Statistics on Woven Carpet using T-Test to Compare Colored Yarns

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Abstract

Design experiments have many potential uses in improving processes and products, comparing alternatives is one of the purposes of experimentation. In this experiment we will compare two different colored yarns in the woven carpet factory, factors might have a cause and effect relationship in Libyan textiles. Woven carpet is very much similar to a woven cloth and is produced on a loom only. Different colored yarns are used to produce intricate designs and patterns. In this experiment, we will use repeated T-Test or paired T-Test to compare colored yarns. In this paper, we will consider these to be paired data samples (intricate designs and patterns) because each pair of values in each row represents a unique product from different colored yarns woven W1, W2, W3, and W4. To compare the mean values we will use paired T-Test.

Keywords
Textile, Yarn, Woven, T-Test, Wilcoxon Test

Woven Carpet

There are several advantages to having carpets in our homes and commercial spaces, including their aesthetic appeal, comfort, economy, temperature, and sound insulation abilities as well as safety considerations. Woven carpet is specified in commercial installations when a particularly tight construction and the dense pile is required, or a particularly intricate pattern is designed Carpet, in various forms, has been a part of interiors for hundreds of years. Carpet variables cover; Fibers, Carpet Construction Variables, and Types of Carpet Installation Parrott, Mollet, Chen-Yu. The major steps necessary to process wool from the sheep to the fabric are: shearing, cleaning and scouring, grading and sorting, carding, spinning, weaving, and finishing Table 1.

Table 1. Carpet variables

Inputs	Carpet Variables
Fibers	Synthetic Fibers Nylon Polypropylene (Olefin) Polyester Wool
Carpet Construction Variables	Yarn Construction Tufted Carpet Other Carpet Construction Methods Carpet Backing Finishes
Types of Carpet Installation	Carpet Installation Cushions and Pads

Designed experiments have many potential uses in improving processes and products, comparing alternatives is one of the purposes of experimentation. Different colored yarns are used to produce intricate designs and patterns. In this experiment, we will use repeated T-Test or paired T-Test to compare colored yarns. Table 2. We will consider these to be paired data samples (intricate designs and patterns) because each pair of values in each row represents a unique product from different colored yarns woven W1, W2, W3, and W4. To compare the mean values we will use paired T-Test.

Table 2. Different Colored Yarns Woven

Woven	Intricate Design	Patterns
W1	7.56	7.47
W2	7.52	7.4
W3	7.7	7.49
W4	7.61	7.55

Descriptive Statistics

We have the samples in different columns and we will put the first sample as intricate design product and second sample as Patterns product. Table 3. Paired T-Test actually evaluates the difference between two samples by taking (Intricate design – Patterns) under two –Tailed test.

Table 3. Actually Evaluates the Difference Between Two Samples

Sample	N	Mean	StDev	SE Mean
Intricate design	4	7.5975	0.0776	0.0388
Patterns	4	7.4775	0.0618	0.0309

The confidence interval for the main difference (Estimation for Paired Difference) showing it's between 0.0169 and 0.2231 which is a positive difference and because we took the difference as being (Intricate design - Patterns) a positive difference suggests that intricate design product has a PH value that is significantly greater than Patterns product.

Mean	StDev	SE Mean	95% CI for μ_difference
0.1200	0.0648	0.0324	(0.0169, 0.2231)

μ_difference: mean of (Intricate design - Patterns)

T-Test measures for a meaningful difference in the PH as begin either Zero or not calculates a T value of 3.70 and P-value of 0.034 because this is less than 0.05 we reject the null hypothesis. There is no difference and conclude that there is a difference between the PH of the two products.

Null hypothesis	H_0: μ_difference = 0
Alternative hypothesis	H_1: μ_difference ≠ 0

T-Value	P-Value
3.70	0.034

We created a new variable as showing bellow which in Table 4.these variables are the differences between each of these paired variables to test the difference in median values (Wilcoxon Signed Rank Test)

Table 4. The Differences Between Each of These Paired Variables

Woven	Intricate design	Patterns	Intricate design - Patterns
W1	7.56	7.47	-14.85
W2	7.52	7.4	-14.68
W3	7.7	7.49	-14.77
W4	7.61	7.55	-15.04

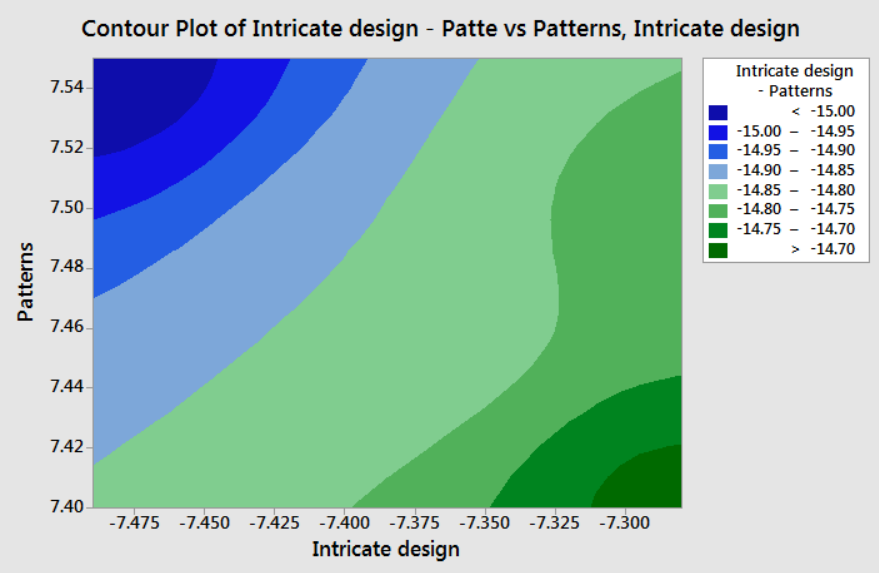

Figure 1. Contour Plot of Intricate design - Patte vs Patterns, Intricate design

Figure 1. We have to do one sample Wilcoxon test to test where the median value of these differences is equal to zero or not.

Descriptive Statistics

Sample	N	Median
Intricate design - Patterns	4	-14.83

η: median of Intricate design - Patterns

Null hypothesis	H_0: η = 0
Alternative hypothesis	H_1: η ≠ 0

Sample	N for Test	Wilcoxon Statistic	P-Value
Intricate design - Patterns	4	0.00	0.100

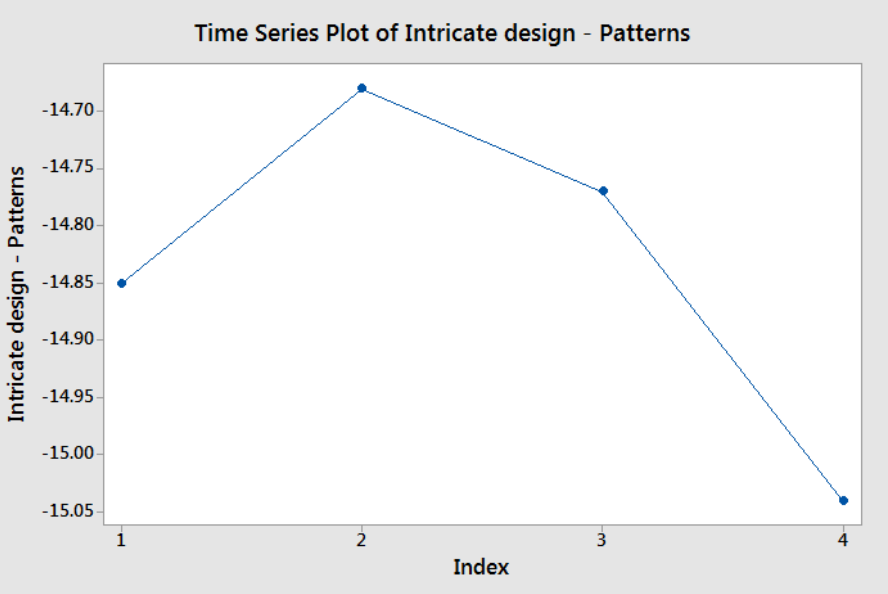

Figure 2. Time Series Plot of Intricate design – Patterns

We select out derived variables (Intricate Design - Patterns). Figure 2. The true median of the differences is Zero with the two-tailed test we got this results with statistic and p-Value of 0.100 so, the non-parametric paired Wilcoxon test is unable to detect a significant difference in the median values of the PH of two products in Libya textile company.

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Biography

Dr. Ahmad Yame earned his Bachelor degree in Engineering Technology from the Lawrence Technological University in 2010, Mr. Yame has three master degree, the latest was in 2015 in Industrial Engineering from Lawrence Technological University, second MSc was in Engineering Management 2011 from the Lawrence Technological University and his first MSc was in Mechanical Engineering back in 2007 from the National University of Malaysia. He earned his Associate's degree in Mechanical Engineering 2004 from the Libyan Higher Professional Center for Comprehensive Professions. He primarily develops engineers but also has experience with software and testing. Dr.Yame has tested many enterprise applications for automotive MAHLE Laboratories in 2013, he working with Panasonic automotive in North America since 2016 to test vehicles for AHU/Sync and diagnostic functionalities of engine control systems. He has organized several simulations, in order to test the engine control software and the diagnostic functionality on a CANlog, respectively, through non-regression and diagnostic tests.