92	Identification of the external customer is important because: It eliminates wasted advertising It produces more profit per customer It helps identify the customer's needs It permits easier product recalls
c	93	A study on best customer satisfaction practices suggests this principle: Use proper sampling methods to collect data Use consultant designed survey forms Use multiple instruments to collect data Use good equipment for sampling
d	94	Project improvement team members normally have: Narrow skills and experiences Diverse skills and narrow experiences Diverse experience and narrow skills Diverse skills and experiences
b	95	The most difficult stage for any team to work through is: Norming Storming Performing Forming
a	96	The team champion has this position because: He or she is at a high level in the organization He or she finished the project first His or her team saved the most money The team members elected him or her

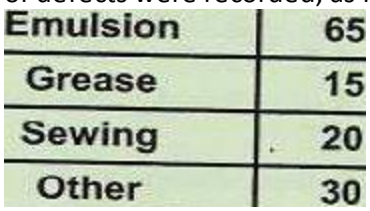
b	97	When one works through a conflict situation with a customer: There is no conflict, the customer is always right The process should not embarrass either party The company should maintain its position All steps and procedures are strictly followed
d	98	Studies have shown that the most effective method to communicate information is: Oral Written Non-verbal A combination of methods
c	99	The downward flow of communications is used form information transfer. By the time it gets to the lowest level, it has been affected by the process of: Spanning Projecting Filtering Leveling
c	100	If a team leader wishes to take an assertive stance in dealing with a conflict, he/she will want to select which of the following positions? Avoiding Accommodating Collaborating Compromising
c	101	What is the main difference between risk analysis and risk management? There is minimal difference, they refer to the same concept Risk analysis refers to tools and risk management deals with consent Risk analysis evaluates risks, while risk management is a more inclusive process Risk analysis includes risk handling while risk management refers to risk monitoring
b	102	A project has been completed and the final report written. The next activity relevant to the project is: Benefit-cost analysis Postmortem analysis Reward and recognition of project team members Document archiving
a	103	Which of the new quality management tools is used to organize facts and data about an unfamiliar subject or problem? The affinity diagram The header technique The activity network diagram Matrix diagram
b	104	Pareto diagrams are used to: Determine a cause-effect relationship between one or more variables Focus attention on problems in priority order Generate a large number of ideas Display causes in nongraphical manner

c	105	When constructing a Pareto diagram where should the “others” category be placed? At the beginning as the first category Directly in the center of the chart At the end as the last category Where it falls according to indicated frequency
d	106	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? L-type T-type C-type Y-type
c	107	Which of the following improvement tools utilize the accumulation of ideas or data into categories? Control charts PDCA Pareto diagrams Flow charts
b	108	For organizing information, facts or data into a systematic, logical manner, which of the following new quality tools would be used? An interrelationship diagraph A tree diagram An activity network diagram Prioritization matrix
d	109	New quality management tools are being used to help the problem solving process. Which of thefollowing tools provided a numeric ranking of options? Interrelationship diagraph Affinity diagram Activity network diagram Prioritization matrices
a	110	Which of these quality tools would NOT be expected to be used during the results confirmation stage of a problem solution? Flow chart Pareto diagram Histogram Control chart
d	111	Which of the following is NOT a potential risk area? Environmental risks Schedule risks Cost risks Mitigation risks
d	112	One would say that the final stage in project management would be: The project proposal The project review Lessons learned Document archiving

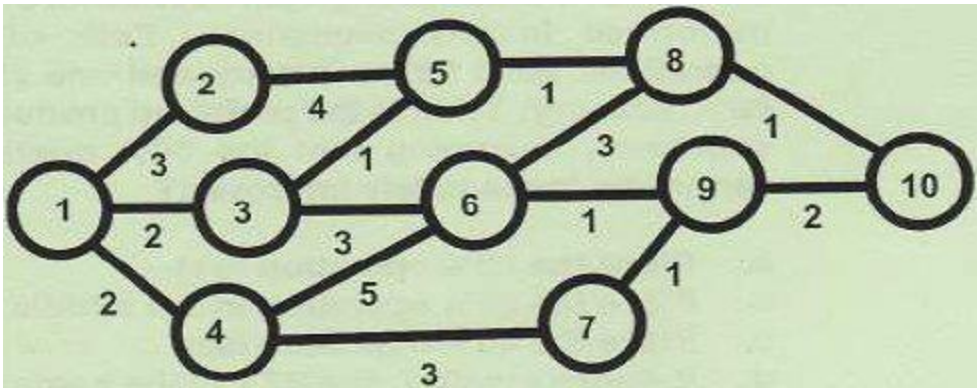
a	113	In developing a chart to plot a course of action, with many of the events or milestones unknown, which new quality management tool would be used? Process decision program chart Activity network diagram Matrix diagram Affinity diagram
b	114	Which of the seven modern quality management tools use techniques that incorporate a form of flow charting? Tree diagrams, activity network diagrams and matrix diagrams PDPC charts, tree diagrams, activity network diagrams Affinity diagrams, tree diagrams, interrelationship digraphs Matrix diagrams, PDPC charts, tree diagrams
c	115	Which of the following management tools requires the least preliminary knowledge about a subject or activity? Prioritization matrices Matrix diagrams Affinity diagrams Activity network diagrams
b	116	What is the danger in bunching ideas immediately into closely related categories when using either the affinity diagram or the interrelationship digraph? The wrong category might be selected Thought patterns could be blessed Arrows might be aimed in the wrong direction The problem resolution can be overlooked
a	117	Any action taken to reduce the probability and/or consequences of an adverse outcome from a development project is called: Mitigation Transference Avoidance Acceptance
b	118	Which statement best describes an optimized risk management process? Cost of resolution equals risk exposure Overall cost and risk are minimized Risk mitigation plans that are rarely exercised A scalable and flexible plan
a	119	Variances from budget for a project: Are the differences between planned and actual costs Indicate the project manager did a poor job of controlling costs Are usually expressed in standard deviation units from the norm Are expected in most complex design activities
a	120	One thousand units of products were examined for the possibility of 5 different undesirable characteristics. A total of 80 defects were found. How many defects would be expected in a million opportunities? 16,000 26,666 61,456 80,000

c	121	Of the four classifications of quality costs, which will prove the greatest dollar savings versus dollars spent? Appraisal costs Internal failure costs Prevention costs External failure costs
c	122	A critical to quality (CTQ) tree can be of value to the six sigma project team. It can translate customer requirements to quantified requirements. This will allow the organization to focus on a problem. An example of a quantified requirement for a mall order publishing house is: Cycle time to print a book Inexpensive pricing The weight of a book not to exceed 3 pounds Exceptional copy quality
c	123	The DPMO for a process is 860. What is the approximate six sigma level of the process? 4.2 4.4 4.6 4.8
c	124	The team's charter describes the team's: Leader, facilitator, recorder, and timekeeper Meeting dates, milestones, and targets Mission, scope, and objectives Members, sponsors, and facilitators
c	125	The use of the program evaluation and review technique (PERT) requires: The critical path to be known in advance Slack times to be added to the critical path Time estimates for each activity in the network Less data than a Gantt chart
c	126	The critical path in a project means that: The project is important to the profits of the organization Slack times can be used to delay the ending date of the project Delays of events on this path delay the ending date of the project Activities cannot be crashed
d	127	Gantt chart advantages include all of the following, EXCEPT: The charts are easy to understand Changes can be made easily Each bar represents a single activity Estimates of optimistic and pessimistic times can be included
a	128	Manual project management planning and controlling methods: Have an advantage over computer methods in terms of cost Have become nearly extinct because of the availability of computer methods Are best for large complex projects Are harder to learn than computer methods

d	129	Advantages of computer software driven project management methods do NOT include: The ability to analyze “what-if” options An automatic calculation of the critical path A determination of the effects of actual results on the project Minimal training requirements
b	130	Six sigma project methodology normally begins with what initial step? Problem definition Define Project charter Champion approval
d	131	The advantages of an effective quality cost measurement system include which of the following? It provides an effective vehicle for Kano analysis It provides the solution to many quality problems It eliminates the need for separate management corrective action efforts It aligns many company and quality goals
c	132	Identify the secondary or consequential customer metrics from the choices below: Conformance quality Color range Average age of receivables Technical support
a	133	The project charter will be useful in many ways, including: Providing a consistent target for the team Permitting the team leader to develop milestones from it Assuring the champion will assign responsible team members Ensuring team members will support the charter
c	134	The project charter will contain a business case, which can be defined as: A reasoning for the redesign of a process or product The full arguments for the project A short summary of the strategic reason for the project A case study of the project situation
d	135	A commonly reported problem associated with six sigma project deals with: A failure to complete any project charter documentation A desire to complete projects on time A requirement that projects must be at least $100,000 in value A lack of business impact for the company
c	136	The target length of an initial six sigma project should be approximately 60 days 90 days 120 days 180 days
b	137	The composition of a team for a typical six sigma project should: Be composed of interested floor operators and area staff Consists of qualified people with the expertise needed Consists of a cross-functional blend of people from various departments Consist of green belts, at the very least

d	138	In the preparation of a project, efforts should be made to identify and involve various parties affected by the planned changes. These other parties are known as: Process owners Champions Team leaders Stakeholders
a	139	Resistance to change resulting from an improvement project can cause failures. The project team might consider development of a plan to handle stakeholders. This plan is most likely to be termed: A communications plan A resistance plan A PERT chart A Gantt chart
d	140	In the construction of a Pareto chart for the number of defects in a book binding operation, four categories of defects were recorded, as identified in the following table.  The correct conventional listing for the Pareto chart categories from left to right would be. Emulsion, other, sewing, and grease Grease, sewing, other, and emulsion Grease, sewing, emulsion, and other Emulsion, sewing, grease, and other
a	141	Review of purchase orders for quality requirements fall into which one of the following quality cost segments? Prevention Appraisal Internal failure External failure
c	142	Using Kano analysis, what would be considered a latent requirement? A basic requirement A variable requirement A delighter A satisfier
c	143	The purpose of “rolled throughput yield” in the six sigma define step would NOT be to: Spot significant differences in yield Provide a baseline metric Use the calculation for customer analysis Analyze a process flow for improvement ideas

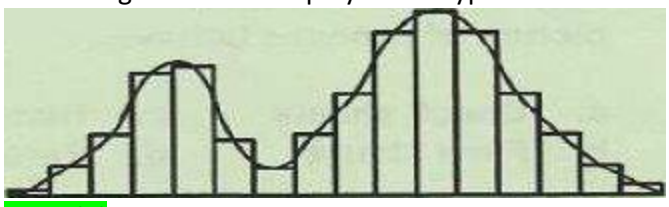
c	144	Understanding customer needs is a constant requirement for organizations. Customer data and information is often collected in various amounts. The organization should resolve to: I Use more proactive approaches II Focus on improvement plans III Identify customer satisfaction drivers IV Sort out the unneeded customer data I only II and III only I, II, and III only I, II, III and IV
a	145	What is the definition of the mitigate step in the risk management process? To reduce the impact of any unforeseen event To hide any relevant risk studies from the stakeholders To make adjustments based on deviations from planned actions To delegate disaster relieve to the proper authorities
b	146	Risk planning requires inputs such as: Avoidance Resources Transference Mitigation
a	147	The new problem solving tool which incorporates PERT and CPM techniques into a project flow chart is called: Activity network diagram Prioritization matrix Tree diagram Process decision program chart
b	148	An improvement team will make inferences about the relative importance and sequence of events when using the interrelationship digraph by the use of: Sticky notes on a wall Arrows leading to or away from topic The start and stopping of a process Numeric scores or indices
c	149	The decision to establish controls for product testing ONLY during the acceptance testing step of the project is a form of risk management known as: Risk avoidance Risk handling Risk acceptance Risk reduction
a	150	A chart is constructed that has defect types on the X-axis, customers on the Y-axis, and numbers of defects at the corresponding column and row intersections is called: A matrix diagram A correlation chart A Pareto diagram A cause-and-effect diagram

a	151	Lessons learned for a project would typically include all of the following, EXCEPT: How to secure increased funding for similar projects The effectiveness of the entire project How to avoid mistakes that were made The adequacy of project resources
c	152	Consider the following network, with events marked within the circles and durations in weeks:  The critical path is: 1-3-6-8-10 1-3-6-9-10 1-4-6-8-10 1-4-6-9-10
a	153	During a project work breakdown structure, a number of planning activities occur. Which of the following items is NOT included? The project objective is defined The work is divided into smaller activities The interrelationship between activities are defined The project schedule is established
d	154	What is a major distinction between the CPM and PERT methods in the evaluation of project performance? Only the PERT method can be displayed on a Gantt chart The PERT technique allows for easier crashing of project time The PERT technique permits network relationships but CPM does not The PERT technique is event oriented, while CPM is activity centered
d	155	Which of the following items is the LEAST likely candidate to assist the problem definition stage of six sigma? CTQ trees Pareto analysis Product yield data Control charts
a	156	There are five fabricating operations that can be performed in any sequence. Four of the operations yield 98% recovery and one yields 80% recovery. What is the preferred production sequence, assuming that the 80% operation cannot be immediately improved? Place the 80% operation first Place the 80% operation in the middle Place the 80% operation last It doesn't matter, the RTY is the same

b	157	The Kano model is used to: Measure supplier performance Analyze customer requirements Describe takt time Calculate rolled throughput time
c	158	If an improvement team were to investigate their customer base by moving from general to more specific customer needs, what technique would be employed? Pareto analysis Kano model CTQ tree Affinity diagram
b	159	A process consists of three sequential steps with the following yields: $Y_1 = 99.8$, $Y_2 = 97.4$, $Y_3 = 96.4$ Determine the total defects per unit 0.063 0.065 0.067 0.069
d	160	In the planning of a new major manufacturing program, the greatest quality effort should be put logically in: Inspection of product Nondestructive testing equipment Noncomformance to specifications Prevention of occurrence of substantial quality
d	161	A process map is used to accomplish which of the following? Display a dynamic picture of process performance behavior Focus attention on process problems in priority order Diagram possible problem causes in a process Track products, operator actions, or administrative procedures
a	162	Which of the following is NOT considered to be one of the new quality management tools? Scatter diagrams PDPC charts Tree diagrams Matrix diagrams
a	163	A process map is ideal for: Detecting the causes for delays Determining defective parts Prioritizing problems Determining if two variables are related
b	164	If you are reading this question you are a customer of QCI. Identify a QCI process output element from the list below: Binder manufacturers Solution texts Authors Paper companies

c	165	Process mapping of activities and systems is most helpful in detecting: Ways to eliminate written procedures Deficiencies in the organizational structure Holes or gaps in the control system Improper uses of statistical methods
b	166	Which of the following process mapping symbols would NOT be associated with a decision point? a  b  c  d 
a	167	The input categories for a classical cause-and-effect diagram would NOT include: Maintenance Manpower Machine Material
d	168	Process input and output variables can be effectively evaluated, using all of the following techniques, EXCEPT: Relationship matrices Cause-and-effect diagrams SIPOC models Box-and-whisker plots
d	169	An Ishikawa diagram is also known as a: Box plot Process map Scatter diagram Fishbone diagram
c	170	The term “variables” can be described in the following way: A quality which can be absent or present in a product A definable attribute or characteristic of a product A quality which can assume several (more than two) values A quality which is absent in a product in one or more specifications
c	171	Which of the following data types would provide the most useful information in eliminating the causes of paint blemishes on automobiles being produced on an assembly line? Attribute Ordinal Locational Variables
b	172	If the interaction roof of a House of Quality uses a numeric scale (instead of alphabetic), what data type would be displayed? Nominal Ordinal Interval Ratio

a	173	The measure of the central location for the nominal scale is considered to be the: Mode Median Arithmetic Average
d	174	When performing calculations on sample data: A continuous relative frequency graph is created Rounding the data has no effect on the mean and standard deviation Coding the data has no effect on the mean and standard deviation Coding and rounding affect both the mean and standard deviation
a	175	Random selection of a sample: Theoretically means that each item in the lot had an equal chance to be selected Ensures that the sample average will equal the population average Means that a table of random numbers was used to dictate the selection Is a meaningless theoretical requirement
c	176	If an engineer or technician were to select samples from a mixture in a vat that is suspected of separation, what sampling technique would be advisable? Random sampling Sequential sampling Stratified sampling Discovery sampling
d	177	In order to ensure data accuracy and integrity, which of the following should NOT be considered? Avoid unnecessary rounding of data Record production data in time sequence Filter data for entry errors Remove data based on a firm hunch that it is false
c	178	Which of the following measures of variability is NOT dependent on the exact value of every measurement? Mean deviation Variance Range Standard deviation
b	179	The sum of the squared deviations of a group of measurements from their mean divided by the number of measurements equals: σ σ^2 Zero The mean deviation
a	180	Determine the coefficient of variation for the last 500 pilot plant test runs of high temperature film having a mean of 900° Kelvin with a standard deviation of 64°. 6% 16.7% 0.6% 31%

c	181	A graphical display of the total percentage of results below a certain measurement value is called a: Histogram Probability density function Cumulative distribution function Expected value
c	182	What tool is customarily used to complement the cause-and-effect diagram? Scatter diagrams Pareto diagrams Brainstorming Force field analysis
b	183	Correlation coefficients are generated from which of the following graphs? Measles charts Scatter diagrams Pareto diagrams Control charts
b	184	Which three of the following four techniques could easily be used to display the same data? I Stem and leaf plots II Box plots III Scatter diagrams IV Histograms I, II, and III only I, II, and IV only I, III, and IV only II, III, and IV only
a	185	The histogram below displays what type of distribution?  Bimodal Polymodal Negative skewed Truncated
a	186	For the normal probability distribution, the relationships among the median, mean, and mode are: They are all equal to the same value The mean and mode have the same value but the median is different Each has a value different from the other two The mean and median are the same but the mode is different
b	187	All of the factors that might be contributing to a production problem must be discovered. Which of the following problem-solving tools would be the best selection? Pareto diagrams Fishbone diagrams Histograms Control charts

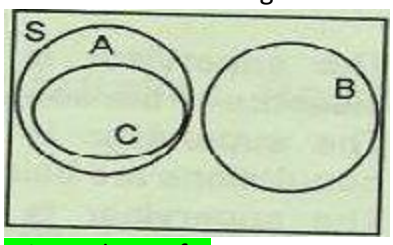
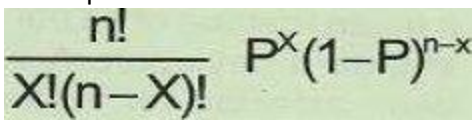
b	188	Which of the following statements describes discrete data? It takes 3 hours and 48 minutes to fly from LA to New York Of 225 people on the airplanes, 85 had connecting flights The flight arrived at 9:08pm There were 5,923 gallons of fuel consumed on the flight
d	189	Locational data might be found on all of the following, EXCEPT: A defect location check sheet A measles chart A concentration chart A recording check sheet
c	190	Identify the data conversion that would be MOST difficult to accomplish: Attribute data converted to variables data Variables data converted to attribute data Accumulated go/no-go data converted to variables data Variables data converted to go/no-go data
c	191	Which of the following is NOT a statistical level of measurement? Ordinal Nominal Numerical Ratio
d	192	Pallets of products are staged in a warehouse prior to shipment. There are indications that container damage is occurring disproportionately at aisle and row end locations. The best method of data collection to confirm this theory would be: Random sampling Sequential sampling Skip-lot sampling Stratified sampling
d	193	The scatter of individual observations from a normally distributed process can NOT be quantified with which of the following? The range The standard deviation The variance The median
a	194	What graphical data method can show the value of all individual readings? A stem and leaf plot A grouped probability density function A normal histogram A complex box plot
a	195	Which of the following statements is most applicable to trend analysis? Experience is required for proper interpretation Bar charts are more informative than run charts Most applications should be reflected as an improvement percentage An improving trend is an indication of corporate survival

b	196	A histogram is also known as: A cumulative frequency graph A relative frequency graph A population distribution function A box-and-whisker plot
a	197	A relational matrix is a problem-solving tool which helps to: Shows cause-effect relationships between input and output variables Focus attention on problems in priority order Generate a large number of improvement ideas Determine where noncomforming parts exist
c	198	A scatter diagram is used to plot gas mileage versus the weight of a car. One would expect the shape of the resulting plot to be: A low positive An increasing slope A decreasing slope No correlation display
d	199	If 87 data observations from a process were to be plotted on a histogram, the rule of thumb would suggest using which number of intervals across the range of the data? 19 4 12 9
a	200	Consider the following data set: 3,4,7,7,8,11,12,13 Which of the following are factual statements regarding this data? The mean is greater than the mode The median is less than the mode The mean is less than the median The mode and the median are the same
b	201	Consider that a sample of ten units is taken from a population. Which of the following statementsiscorrect? The standard deviation is usually greater than the variance The range is greater than the standard deviation A sigma estimate cannot be determined No estimate of the population average is possible
c	202	Which of the following quality tools displays large amounts of numeric data to show a static picture of process behavior? Check sheets Flow charts Histogram Pareto diagrams
a	203	What is the mode of the following data set? 4, 2, 6, 8, 7, 4, 3, 4, 7 4 5 6 7

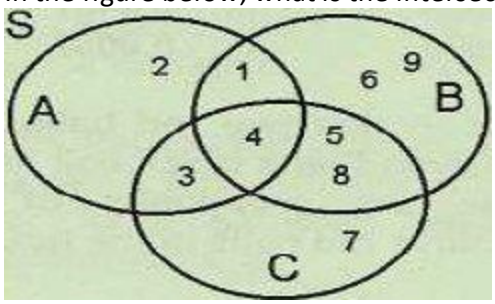
d	204	What is the mean height of five men who have the following heights? 5'6", 5'9", 5'4", 5'11", 5'8" 6'0" 5'5" 5'6 ½" 5'7 3/5"
b	205	Calculate the standard deviation of the population for the following set of five sample observations: 1.5, 1.2, 1.1, 1.0, 1.6 1.280 0.259 0.231 0.518
b	206	What is the standard deviation of the following complete set of data: 3.2, 3.1, 3.3, 3.3, 3.1? 3.2 0.0894 0.1 0.0498
d	207	The grades of a student on six examinations were 84, 91, 72, 68, 87, and 78. Find the median of the grades: 84 78 80 81
d	208	The SIPOC process map stands for suppliers, inputs, process, outputs, and customers. It provides a view of the process that contains approximately how many steps? 21-40 steps 16-20 steps 8-15 steps 4-7 steps
a	209	You conduct a thorough statistical analysis of the capabilities of three machines and conclude thatmachine number 3 is giving a consistently sub-standard performance. Your recommendation is, due tothemachine's age and the costs to repair, it should be replaced with new equipment. The line supervisor statedthatthere was no value in conducting an analysis to conclude what was already known to be a fact. What can be stated about these two contrasting approaches? The statistical analysis validates the supervisors intuition The supervisor is right, there was no need to make a detailed analysis Neither conclusion is necessarily right, there is always room for error More data may be needed to convince the supervisor
b	210	After attending SPC classes, a second shift production supervisor implements a mean chart foranimportant quality characteristic. The supervisor stated, "I'm happy to announce that out of 24 sample means (sample size 5 units, taken every 20 minutes) none were found outside of the specification limits. The process is running flawlessly." What can be stated about the supervisor's conclusion? The supervisor is wrong, there is no measure of the confidence level The supervisor is wrong, two different populations are being compared The supervisor is right, for the wrong reasons The supervisor is right, all values are within specifications

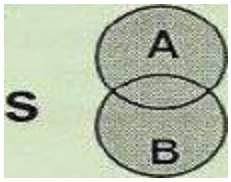
c	211	ASQ sectional history indicates that 43% of all candidates successfully pass certification exams. A total of 12 company employees (including you) will take the upcoming CSSGB exam. The area manager has promised a big bonus if all 12 of you pass the exam. What is the probability of getting the promised bonus? 1.000000 0.083000 0.000040 0.001176
d	212	The Poisson distribution can be used to approximate the binomial distribution under which of the following conditions? When p is equal to or larger than 0.1 and the sample size is large When p is equal to or larger than 0.1 and the sample size is small When p is equal to or smaller than 0.1 and the sample size is small When p is equal to or smaller than 0.1 and the sample size is large
a	213	Which of the following two distributions have theoretical ties to the chi-square distribution? F and t distributions F and normal distributions Normal and t distributions Binomial and normal distributions
b	214	As a new green belt in the company you receive the following information: $\bar{\bar{X}}$ = 4.241 mm, $S = {}_x$0.565 mm, n = 5 You decide to estimate the process parameters but discover that the original data was lost and all you have are these 3 numbers. What is the best estimate that can be made of the process parameters under the current circumstances: $\hat{\mu}$ = 4.241 and $\hat{\sigma}$ = 0.565 $\hat{\mu}$ = 4.241 and $\hat{\sigma}$ = 1.263 $\hat{\mu}$ = 4.241 and $\hat{\sigma}$ = 0.253 $\hat{\mu}$ = 1.896 and $\hat{\sigma}$ = 1.263
c	215	Which of the following statistical term statement is correct? Parameters come from samples Samples come from statistics Statistics come from samples Populations come from statistics
d	216	What is the practical use of the F distribution? To study the equality of two means To study the equality of goodness of fit data To study the quality of one mean and one variance To study the equality of variances
c	217	Which of the following distributions have their x-axis starting at 0? Normal and t Normal and chi-square Chi-square and F F and t

c	218	A number resulting from the manipulation of some raw data according to certain specified procedures is called: A population A constant A statistics A parameter
b	219	The distribution of a characteristic is negatively skewed. The sampling distribution of the mean for large samples, taken from this same distribution, is: Negatively skewed Approximately normal Positively skewed Lognormal
a	220	If the probability of a car starting on a cold morning is 0.6, and we have two such cars, what is the probability of at least one of the cars starting on a cold morning? 0.84 0.81 0.60 0.36
b	221	For two events, A and B, which one of the following is a true probability statement? P(A or B) = P(A) + P(B) if A and B are independent P(A or B) = P(A) + P(B) if A and B are mutually exclusive P(A and B) = P(A) x P(B) if A and B are mutually exclusive P(A or B) = P(A) x P(B) if A and B are independent
d	222	Which of the following distributions does NOT require the use of the natural logarithmic base for probability density calculations? Normal Poisson Chi-square Binomial
b	223	Determining the lower limit of success at a desired confidence level for n tests with f failures is an application of the: Normal distribution Binomial distribution Chi-square distribution Hypergeometric distribution
a	224	The distribution which has a mean equal to the variance is the: Poisson Exponential Weibull Rayleigh

d	225	Given the following information: Probability of 1 or more defects = 0.69 Probability of 2 or more defects = 0.34 Probability of 3 or more defects = 0.12 Probability of 4 or more defects = 0.03 What is the probability of 2 or fewer defects? 0.34 0.69 0.46 0.88
a	226	In reference to the figure below, which of the following is NOT true?  A is a subset of B B and C are mutually exclusive C is a subset of A A and C are additive probability events
d	227	The probability of a train arriving on time and leaving on time is 0.8. The probability of the same train arriving on time is 0.84. The probability of this train leaving on time is 0.86. Given the train arrived on time, what is the probability it will leave on time? 0.93 0.84 0.88 0.95
c	228	The expression below is which of the following?  General term for the Poisson distribution General term for the normal distribution General term for the binomial distribution General term for the chi-square distribution
c	229	Which of the following statistical distributions can be used to compare sample means? Chi-square distribution Normal distribution t distribution Exponential distribution
b	230	Suppose that 5 bad electron tubes were mixed with 8 good tube. If 2 tubes are drawn simultaneously, what is the probability that both are good? 8/13 14/39 7/12 36/91

c	231	In a probability study, an outcome or event that cannot be broken down any further is referred to as: A mutually exclusive event A dependent event A simple event An event complement
b	232	If events cannot occur simultaneously they are called: Randomly selected Mutually exclusive Independent Statistically stable
d	233	The average number of flaws in large plate glass is 0.25 per pane. The standard deviation of this Poisson distribution is: 0.25 0.05 0.75 0.50
c	234	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? 0.184 0.061 0.205 0.051
b	235	On average, a company hires 4 people per month. In a given month, what is the probability that exactly 7 people will be hired? 0.0003 0.0595 0.4487 0.0087
b	236	A box contains two red balls and two black balls. Given that a black ball has been drawn, what is the probability of drawing two consecutive red balls in the next three draws? 1/6 2/3 1/3 ¼
c	237	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: .0100 .0010 .0082 .0093

a	238	The car you drive to work has a 90% chance of starting in the morning. It is blocked by your spouse's car which has an 80% chance of starting. Both cars are blocked by your son's car which has a 70% chance of starting. What is the probability of getting to work in your own car? 0.504 0.560 0.630 0.720
a	239	15 process improvement ideas have been submitted for a project selection. Unknown to the team, two of these ideas have the potential for breakthrough improvement. If your team selects two projectsatrandom, what are the chances of picking both winners? 0.0095 0.0714 0.1333 0.1538
d	240	Defining the sample space S as {rock, book, cigar, guitar, dog}, what is the compliment of {cigar, dog}? {rock, book, cigar, guitar, dog} {cigar, guitar, dog} {dog} {rock, book, guitar}
c	241	In the figure below, what is the intersection of events A and C?  1, 3, and 4 1, 2, 3, 4, 5, 7, and 8 3 and 4 2, 3, 4, and 7
c	242	If events A and B are independent, then: P(B/A)=P(A) P(A/B)=P(B) P(B/A)=P(B) P(B/A)=P(A)+P(B)
a	243	In determining a process average fraction defective using inductive or inferential statistics, one would be using: Statistics, computed from samples, to make inferences about populations Populations, computed from samples, to make inferences about populations Samples, computed from statistics, to make inferences about populations Samples, computed from populations, to make inferences about samples

b	244	Assume a large lot contains exactly 4% defective items. Using the Poisson distribution, what is the probability that a random sample of 50 items will NOT reflect the true lot quality? 27% 73% 82% 67%
b	245	For a certain make of car, the brake linings have a mean lifetime of 40,000 miles with a 5,000 mile standard deviation. A sample of 100 cars has been selected for testing. Assuming that the population correctionmay be ignored, the standard deviation of X-bar is: 50 miles 500 miles 400 miles 4000 miles
c	246	When performing an analytical study, which of the following statistical values would seldom be known? The true critical value The sample statistic The true population parameter The degree of uncertainty
b	247	When P(A|B) ≠ P(A) then: Events A and B are independent Events A and B are dependent Events A and B are mutually exclusive Events A and B are complements
a	248	Refer to the Venn diagram below:  If the probability of event A is 20%, the probability of event B is 30%, and the probability of event A intersecting event B is 8%, what is the probability of neither event? 58% 56% 48% 44%
d	249	The upper and lower specifications for a certain product are 7 lbs. and 7.3 lbs. Actual data indicates that the product is currently running at an average of 7.465 lbs., with a standard deviation of 0.03039 lbs. The calculations indicate C_p=1.645 and C_{pk}=-1.81. What conclusions can be made about the process? There is something wrong with the calculations; a negative C_{pk} is not possible The specifications must be unrealistically set The process is close to 6 sigma; the negative C_{pk} is irrelevant The C_p and C_{pk} values indicate that the process problem is not centered

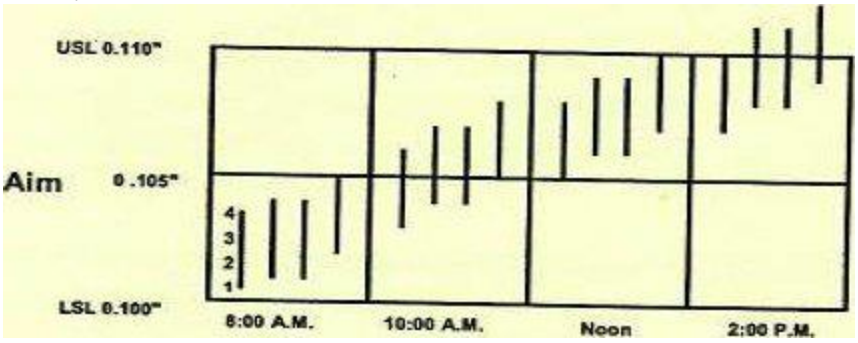
d	250	Two micrometers are used to measure the same quality characteristic (thickness in this case). The micrometer at headquarters has more decimal places than the one being used at the plant. The micrometer at headquarters is more: Accurate Precise Advanced Sensitive
c	251	What is the practical difference between the precision/tolerance ratio (P/T ratio) and the precision/total variation ratio (P/TV ratio). P/T ratio and P/TV ratio are practically the same P/T ratio gives a better picture of the measurement precision for internal improvement studies while P/TV ratio is better for evaluations relative to specifications P/T ratio gives a better picture of the measurement precision relative to specifications while P/TV ratio is better for internal improvement studies The combined P/T and P/TV ratios should equal one in order to achieve a better understanding of the measurement system analysis results
a	252	Which of the following is a necessary assumption to validate the meaning of the standard deviation of measurement variability? Measurement errors are independent The measurement scale is normally distributed Measurement errors are independent of the operators involved in the study Measurement errors are skewed in the direction of normality
c	253	Two constant values are often used to calculate P/T and P/TV ratios. What is the origin of the value 6 and 5.15 in the ratio calculations? They represent the most common values found in MSA statistical tables They were randomly selected and have never been changed They represent 99.73% and 99% of the total population of measurements, assuming normality They represent 95% and 100% of the range of normal values
a	254	Which MSA method allows the intersection between operators and parts to be determined? ANOVA method Average and range method Interaction method Range method
b	255	The calculation for reproducibility using the average and range method comes from: Examining the variation between the appraisers and within their readings Examining the variation between the average of the appraisers for all parts measured Checking the variation within each appraiser group Examining the variation between at least two separate instruments
a	256	A combined calculation of repeatability and reproducibility using the average and range method produces a ratio of 7.42% of process tolerance. What can be stated about the 7.42% value? The measurement system is acceptable The measurement system is marginal The measurement system is not acceptable It must be separated into individual R&R values

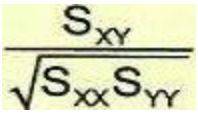
d	257	What is the null hypothesis (H_0) for process capability? That the ratio between the specs and the process spread should be one That the ratio between the specs and the process spread should be larger than one That the ratio between the specs and the process spread should be 1.67 None of the above
a	258	Why is the normality assumption essential to the interpretation of the capability index? Because a spread of 6 standard deviations represents 99.73% of cases Because only normal distributions are capable of statistical control Because the specifications are always explained by the bell curve Because the normal distribution always has a mean of 0
b	259	When considering a quality characteristic for process capability calculations, a green belt should consider which of the following? Choose those characteristics with the highest process capability index ratios Choose a small number of customer defined CTQ characteristics Choose only normal characteristics to comply with the normality assumption Choose all characteristics defined in the procedures and work instructions
b	260	A process shows lack of stability but yesterday's capability index was so great (1.77) that your supervisor decides to use it as a benchmark for all future process capabilities. What should you advise yoursupervisor? Use the 1.77 value, it is so good that the process instability is insignificant Do not use the 1.77 value, first get the process to statistical stability Use the 1.77 value but improve the process until it shows statistical stability Do not use the 1.77 value, the unstable process may provide a better index later
d	261	What is the effect of management tampering with process capability? Process capability will improve if management uses a motivational approach Process capability will improve if management punishes the poor quality offenders Process capability will deteriorate if management does not act promptly Process capability will deteriorate if management mandates frequent adjustments
a	262	6 sigma means 3.4 ppm considering a shift in the mean of 1.5 standard deviations. What is the value of 6 sigma without the 1.5 standard deviation shift in the mean? 0.002 ppm 0.135 ppm 2.4 ppm 4.9 ppm
b	263	When a process is not centred relative to specifications, which of the following statements is true? C_{pk} is equal to C_p when the population is normal C_{pk} is the smallest value of either C_p upper or C_p lower C_{pk} is the largest value of either C_p upper or C_p lower C_{pk} is the value closest to 1 in the partial capability index calculation
c	264	It is often desirable to do an R&R study of a gage system and compare it to the total process variation. What must be assured about the gage being used before an R&R study can be performed? Accuracy and precision Reliability and sensitivity Accuracy and sensitivity Reliability and precision

d	265	The data from an R&R study may be used to determine all of the following, EXCEPT: Reproducibility Process variation Repeatability Sensitivity
c	266	When making measurements with test instruments, precision and accuracy mean: The same The opposite Consistency and correctness, respectively Exactness and traceability, respectively
a	267	Assume in an R&R study, using the ANOVA method, that the technician-to-technician error was noted to be very low. This value could also be stated as low: Reproducibility error Repeatability error Interaction error Process error
a	268	The advantage of the R&R range method compared to the average and range or ANOVA methods is that it is a quick way to: Quantify the total R&R portion of measurement Quantify the repeatability portion of measurement Quantify the reproducibility portion of measurement Quantify any part and technician measurement interactions
a	269	Precision is: Getting consistent results repeatedly Reading to one decimal greater than the reported dimension Distinguishing small deviations from a standard value Extreme care in the analysis of data
d	270	When the natural process limits are compared with the specification range, which of the following courses of action is LEAST desirable? Change the specifications Center the process Reduce the variability Accept the losses
d	271	Process capability analysis is often defined as: The ability to make the process reliable and maintainable The inherent variability of items produced by the process The variability allowed by the specification limits The determination that the process can meet the product specifications as intended

c	272	A comparison between the C_p and C_{pk} for a process would find which of the following to be true? I. The C_{pk} value is often larger than C_p II. The denominator of the C_p calculation is twice that of the C_{pk} III. The C_p value does not account for centering IV. Neither calculation requires a stable process I and IV only I and III only II and III only II and IV only
a	273	In order to calculate a performance index, what two facts must be known about the process? The specification limits and the standard deviation The process average and process control spread The process standard deviation and Z value The process confidence interval and process average
a	274	If C_{pk} (upper) was determined to be 2.0 and C_{pk} (lower) was determined to be 1.0, what factual statements can be made about the process? The process is shifted to the left A calculation error has been made The process is not stable C_{pk} must be reported as 2.0
d	275	A process has been performing satisfactorily for some time. An improvement is required. Your responseis to: Direct the workforce to be more careful in their work Issue a slogan “do it right the first time” Identify the special clauses to correct the process Identify the common cause condition to correct the process
b	276	The reported C_{pk}, for a process with an average of 28, a spread of 10 units, and upper and lower specification limits of 15 and 35 respectively, would be: 1.6 1.4 1.8 0.714
a	277	Determine the reported P_{pk} for a process with a spread of 10 units, an average of 23, and upper and lower specification limits of 15 and 35 respectively. 1.6 1.8 2.0 0.625
c	278	When comparing short term machine capability indexes to long term process capability indexes,one would expect to find: A plus and minus shift of 1.5 standard deviations The machine capability to a lower number The process capability to be a lower number The machine and process capabilities to be virtually identical

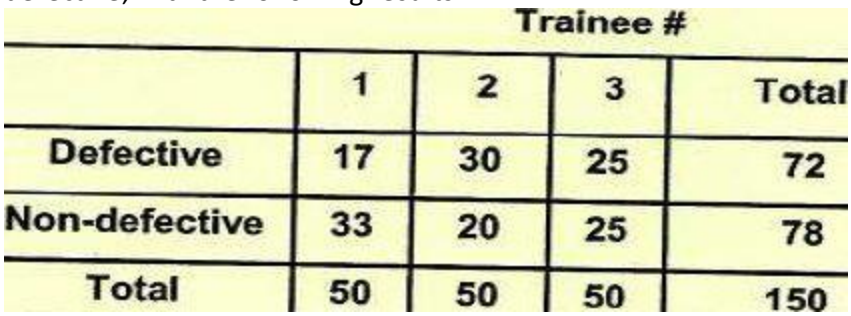
a	279	It is suspected that a process requiring a capability determination is not normal, but appears to be stable. The LEAST desirable action to take, at this point, would be to: Advise the customer and request specification changes Reduce variation to the point that it doesn't matter Transform the data to that of a normal distribution Test the normality assumption using a chi-square test
d	280	The p bar for a p chart for a critical customer component is 0.00265. If the customer wanted a six sigma report for the component in DPMC, what should be reported? Nothing, process capability isn't possible for attributes Report p bar as 0.00265 Call the customer and ask for more detail Report DPMO as 2,650
c	281	An engineer has conducted a year-end analysis (365 data points) of incoming materials by checking for dimensional variation. For one of the items (a ruler), the print dimension of length is to be 12.50 inches +/- 0.02 inches. The computer software indicated that the grand average was 12.52 inches and was statistically different from 12.50 inches. The engineer should do the following: Since the result is statistically significant, request the supplier to modify his equipment by 0.02 inches Follow the decision of the computer analysis, start rejecting the rulers The result is not of practical significance; the difference is too small to justify a change The supplier is to be notified via a corrective action request to correct his process
b	282	A p-value is used in many statistical calculations. It can be described as: Being similar to the critical statistical value as found in the statistical tables Containing an extreme test statistic probability value as obtained from the sample data Having the typical set values of 5% to 1% Being reported only when significant
b	283	Of the various statistical analysis tools available, which one would be the most likely to show a plot of all readings taken? X-bar – R charts Multi-vari charts ANOVA Chi-square
b	284	Identify the major area of variation classification NOT specifically addressed in multi-vari studies: Cyclical Piece-to-piece Temporal Positional
c	285	All multi-vari charts would initially plot a measurement for which of the following categories? Within batch Top to bottom Positional Cylindrical

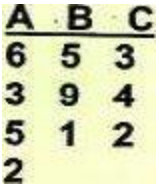
b	286	Consider the following multi-vari chart of a single product measured in the same four locations, across width, over time.  Evaluating the chart by eye, arrange the categories of variation from largest to smallest. Temporal, cyclical, positional Temporal, positional, cyclical Positional, cyclical, temporal Positional, temporal, cyclical
a	287	In a simple two variable linear regression study, what does the ter$\hat{\beta}_1$ represent? The slope of the line The x axis intercept The measurement of interaction The y axis intercept
b	288	A study was conducted on the relationship between the speed of different cars and their gasoline mileage. The correlation coefficient was found to be 0.35. Later, it was discovered that there was a defect in the speedometers and they had all been set 5 miles per hour too fast. The correlation coefficient was computed using the corrected scores. Its new value will be: 0.30 0.35 0.40 -0.35
b	289	As the scatter of points around a regression line becomes greater, r^2 will: Be unaffected Become smaller Become larger Approach a value of 1
b	290	The coefficients in the equation below can be determined using: $Y_i = a + bx_i + e_i$ Inference testing Least squares regression Sum of squares estimation Hypothesis testing

b	291	The equation below is:  The covariance of X and Y The correlation coefficient of X and Y The coefficient of determination of X and Y The variance of the product of X and Y
c	292	Given a coefficient of determination of 0.9, what is the correlation coefficient? 0.9 or -0.9 0.81 or -0.81 0.9487 or -0.9487 0.9487
b	293	If no correlation exists between two variables, then: The correlation coefficient should equal a negative value As one variable changes, one cannot predict a value for the other variable Both variables will decrease simultaneously Analysis of variance must be used to determine if an interaction is present
a	294	A random sample size n is to be taken from a large population having a standard deviation of 1 inch. The sample size is to be determined so that there will be a 0.05 risk probability of exceeding a 0.1 inch tolerance error in using the sample mean to estimate μ. Which of the following values is nearest the requiredsample size? 384 44 202 109
c	295	If the 95% confidence limits for mean μ turn out to be 6.5, 8.5: The probability is 0.95 that X-bar falls between 6.5 and 8.5 The probability is 0.95 that X falls between 6.5 and 8.5 The probability is 0.95 that the interval (6.5, 8.5) contains μ $4\sigma = 8.5 - 6.5$
b	296	A test of significance using a given value of α is performed on the yield data from a process, usingastandard material and a proposed substitute. Which of the following conclusions is NOT possible from this test? The standard material is better than the substitute material There is an interaction between the two materials The probability of type I error is alpha The sample size is too small to detect any material differences
d	297	Which of the following is a valid null hypothesis? p > 1/8 mu <98 The mean of population A is not equal to the mean of population B mu = 110

b	298	A null hypothesis states that a process has not improved as a result of some modifications. The type II error is to conclude that: One has failed to reject the null hypothesis when it was true One has failed to reject the null hypothesis when it was false One has rejected the null hypothesis One has made a correct decision with an alpha probability
a	299	The difference between setting alpha equal to 0.05 and alpha equal to 0.01 in hypothesis testing is: With alpha equal to 0.05, one is more willing to risk a type I error With alpha equal to 0.05, one is more willing to risk a type II error Alpha equal to 0.05 is a more "conservative" test of the null hypothesis With alpha equal to 0.05, one is less willing to risk either type I or type II error
d	300	When finding a confidence interval for mean μ, based on a sample size of n: Increasing n increases the interval Having to use S_x instead of n decreases the interval The larger the interval, the better the estimate of μ Increasing n decreases the interval
c	301	In the regression equation y = mx + b, y increases with x in all cases: If b is positive If b is negative If m is positive If m is negative
a	302	If a sample size of 16 yields an average of 12 with a standard deviation of 3, estimate the 95% confidence interval for the population (assume a normal distribution). $10.40 \le \mu \le 13.60$ $10.45 \le \mu \le 13.55$ $10.53 \le \mu \le 13.47$ $10.77 \le \mu \le 13.23$
b	303	Determine the 95% confidence interval for a population proportion if 6 defectives were found in the sample size of 100 units. $0.021 \le p \le 0.099$ $0.0135 \le p \le 0.1065$ $0.011 \le p \le 0.109$ $0.0245 \le p \le 0.0955$
b	304	Which of the following statements is NOT true? Confidence intervals decrease in width as the sample size increases Confidence intervals are always symmetrical Confidence intervals for the mean are independent of the population distribution Confidence intervals decrease with larger sample sizes
c	305	Given the data below, what is the 90% confidence interval for the variance? 22, 23, 19, 17, 29, 25 4.21-99.07 15.32-28.66 8.27-79.88 16.87-56.52

b	306	Determine whether the following two types of rockets have significantly different variances at the 5% level. Assume that the larger variance goes in the numerator. **Rocket A** **Rocket B** **61 readings** **31 readings** **1,347 miles²** **2,237 miles²** Significant difference because Fcalc < F table No significance difference because Fcalc < F table Significance difference because Fcalc > F table No significance difference because Fcalc > F table
c	307	The test used for testing significance in an analysis of variance table is the: Z test t test F test Chi-square test
b	308	The critical value for t, when making a two-tailed paired t test, with a sample size of 13, and alpha = 0.05, is: 1.782 2.179 2.064 1.711
c	309	In order to test whether the average output of one machine is the same or greater value than another machine, a sample of ten pieces was taken from each. The calculated t value turned out to be 1.767. Using a level of significance of 0.05, one-tailed test, one concludes that: The obtained t ratio does not fall within the critical region There was no significant difference between the means The null hypothesis was rejected The null hypothesis was not rejected
b	310	In a t test, alpha is 0.05, therefore: 5% of the time we will say that there is no real difference, but in reality there is a difference 5% of the time we will say that there is a real difference when there really is not a difference 95% of the time we will make an incorrect inference 95% of the time the null hypothesis will be correct
d	311	A student's t test can be used to determine whether or not differences exist in: Variability Confidence intervals Correlation coefficients Averages
d	312	The results of a designed experiment are to be analyzed using a chi-square test. There are five treatments under consideration and each treatment falls under two categories (success or failure). The calculated value of chi-square is compared to the tabulated chi-square with how many degrees of freedom? 10 9 5 4

b	313	Which table should be used to determine a confidence interval on the mean when σ is not known and the sample size is 10? Z t F X^2
d	314	Three trainees were given the same lot of 50 pieces and asked to classify them as defective or non-defective, with the following results:  In determining whether or not there is a difference in the ability of the three trainees to properly classify the parts, which of the following statements is (are) true? I The chi-square calculated value is 6.9 II Using a level of significance of 0.050, the critical value of the chi-square is 5.99 II Since the obtained chi-square is greater than 5.99, the null hypothesis is rejected I only I and II only II only I, II, and III
a	315	When making inferences about a population variance based on a single sample from that population, what distribution is used? Chi-square Normal t distribution F distribution
c	316	In performing an analysis of variance for a single factor experiment, a fundamental assumption which is made is that the factor: Means are equal Means are unequal Variances are equal Variances are unequal
b	317	Consider the SS and MS columns of an analysis of variance table for a single factor design. The appropriate ratio for testing the null hypothesis of no treatment effect is: SS treatments divided by SS residual MS treatments divided by MS residual SS treatments divided by MS residual MS treatments divided by SS residual

a	318	A designed experiment hass been conducted at three levels (A, B, and C) yielding the following "coded" data:  A B C 6 5 3 3 9 4 5 1 2 2 As a major step in the analysis, one would calculate the degrees of freedom for the "error" sum of squares to be: 7 9 6 3
c	319	One-way analysis of variance is most similar in its objectives to: A test of a population mean A test for equality of two sample proportions A test for equality of two population means A chi-square test for independence
b	320	In the manufacture of airplane fuselage frame sections, thousands of rivets are used to join aluminum sheets and frames. A study of the number of oversized rivet holes and the number of minor repairs to a unit yielded a correlation coefficient of ± 1.08. This means that: The number of oversized rivet holes on a unit is a good predictor of minor repairs A new statistician should be hired The number of oversized rivet holes is a poor predictor of minor repairs A small number of minor repairs will have to be made
a	321	Ratios of two variances drawn from the same normal population are described by which one of the following distributions? F Student's t Chi-square Normal
c	322	When plotting a multi-vari chart on graph paper, what metric is used for the vertical scale? Time Count data Variable data Percentages
b	323	Why should an experimenter plot data points and graph the least squares line if a probabilistic regression model exists? To visually present the relationship to others To check for fit; there may be a calculation error There's no rational reason for doing so To permit a projection outside of the test area

c	324	A regression analysis yielded a total sum of squared errors of 1000 and a total sum of squares equal to 1600. What is the correlation coefficient? Cannot be determined from the given information +0.375 or -0.375 +0.612 or -0.612 +0.790 or -0.790
b	325	If the means of two populations are close in value then: The null hypothesis will not be rejected A large sample is necessary to reject the null hypothesis A null hypothesis decision will often be delayed The appropriate critical value is very important
a	326	The alpha critical region, to determine if a new pen writes more strokes before refill, would be placed: in the upper tail in both upper and lower tails in the lower tail in neither tail
b	327	A six sigma green belt is performing a hypothesis test of two sample means. Sixteen samples of method A and sixteen samples of method B are produced. The standard deviations are unknown, but thought to be the same. How many degrees of freedom are to be used for the t test? 16 30 31 32
c	328	Identify the confidence interval calculation that is most likely to be non-symmetrical. Means for larger samples Means for small samples Variation confidence interval Proportion confidence interval
b	329	The current process produces fifty units per shift, a new process yielded fifty-two units per shift forsixteen straight shifts, with a standard deviation of four units per shifts. What is our level of confidence that the process has changed? <90% 90-95% 95-99% >99%
c	330	It is desirable to reduce the variation in a process. The current variance is known to be six. A new process yielded a standard deviation of two for twenty-five trials. What is the chi-square calculated statistic? 13.85 15.66 16.00 18.24

a	331	It is desirable to reduce the variation in a process. The current variance is known to be seven. A newprocess yielded a standard deviation of two for twenty-five test trials. What is the calculated statistic and decision for 95% confidence? 13.71, reject the null 13.71, fail to reject the null 13.85, reject the null 13.85, fail to reject the null
c	332	If a one-tail F test (95% confidence) with ten samples yielded a variance of nine, and nine samples yielded a variance of four, what F critical value would be used? 3.23 3.44 3.39 3.14
a	333	What would be the calculated F statistic if a one-tail F test (95% confidence) with ten samples, yielding a variance of nine, and nine samples yielding a variance of four? 2.25 3.39 3.44 5.06
d	334	What inference test does not require some knowledge of a test or population variation? t test Paired t test z test Chi-square test
b	335	When constructing a power of test curve one would not be surprised to discover that as alpha (α) increases: The value of mu becomes greater Beta decreases The probability of rejecting the null hypothesis decreases The sample size becomes larger
d	336	A small positive change truly exists between a test trial and the current process. However, the samplefrom the test trial happens to demonstrate a radical improvement. What type of decision would probably be made? A type II error A 1-alpha decision A type I error A 1-beta decision
b	337	A statistical software program returned a p-value of 0.023. If the desired level of significance is 0.025, then the conclusion is: Reject the null hypothesis, there is no statistical difference Reject the null hypothesis, there is a statistical difference Fail to reject the null hypothesis, there is no statistical difference Fail to reject the null hypothesis, there is a statistical difference

c	338	The hybrid option on a $25,000 car costs $3,000. A gas mileage test found the hybrid averaged 39.1 mpg and the standard model averaged 34.7 mpg and a p-value of 0.024. At a level of significance of 5%, the difference is: Not statistically significant, but the standard car Not practically significant, buy the hybrid car Statistically significant, but not practically significant Statistically significant, one should buy the hybrid
d	339	A test of hypothesis was performed, although the desired level of confidence was not establis hed priorto performing the calculations. A p-value of 0.0416 was found. One would most likely conclude: The statistically significant difference has not been proven To fail to reject the null hypothesis The null hypothesis can neither be rejected or fail to be rejected That there is a statistically significant difference
a	340	For a one-tail F test (95% confidence) with ten samples yielding a variance of nine and nine samplesyielding a variance of four, what would be the test result? Fail to reject the null hypothesis Reject the null hypothesis Accept the alternate hypothesis Fail to reject the alternate hypothesis
b	341	A six sigma green belt has run a 2^{5-2} fractional factorial design. Only 2 of the 5 factors remained important after the factorial analysis. Escalation of this DOE to an optimization model will be best accomplished by: Performing a new full factorial of the 2 factors Performing a response surface experiment Decreasing the degrees of freedom of the original DOE Adding an additional factor level
c	342	Which of the following is a single factor experiment containing 2 specific nuisance factors? Graeco-Latin square Fractional factorial experiment Latin square Mixture design
c	343	When calculating the sample size for a DOE, one is actually calculating the: Number of runs Number of factors Number of replicates Number of blocks
d	344	What is the relation between resolution III experiments and confounded responses? In resolution III experiments, there are no confounded interactions In resolution III experiments, only interactions are confounded In resolution III experiments, all factors are confounded In resolution III experiments, main effects and two factor interactions are confounded
b	345	The normality of residuals for factor A indicate a uniform behavior around zero, what can be concluded from this fact? There is something wrong with the model. Go back to the planning stage Normality of residuals has been demonstrated by this uniform behavior Factor A is a nuisance factor as demonstrated by the uniformity of residuals Factor A is statistically significant because of the uniformity of residuals

b	346	Because of the larger number of variables under study, an engineer is considering a fractional factorial instead of a full factorial to analyze a process. Apart from the possibility of studying a large number of factors with relatively few experiments, what other characteristic will support a decision to use a fractional factorial instead? It is suspected that there are many interactions The process is well known and only the main factors are of concern A fractional factorial will determine the main effects curvature Blocking is necessary to account for nuisance factors in this study
a	347	After a screening experiment, all significant factors happen to be qualitative. A decision to run some intermediate values will result in: Nothing, it is not possible to optimize qualitative variables The discovery of the optimum combination of qualitative variables Indications of curvature around the zero setting The discovery of potential interactions between the qualitative variables
c	348	Which of the following DOE strategies most resembles the Kaizen philosophy? Response surface Mixture designs EVOP One factor at a time analysis
a	349	Measuring system re-analysis seems an odd improvement after the real process improvements havebeen implemented. What is the logic behind this step? Process variation reduction requires a re-evaluation of the measuring system Improvements should not be completed without a newer measurement system It is mandatory to change the measuring system after each improvement The linearity of the old measuring system may no longer be appropriate
d	350	Why is it necessary to validate the results of a DOE? It is unnecessary because future process results will confirm the improvement To validate the results when the DOE is based on a factorial evaluation To validate the results only when no interaction terms are present To validate the results by revisiting the best combinations of effects and interactions
a	351	To state that a model in an experimental design is fixed indicates that: The levels used for each factor are the only ones of interest The levels were chosen from a fixed population The equipment from which the data are collected must not be moved The factors under consideration are qualitative
b	352	Which of the following is NOT true in regards to blocking? A block is a dummy factor which doesn't interact with real factors A blocking factor has 2 levels A block is a subdivision of the experiment Blocks are used to compensate when production processes restrict randomization of runs
b	353	Which of the following DOE statements is correct? Variables are confounded if they are difficult to study Two or more variables are confounded if their effects cannot be separated Variables are confounded if they form a linear combination Two or more variables are confounded if they produce the same effects

c	354	The advantage of using the modern designed method of experimentation, rather than the classical, isthat: Everything is held constant except the factor under investigation Experimental error is recognized but need not be stated in quantitative terms Fewer terms and measurements are needed for valid and useful information The sequence of measurement is often assumed to have no effect
d	355	In a full factorial experiment with 4 factors at 3 levels each, how many trials are required? 24 12 64 81
a	356	The basic statistical principle in EVOP is: The ability to recognize small differences through large sample sizes Operating with low levels of confidence Making large changes in independent variables Determining dome contours
c	357	When selecting and scaling the process input variables for an experiment, which of the following is NOT a desirable approach? Include as many important factors as possible Set factor levels at practical or possible levels Combine process measurement responses when possible Be bold, but not foolish in selecting high and low factor levels
b	358	Identify the assumption that is NOT made when conducting an experiment: That the measurement system is capable for all included responses That the selected factors are the only ones of importance That the process remains relatively stable during the duration of the testing That residuals are well behaved
c	359	About 9 months after embarking on a six sigma effort, a company moved from measurement with traditional mikes and verniers to digital mikes and two piece linear scales. Why was this action necessary? They probably wanted to show prospective customers their level of measurement precision If changes were made they did not want to be caught “asleep at the switch” Processes have improved and they needed finer product measurements This would be required in the control phase of the DMAIC process
b	360	Which of the following statements is true about a Latin square design? It minimizes the chance for factor confounding It does not allow for the effects of interaction in the design It eliminates the need to ensure that the effects of interaction are additive It is useful because the underlying distribution does not need to be normal
a	361	The iterative approach to DOE refers to: The use of sequential experimentation Assuring the stability of the process during experimentation Assuring the capability of the measurement system Appropriate estimates of experimental error

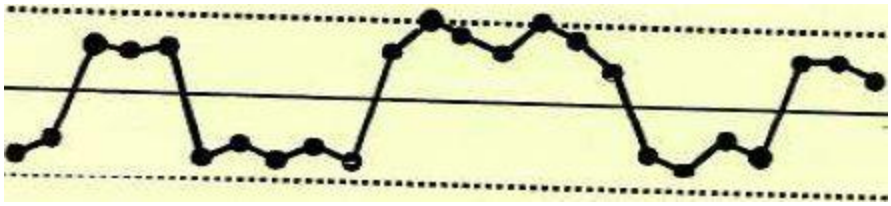
c	362	A designed experiment of three factors (A, B, & C) at two levels was conducted. The eight runs were analyzed, suggesting that one level of factor A showed significant improvement. The plant managerstated that no additional runs are needed. The best response is: The experiment did its job and should be closed The results of the test should be implemented immediately Additional replications are needed to verify the experiment An EVOP should be conducted to improve the process further
c	363	As a good experimenter, you have built a predictive model of the experimental data. The differences between the actual response data and the model data are termed: Confounded data Nested experiments Residuals Efficiency of estimators
c	364	Plackett and Burman experimental designs are called screening designs. A screening design can bedefined as: An experiment with interactions among the main effects The use of non-geometric experimental designs An identification of the key input factors A fractional factorial experiment
d	365	Which of the following tools would be of LEAST value when assessing the results of an improvementteam's activities? A post redesign FMEA A follow-up capability analysis Multi-vari studies A brainstorming session
b	366	Identify the post-improvement tool which would be most beneficial when generating fresh ideas afterthe results of an improvement process have been disappointing. A post-improvement capability analysis A post=improvement brainstorming session A follow-up FMEA study A multi-vari re-analysis
a	367	The results of most green belt DOE activities would be analyzed using: Specific computer software programs Response surface plots EVOP analysis Multi-vari analysis
a	368	Assuming no interactions, the main effects analysis of a one-half fractional factorial experiment compared to a comparable full factorial experiment, yields which of the following outcomes? Both results are approximately the same Only the full factorial is accurate Both can be calculated but computer software is required The one-half factorial gives one-half of the final outcome

d	369	A six sigma project has progressed to the point that a control plan is required. Control plan activities canbe considered closed after which of the following? A process owner is named for the control plan A responsible engineer is designated The cross functional team signs off on the control plan The control plan is a “living document” and is rarely closed
b	370	At the early stages of the DMAIC project, the voice of the customer shouted “safety” in every customer focus group, customer interview, and customer survey. The control plan is now missing the team member list. The control plan also addresses product performance in detail, but not product safety. Can this control plan be implemented? Yes, the team is better informed than the customer No, the main CTQ requirement was not addressed in the control plan No, the paper work is not complete Yes, safety is not a CTQ
b	371	Process A consists of several machines that combine their output into a common stream. Once combined, it is impossible to trace single pieces to specific machines. Process B receives the mixed pieces.Acorrective action requires finding the root cause of a defect found in some of these pieces. A team assigned to this problem is thinking of using SQC to detect the source of the problem. Where should SQC be implemented? At the beginning of Process B At each machines in Process A At the end of Process B At the beginning of process A
d	372	A six sigma team is investigating the sources of variation in fabric rolls. All rolls are different in length. The variable of interest is the number of holes per unit of length. Which control chart will work best for this situation? X-bar and R chart p chart c chart u chart
d	373	A control chart is used to: Determine if defective parts are being produced Measure process capability Determine causes of process variation Detect non-random variation in processes
b	374	A process has been experiencing problems lately. The operators charting the process have identified the cause to be due to a change in incoming materials. This problem is: Attributed to purchasing A special cause A common cause A normal event
b	375	The most common subgrouping scheme for $\bar{X}$ – R control charts is to separate the variation: Within stream versus stream-to-stream Within time versus time-to-time Within piece versus piece-to-piece Inherent process versus error of measurement

c	376	Since many variables are important in control charting, what is the risk of having an operator plot a large number of characteristics? None, if the operator is trained and knowledgeable Danger in overlooking a CTQ characteristic Distraction from the actual process itself It is non-value added work in the lean philosophy
a	377	The design of a control plan for a particular part incorporates information from a variety of sources such as flow charts, QFD, FMEAs, designed experiments, and statistical studies. It is a tool to monitor and control the part of process. If used properly, the control plan avoids which of the following problems? Becoming a substitute for written operator instructions Having a listing of the critical Xs and Ys of the process Error proofing the process through various control plans Being used as evidence of installed controls
a	378	What is the importance of the reaction plan in a control plan? It describes what will happen if a key variable goes out of control It indicates that a new tea must be formed to react to a problem It lists how often the process should be monitored It defines the special characteristics to be monitored
d	379	An X-bar and R chart was prepared for an operation using twenty samples with five pieces in each sample; $\overline{\overline{X}}$ was found to be 33.6 and $\overline{R}$ was 6.20. During production, a sample of five as taken and the pieces measured 36, 43, 37, 25, and 38. At the time this sample was taken: Both the average and range were within control limits Neither the average nor the range were within control limits Only the average was outside control limits Only the range was outside control limits
a	380	A process is in control with p bar = 0.10 and n = 100. The three sigma limits of the np control chart are: 1 and 19 9.1 and 10.9 0.01 and 0.19 0.07 and 0.13
d	381	An X-bar – R chart has been in control for sometime. If the range suddenly and significantly increases, the mean will: Usually increase Stay the same Always decrease Occasionally show out of control of either limit
d	382	An X-bar control chart is based on a sample size of 4. An operator mistakenly plots the value of a single observation on the control chart. This point: Will not cause any mis-judgments if the process is in control Will always be plotted near the center line of the control chart Will cause the associated R chart to show an out of control condition Increases the probability of the process being labeled out of control

d	383	While plotting a control chart, it is noted that two of the last three points are greater than 2 sigma, four out of the last five points are beyond 1 sigma, and eight successive points are on one side of the center line. This information suggests that one should: Stop the process immediately Take more readings and continue to plot Write a discrepancy notice to the supervisor Investigate to determine what has changed
c	384	An X-bar chart has shown control for a long time. However, the points for the last 50 samples are all very near the center line on the chart. In fact, they are all within one sigma of the center line. This probably indicates that: A desirable situation has developed An undesirable situation may occur The process standard deviation has decreased during the last 50 samples The control limits are incorrectly computed
b	385	A six sigma project team is led by a green belt. The current activity is to develop a control plan. The ultimate responsibility for developing the initial plan would belong to: The project team The green belt The process owner The production function
a	386	Compute the upper control limit for an S chart, based on a sample size of 10, if the process is in control with a mean of 40 and a sample standard deviation of 7. 12.0 13.3 15.7 21.0
c	387	If a process is out of control, the theoretical probability that a single point on the X-bar chart will fall between plus one sigma and the upper control limit is: 0.2240 0.1587 Unknown 0.3413
d	388	A process is checked at random by inspection of samples of four shafts after a polishing operation, and X-bar and R charts are maintained. A person making a spot check measures two shafts accurately, and plots their range on the R chart. The point falls just outside the control limit. He/she advises the department foreman to stop the process. This decision indicates that: The process level is out of control The process level is out of control but not the dispersion The person is misusing the chart The process dispersion is out of control
a	389	Effective control chart subgrouping includes all of the following actions EXCEPT: Group product so that the subgroups are as heterogeneous as possible Group product produced as nearly as possible at one time Group product to achieve maximum opportunity for variation between subgroups Group product to be representative of production over a time period

d	390	Each value below is the number of defects found in groups of five subassemblies inspected over a period of time: 77 61 59 22 54 64 49 54 92 22 75 65 41 89 49 93 45 87 55 33 45 77 40 25 20 What are the c chart control limits for the 25 readings? 82.5, 28.9 15.6, 6.6 65.7, 45.7 78.1, 33.3
a	391	A stamping press makes four parts at a time. To set up control charting for this process, the best rational subgrouping should be to: Use separate control charts for each cavity, using 4 sequential parts Use one control chart for the press, using 4 parts from one stamping Use one control chart for the press, using 4 sequential parts from one cavity Use one control chart for the presses with a sample size of 6
d	392	A quality professional wants to chart the weight of packages on a highly automated food processing line. The recommended control chart is an X-bar – S chart and not the typical X-bar – R chart, in wide use throughout the facility. The most logical reason for this switch is which of the following? The X-bar control limits will be tighter The supervisor obviously wants some variety in control chart usage Only one control chart will be required The X-bar and S value will come automatically from a weight checker
a	393	The implementation of a control plan in the painting department was so successful that a master black belt wants you to implement the same control plan in the final assembly line. What changes should be made before implementing the necessary control plan? Each control plan is unique, a new plan must be developed for the final assembly line A lot of changes will be necessary No changes are needed, since the two areas are in the same company Minor changes may be necessary to reflect the assembly line differences
c	394	A p chart has been plotted for some time. Recently, steps have been made to substantially improve the process. One would not be surprised to find that: The chart demonstrates more out of control conditions The chart must be converted into a variable chart A larger sample size must be taken The chart requires the samples to be taken more frequently than in the past
b	395	How many individual data values are considered sufficient to accurately calculate the upper and lower control limits for X-bar – R control charts? 20 100 200 500

d	396	When should an X – MR chart be used? When the number of defective data is being monitored When an exceptionally large run size is expected When range data is unreliable For destructive testing applications
d	397	Which of the following problems would most likely appear in the X-bar control chart pattern shown?  A varying environmental temperature A tired operator An incorrect calculation of control limits An output process alternately fed by different input processes
c	398	Five samples (#1 through #5) of four measurements were taken with the following results. What are the upper and lower control limits for an X-bar chart calculated from this data? #1 #2 #3 #4 #5 20 23 22 19 22 22 20 17 20 23 18 17 21 23 19 19 18 22 18 17 UCL = 23.0 / LCL = 17.0 UCL = 22.9 / LCL = 27.1 UCL = 23.8 / LCL = 16.2 UCL = 23.65 / LCL = 16.35
c	399	Which control chart pattern best represents an in control process? A consecutive run of seven or more points on one side of the centerline A random distribution of points with one point outside the control limits A random distribution of points on both sides of the centerline A steady trend of points toward either control limit
c	400	If a control chart has UCL = 45.1 and USL = 45.6, and the last sample has values of 44.6, 45.7 and 44.8, one can conclude: The process is within specification and in control The process is within specification but out of control • The process is out of specification but in control The process is out of specification and out of control