Green Belt Test Questions:

1. Sigma refers to a roman letter that mathematicians use when discussing "average" or "mean"

   [ ] True [ ] False

2. A process operating at 6 Sigma will only generate 3.4 defects per million opportunities?

   [ ] True [ ] False

3. In order to achieve Six Sigma, practitioners follow a standard & rigorous methodology known as _____

4. Six Sigma originated in the 1980's at Motorola?

   [ ] True [ ] False

5. To achieve Six Sigma the DMAIC methodology follows which approach

   [ ] Brainstorm possible factors then randomly analyze them to find the significant ones

   [ ] Use SME knowledge & experience to quickly find solutions

   [ ] Use the transfer function Y=f(x)

6. A Six Sigma process will only produce this many defects per million opportunities _____

7. Achieving Six Sigma has nothing to do with meeting customer expectations?

   [ ] True [ ] False

8. Who is credited as being the father of Six Sigma?

   [ ] Bob Galvin [ ] Mikel Harry

   [ ] Jack Welch [ ] Bill Smith

©Copyright Grand Valley State University

9. Hard costs and soft costs are two types of COPQ

[ ] True [ ] False

10. COPQ is an acronym that stands for what? _____

11. Which of the following is the one that is not part of the 7 deadly Muda?

[ ] Defects [ ] Over Production

[ ] Inventory [ ] Waiting

[ ] Movement [ ] Conveyance

[ ] Over Processing [ ] Measuring

12. The Pareto Principle is named after an Italian economist Vilfredo Pareto

[ ] True [ ] False

13. CTQ's are translated from VOC

[ ] True [ ] False

14. CTQ is an acronym that stands for what? _____

15. DPU is calculated by dividing the number of defects by the number of units

[ ] True [ ] False

16. In Six Sigma Primary and Secondary Metrics are Mandatory

[ ] True [ ] False

17. RTY is an acronym that stands for what? _____

18. DPU is an acronym that stands for what? _____

©Copyright Grand Valley State University

19. DMPO is an acronym that stands for what? _____

20. Which of these is not one of the 4 stages of team development?

[ ] Performing [ ] Storming

[ ] Norming [ ] Forming

[ ] Adorning

21. Which is not a characteristic of a successful team?

[ ] Common goals and working together to achieve that goal

[ ] Team member diversity (skills, knowledge, experience etc.)

[ ] Appropriate resources are available

[ ] Mutual respect

[ ] A good leader exists among the team

[ ] Complacency exists

22. The _____ metric is your critical measure, it's the reason for your project, it's your beacon. This metric is the single most important thing to understand in order for you to be successful.

23. A well written problem statement contains all of the following except

[ ] Baseline [ ] Goal

[ ] Gap [ ] COPQ

[ ] Timeline Reference [ ] Project Plan

24. From the following, select those that are characteristics of a Lean Enterprise

[ ] Pull Systems [ ] Flow

[ ] Zero Waste [ ] Availability

[ ] Flexibility [ ] Value Add

©Copyright Grand Valley State University

25. Put these 5S's into the proper order of execution

[ ] Set in Order [ ] Sort

[ ] Shine [ ] Sustain

[ ] Standardize

26. Lean and Six Sigma are Both focused on Quality & Value for the customer?

[ ] True [ ] False

27. What is the Japanese word for waste? _____

28. What type of muda is waste from working more than required, scheduling more capacity than necessary or using resources that are overkill?

[ ] Inventory [ ] Over-Production

[ ] Motion [ ] Waiting

[ ] Transportation [ ] Over-Processing

29. _____ are flaws, errors or other non-conformities that compromise the value of a product

30. Lean is only about removing waste from the enterprise?

[ ] True [ ] False

31. The 5 Principals of Lean are paraphrased below, select the correct 5

[ ] Customer Defines Value [ ] Identify the Value Stream

[ ] Continuous Flow [ ] Pull Where Possible

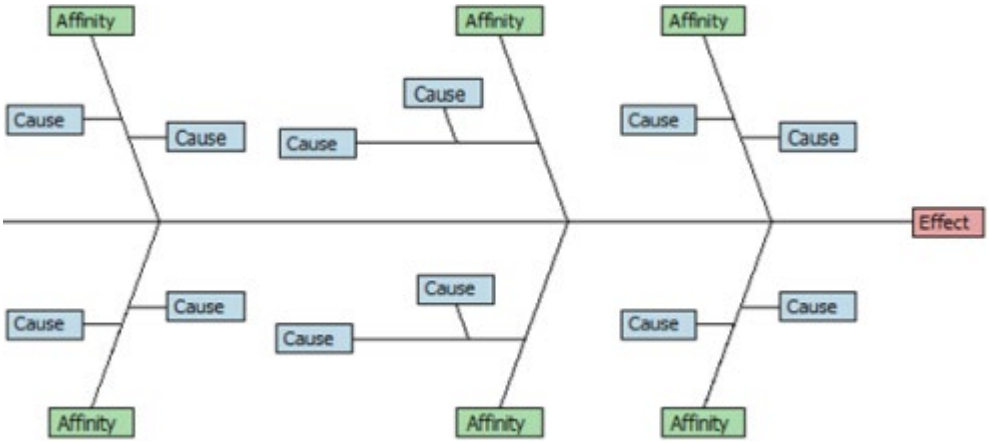
[ ] Manage Toward Perfection [ ] Batch Processing

[ ] Work Faster

©Copyright Grand Valley State University

32. _____ is when more products are produced than are required by the next function or customer.

33. What is this?



[ ] FMEA [ ] C&E Diagram

[ ] Process Map [ ] XY Diagram

34. Arrange these C&E process steps into the correct order of execution.

[ ] Affinitize or group the causes

[ ] Brainstorm all potentials causes

[ ] Evaluate

[ ] Identify & define the effect

35. SIPOC is an acronym using which words?

[ ] Suppliers [ ] Immediate

[ ] Inputs [ ] Process

[ ] Outputs [ ] Customers

[ ] Primary [ ] Secondary

©Copyright Grand Valley State University

36. A SIPOC is another name for a flow chart

[ ] True [ ] False

37. An FMEA ranks potential failures using values assigned to severity, occurrence and detection?

[ ] True [ ] False

38. Which of these tools might you use if you want to develop a Risk Priority Number and ranking for the various types of failures that could occur?

[ ] Cause & Effect Diagram [ ] SIPOC

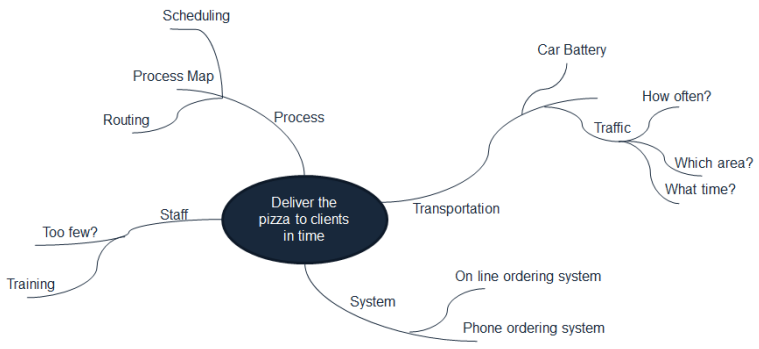
[ ] Functional Process Map [ ] Thought Process Map

[ ] XY Diagram [ ] FMEA

39. _____should be used when trying to understand the links between customers, process steps and process outputs.

40. _____ should be used when brainstorming possible causes to an effect.

41. What is this?



[ ] FMEA [ ] C&E Diagram

[ ] Process Map [ ] SIPOC

[ ] Thought Process Map [ ] Spaghetti Map

©Copyright Grand Valley State University

42. Continuous variables are measured, Discrete variables are counted

[ ] True [ ] False

43. Nominal Data are discrete and rank ordered.

[ ] True [ ] False

44. Median is the average of a set of data

[ ] True [ ] False

45. Median is the middle value in a set of data

[ ] True [ ] False

46. Mode is the value in a data set that occurs most frequently

[ ] True [ ] False

47. Standard Deviation is a measure that describes how far the data points spread away from the mean

[ ] True [ ] False

48. For the normal distribution, about _____ % of the data fall within +/- 1 standard deviation

49. For the normal distribution, about _____ % of the data fall within +/- 2 standard deviation from the mean?

50. A _____ is a graphical tool to present the distribution of the data

51. The null hypothesis for a normality test is that the data are normally distributed?

[ ] True [ ] False

©Copyright Grand Valley State University

52. Select only those that are examples of graphical analysis tools

[ ] Box Plots [ ] Histograms

[ ] Scatter Plots [ ] Run Charts

[ ] ANOVA table [ ] Regression Equation

53. Measurement Systems Analysis is a step in a Six Sigma project that ensures the data are reliable and trustworthy before making any data-based decisions.

[ ] True [ ] False

54. Repeatability evaluates whether the same appraiser can obtain the same value multiple times when measuring the same object using the same equipment under the same environment.

[ ] True [ ] False

55. Which are common sources of variation in most measurement systems?

[ ] Part to part variation [ ] Measurement instrument

[ ] Repeatability [ ] Reproducibility

[ ] Humidity [ ] Altitude

56. In a Measurement Systems Analysis, which source of variation do we hope to see be the greatest?

[ ] Part to part variation [ ] Measurement instrument

[ ] Measurer (person measuring) [ ] Altitude

[ ] Humidity

57. _____ is the difference between the observed value and the true value of a measurement.

58. _____ evaluates whether different appraisers can obtain the same value when measuring the same object independently.

©Copyright Grand Valley State University

59. In a Variable Gage R&R, the acceptable % contribution of variation attributable to Repeatability and Reproducibility should be less than _____ %

60. If Kappa is greater than 0.7 the measurement system is acceptable

[ ] True [ ] False

61. Cp considers the within-subgroup standard deviation and Pp considers the total standard deviation from the sample data.

[ ] True [ ] False

62. Being stable does not guarantee a process to be capable. However, being stable is a prerequisite to determine whether a process is capable.

[ ] True [ ] False

63. Cpk measures the process's potential capability to meet the two-sided specifications. It doesn't take the process average into consideration.

[ ] True [ ] False

64. Cp, and Pp take both the variation and the average of the process into consideration when measuring the process capability.

[ ] True [ ] False

65. A Cp of greater than 1 suggests...

[ ] Total process variation is greater than the width between the USL and LSL

[ ] Total process variation is less than the width between the USL and LSL

66. A Pp of less than 1 suggests...

[ ] Total process variation is greater than the width between the USL and LSL

[ ] Total process variation is less than the width between the USL and LSL

©Copyright Grand Valley State University

67. Which of the following measurements is NOT a process capability index?

[ ] Cp [ ] Cpk

[ ] Kappa [ ] Percent Defectives

68. The _____ chart is used to visualize sources of variation.

69. Pick which of the following are basic features of the data that a probability distribution

[ ] Shape [ ] Center

[ ] Scale [ ] Stability

70. Which distribution has mean equal to np and the variance equal to np(1-p)?

[ ] Binomial [ ] Normal

[ ] Exponential [ ] Weibull

71. Which continuous probability distribution is the basis for the analysis of variance or test for equal variances?

[ ] Normal Distribution [ ] F Distribution

[ ] Student t distribution [ ] Chi Square Distribution

72. Select only continuous distributions from the list below.

[ ] Normal Distribution [ ] F Distribution

[ ] Student T Distribution [ ] Binomial Distribution

[ ] Poisson Distribution

73. 68-95-99.7 Rule for Normal Distribution states that

- about 68% of the data stay within σ from the mean.
- about 95% of the data stay within 2σ from the mean.
- about 99.7% of the data stay within 3σ from the mean

[ ] True [ ] False

©Copyright Grand Valley State University

74. The process of selecting a subset of observations within a population is referred to as _____.

75. Statistical inference is the process of making inferences regarding the characteristics of an unobservable population based on the characteristics of an observable _____.

76. To reduce β risk, we should increase the _____.

77. The higher the confidence level, the wider the confidence interval?

[ ] True [ ] False

78. The larger the sample size, the wider the confidence interval?

[ ] True [ ] False

79. A valid sample must be unbiased and representative of the population?

[ ] True [ ] False

80. The more variability, the tighter the confidence interval?

[ ] True [ ] False

81. Which sampling strategy is used to select samples at regular intervals based on a ordered list where items in the population are arranged in some order?

[ ] Simple random sampling [ ] Stratified sampling

[ ] Systematic sampling [ ] Cluster sampling

82. A Population is grouped into distinct and independent categories and then samples are randomly or systematically selected in each category of the population. Which sampling strategy is this?

[ ] Simple random sampling [ ] Stratified sampling

[ ] Systematic sampling [ ] Cluster sampling

©Copyright Grand Valley State University

83. A hypothesis test is a statistical method in which a specific hypothesis is formulated about the population, and the decision of whether to reject the hypothesis is made based on sample data.

[ ] True [ ] False

84. When the p-value is _____ than the α level, we reject the null and claim that there is a statistically significant difference between different groups.

85. α risk is the risk of making a Type I error?

[ ] True [ ] False

86. The proportion of the area under the sampling distribution and beyond the test statistic is the _____.

87. α risk is the risk of being wrong if you fail to reject the null?

[ ] True [ ] False

88. In which of the following conditions can we not reject the null hypothesis?

[ ] the test statistic falls into the critical region

[ ] the test statistic is greater than the critical value

[ ] P-value is smaller than alpha level

[ ] P-value is greater than alpha level

89. One-tailed hypothesis test is used when we care about whether there is a difference between groups and we don't care about the direction of the difference.

[ ] True [ ] False

90. Select the two possible conclusions of hypothesis testing

[ ] Accept the Alternative Hypothesis [ ] Reject the Null Hypothesis

[ ] Fail to Reject the Null Hypothesis [ ] Reject the Alternative Hypothesis

©Copyright Grand Valley State University

91. When p-value is higher than the α level, we fail to reject the null and claim that there is no statistically significant difference between different groups.

[ ] True [ ] False

92. One sample t-test is a hypothesis test to study whether there is a statistically significant difference between a population mean and a specified value.

[ ] True [ ] False

93. A _____ is a hypothesis test to study whether there is a statistically significant difference between the means of two populations

94. Which of these is not an assumption of the ANOVA?

[ ] The data of k populations are discrete

[ ] The data of k populations are continuous.

[ ] The data of k populations are normally distributed

[ ] The variances of k populations are equal.

95. If the p-value of a t test is 0.6656 and the alpha level is 0.05 then we _____ the null hypothesis and we claim that the means of two groups are _____ .

[ ] fail to reject [ ] reject

[ ] equal [ ] unequal

96. In a Two Sample T-test If |tcalc|>tcrit, we reject the null and claim there is a statistically significant difference between the means of the two populations.

[ ] True [ ] False

97. The One-way ANOVA (one-way analysis of variance) is a statistical method to compare means of two or more populations.

[ ] True [ ] False

©Copyright Grand Valley State University

98. Which of these is not one of the three types of two sample t-tests?

[ ] Two Sample T-test unknown variances

[ ] Two Sample T-test known variances; equal variances

[ ] Two Sample T-test known variances; un-equal variances

[ ] Two Sample T-test known variances; variances greater than 1

99. ANOVA compares the means of different groups by analyzing the averages between and within groups.

[ ] True [ ] False

100. The Mann-Whitney test is a statistical hypothesis test to compare the medians of two populations which are normally distributed?

[ ] True [ ] False

101. The _____ test is a one-way analysis of variance hypothesis test to compare the medians among more than two groups.

102. Mood's median is an alternative to Kruskal-Wallis?

[ ] True [ ] False

103. Which of these is not a true statement?

[ ] For the data with outliers, Mood's median test is more robust than Kruskal-Wallis

[ ] Mood's median is an alternative to Kruskal-Wallis.

[ ] Mood's median test is used to compare the medians of two or more populations

[ ] Mood's median test is not robust for non-normally distributed populations.

©Copyright Grand Valley State University

104. Select all that are accurate statements.

[ ] One sample sign tests are hypothesis tests comparing medians to a specified value

[ ] the one Sample sign test is an alternative test to the parametric one sample t test

[ ] One sample sign test is a distribution-free test.

105 The difference between the One Sample Sign test and the One Sample Wilcoxon test is that the One Sample Wilcoxon assumes the distribution of the data is symmetric.

[ ] True [ ] False

106. Chi-square test can be used to test whether there is any statistically significant relationship between two discrete factors?

[ ] True [ ] False

107. Correlation analysis helps us to understand the direction and degree of association between variables. It also suggests causation or the cause of the relationship between variables.

[ ] True [ ] False

108. It is possible that two variables have a perfect non-linear relationship when the correlation coefficient is low.

[ ] True [ ] False

109. Correlation implies causation.

[ ] True [ ] False

110. R2 (also called coefficient of determination) measures the proportion of variability in the data which can be explained by the model.

[ ] True [ ] False

111. R2 ranges from 0 to 1. The higher R2 is, the better the model can fit the actual data.

[ ] True [ ] False

©Copyright Grand Valley State University

112. Residuals are the vertical difference between actual values and the predicted values or the "fitted line" created by the regression model.

[ ] True [ ] False

113. Which of these statements is incorrect?

[ ] Simple Linear Regression is a statistical technique to fit a straight line through the data points.

[ ] Simple Linear Regression models the quantitative relationship between two variables.

[ ] Simple Linear Regression describes how one variable changes according to the change of another variable.

[ ] Simple Linear Regression uses at least two predictor variables.

114. The _____ in the regression model is the difference between the actual Y and the fitted Y.

115. The difference between Simple Linear Regression and Multiple Linear Regression

- Simple Linear Regression only has one predictor.
- Multiple Linear Regression has two or more predictors.

[ ] True [ ] False

116. Multicollinearity is a situation where two or more independent variables in a multiple regression model are correlated with each other?

[ ] True [ ] False

117. To detect multicollinearity and quantify its severity in a regression model we use a measure called _____.

©Copyright Grand Valley State University

118. Which of these is not a recommended way to deal with multicollinearity?

[ ] Increase the sample size

[ ] Collect samples with a broader range for some predictors

[ ] Remove the variable with high multicollinearity and high p-value

[ ] Remove variables that are included more than once

[ ] Remove the variable with low multicollinearity and low p-value

119. Select three types of valid logistic regression models

[ ] Binary [ ] Ordinal

[ ] Nominal [ ] Tertiary

120. From the following, select those that are good indicators of a valid multiple regression model

[ ] Rsquare Adj > 0.80

[ ] All variables VIF < 5

[ ] Regression model p-value < 0.05

[ ] Residuals normally distributed with mean near 0

[ ] Residuals are independent

[ ] All variables p-value < 0.05

121. Your multiple regression model returned 3 variables that were significant and the model looks good based on all other measures. Of the 3 variables, the one with the _____ coefficient has the most influence on your "Y".

122. The following assumptions should be met to ensure the reliability of any simple or multiple linear regression model:

- The errors are normally distributed with mean equal to zero.
- The errors are independent.
- The errors have a constant variance.
- The underlying population relationship is linear.

[ ] True [ ] False

©Copyright Grand Valley State University

123. Residuals are the vertical difference between actual values and the predicted values or the "fitted line" created by the regression model.

[ ] True [ ] False

124. 5S is systematic method to organize, order, clean, and standardize a workplace…and keep it that way?

[ ] True [ ] False

125. Kanban system is a demand driven system

[ ] True [ ] False

126. An example of a detective type of Poka Yoke is when your car makes an audible "ding" or alarm when your passenger has not buckled their seat belt?

[ ] True [ ] False

127. An example of a preventive type of Poka Yoke is when your dishwasher will not start without the door closed?

[ ] True [ ] False

128. The term "poka-yoke" in Japanese means "signboard"

[ ] True [ ] False

129. A _____ system is a "pull" production scheduling system to determine when to produce, what to produce and how much to produce based on the demand

130. This word in Japanese means "signboard" _____

©Copyright Grand Valley State University

131. Which if these is not a benefit of a Kanban system

[ ] Minimizes in-process inventory

[ ] Prevents overproduction

[ ] Improves responsiveness to dynamic demand

[ ] Increases dependency on accurate demand forecasts

[ ] Streamlines the production flow

[ ] Visualizes the work flow

132. From the following, select those that are characteristics of a Lean Enterprise

[ ] Pull Systems [ ] Flow

[ ] Zero Waste [ ] Value Add

[ ] High Levels of Inventory [ ] Several Quality Control Teams

133. Statistical process control (SPC) is a statistical method to monitor the performance of a process using control charts in order to keep the process in statistical control?

[ ] True [ ] False

134. Statistical process control can be used to distinguish between the special cause variation and the common cause variation in the process?

[ ] True [ ] False

135. It is impossible to eliminate the special cause variation from a process?

[ ] True [ ] False

136. Statistical process control can be used in different phases of six sigma projects

[ ] True [ ] False

©Copyright Grand Valley State University

137. This control chart plots individual points on one graph and moving range points on another graph

[ ] I-MR [ ] Xbar-R

[ ] Xbar-S [ ] EWMA

138. I chart is valid only if MR chart is in control

[ ] True [ ] False

139. Xbar-R chart is a control chart for continuous data with a constant subgroup size between two and ten

[ ] True [ ] False

140. U chart is a control chart monitoring the percentages of defectives

[ ] True [ ] False

141. P chart is a control chart monitoring the average defects per unit

[ ] True [ ] False

142. Test 1 of the Western Electric rules for SPC is when one point lands more than three standard deviations from the center line?

[ ] True [ ] False

143. NP chart is a control chart monitoring the count of defectives

[ ] True [ ] False

144. Return on investment is the ratio of net financial benefits (either gain or loss) on a project or investment to its financial costs

[ ] True [ ] False

©Copyright Grand Valley State University

145. Net present value is the total present value of cash flows calculated using a discount rate?

[ ] True [ ] False

146. _____ ensure that the changes introduced by a Six Sigma project are sustained over time

147. _____ are documents that focus on process steps, activities and specific tasks required to complete an operation.

148. Which of these might not be considered a standard element of a control plan?

[ ] SOP (Standard Operating Procedures) [ ] Communication Plan

[ ] Training Plan [ ] Audit Plan

[ ] Floor plan

149. Control plans typically include measurement systems that monitor and help manage key process performance?

[ ] True [ ] False

150. Communication Plans are documents that focus on planning and preparing for the dissemination of information?

[ ] True [ ] False

151. A response plan should be a component of as few control plan elements as possible

[ ] True [ ] False

152. Which of the following might be used to ensure actions, processes, procedures and other tasks are performed as expected?

[ ] Audit [ ] Training

[ ] SOP's [ ] Communication

[ ] Measurements [ ] Poka-Yoke

©Copyright Grand Valley State University

Situational Question

The division you support has been producing units of a special product at one of its troubled facilities. Recently senior management has announced layoffs that have impacted operations so severely that immediate changes in processes are the only way the business can continue producing units. Your peers and supervisors have acted quickly to make the necessary changes and redesign the production & supply chain process to accommodate fewer employees. You have been pulled in to take on the responsibility of monitoring the quality of the units being produced to ensure that the process changes have not adversely affected quality. Fortunately you were anticipating this management action and you began collecting defect data 30 days ago.

A month has now passed since the process changes have been in effect. Below is the data you have been able to collect over the past 60 days. The first 30 data points were proactively collected by you prior to the layoff and the second 30 points are post layoff. Because you diligently studied your Six Sigma training materials, you were also savvy enough to make sure that all data points were randomly drawn from equal subgroup sizes that were properly stratified across shifts and other known production variations so you're confident in the data.

Your supervisors are now requesting an assessment of the quality data and have asked you to conduct the analysis and present it in the production review scheduled for this week. In preparation, use the data below to perform your analysis and answer the following questions:

©Copyright Grand Valley State University

Defects	Process Change
19	Before
23	Before
14	Before
18	Before
9	Before
22	Before
16	Before
12	Before
11	Before
19	Before
10	Before
19	Before
23	Before
14	Before
18	Before
9	Before
12	Before
14	Before
12	Before
19	Before
16	Before
14	Before
15	Before
13	Before
18	Before
17	Before
15	Before
12	Before
9	Before
12	Before
13	After
17	After
8	After
12	After
3	After
16	After
10	After
6	After
5	After
13	After
4	After
13	After
17	After
8	After
12	After
3	After
6	After
8	After
6	After
13	After
10	After
8	After
9	After
7	After
12	After
11	After
9	After
6	After
3	After
6	After

153. True or False, the process before the layoff (before process changes) was in control?

[ ] True [ ] False

154. True or False, the process after the layoff (post process change) is not in control?

[ ] True [ ] False

155. Given what you know of the situation, which control chart should you use to determine if this process is in control?

[ ] Xbar S [ ] P chart

[ ] NP Chart [ ] C chart

156. True or False, the data is normally distributed for each parameter?

[ ] True [ ] False

157. True or False, the parameters have equal variances?

[ ] True [ ] False

158. True or False, in terms of defects, the process after the layoff has improved?

[ ] True [ ] False

159. True or False, the p-value for a 2 sample-t test between the before and after subgroups is greater than 0.05?

[ ] True [ ] False

©Copyright Grand Valley State University