Lab report critical essay

Psychology, Psychotherapy

Repeatability measurements were taken on a bolt to get the total length, and also measuring the low rate of a faucet by measuring the amount of time it took to fill a beaker. To ensure a more accurate sample, twenty measurements of each section were obtained. For the batch measurement portion of this lab, a multi-meter was used to measure the resistance in a pack of ten resistors. Each member measured the resistors twice to allow for more precise statistical analysis.

After all measurements were recorded, statistical analysis such as mean, standard deviation, and true mean range with 90%, 95%, and 99% confidence intervals were used to obtain the results. Once calculations were made, it was determined that there was error in this vibratory due to theenvironmentand to human error, however all of the results fell within the ranges of confidence for each given section. Relevance In this experiment length, flow rate, and resistance was measured and the true mean was calculated. It was observed that the true mean varied depending on the variation of the sample mean and sample standard deviation.

It was shown that the population mean, or true mean, could not be found exactly, but could be estimated as a range with a certain level of confidence with the measurement of the sample mean and sample standard deviation. The knowledge practiced in this lab can be lawful in future experiments if say a company needs to estimate the population average with a specified level of confidence of a bolt that they only have a few samples of. Introduction There are multiple ways of measurement, as well as, many different types of ways to analyze raw data.

In this lab the objective is to experiment with two different types of measurements, repeatability and batch measurements. Theoretically the bolt length plus the cap thickness (B+C) should be equal to the measured total length of the bolt(A). Taking multiple measurements done by multiple people until twenty samples re obtained measuring all four components of the bolt and obtaining the raw data of bolt measurements. By having multiple people take measurements a small amount of human error is removed in case one person didn't measure as accurate.

By having multiple measurements done by each person a bigger sample size is obtained, and bigger sample size typically means more accurate results. After the measurements were made a sample mean was calculated, as well as, a sample standard deviation for all four components of the bolt. The sample mean and sample standard deviation were 2 lactated to estimate the true mean of the population with a level of confidence of 90 and 95 percent. Once the true mean of each component was estimated a comparison was made between the total length(A) and the sum of the cap thickness(S) and bolt length(C).

In theory (B+C) should equal the total length of the bolt(A), as they represent the same length. Though they should be the same, they are not. The sum of measurements, (B) and (C) yield a much wider range of true mean than the measurement of (A). This difference is created by multiple types of error such as, human error, maybe reading the caliper wrong. Or error such as mechanical error, maybe the caliper itself was broken or not

calibrated. In the second module of this lab the flow rate of the faucet water is measured using a stop watch and a mall beaker.

Obtaining the flow rate of the water in 20 different samples, then summarizing the raw data into sample mean and sample standard deviation. With the sample mean and standard deviation, the true mean is to be estimated with a confidence level of 90 percent and then again with 95 percent. In the third module the measurements were made in batches. The measurements of batches of resistors were measured with a Center Multi-meter to make sure they all locked in at the same resistance. The resistors measured in this lab were quite strong, getting up to kick.

Each group member measured the batch of resistors twice, then a pooled mean and pooled standard deviation was calculated. Pooling all the members samples together gives us one large sample and a more accurate estimate of the true mean. Using these calculated pooled mean and standard deviation the true mean was found as a range with a 99 percent level of confidence, and then again with a 95 percent level of confidence. The experimental setup and procedures are described in section The results of the experiments can be found n section {V} followed by conclusions in section {VI}.

The appendix with the data chart can be found in section{Veil} Testing the repeatability of the measurements and taking the sample average and sample standard deviation to compare with each other, as well as, estimate the population mean and standard deviation. In three different modules linear dimension, flow rate, and resistance were measured. The primary

objectives of this lab are to practice using devices that measure length and flow rate, to apply statistical principles to raw data sets, and to become familiar with use off multi-meter. Formulas Used: Sample Mean

Standard Deviation True Mean Range 3 Experiment: Equipment: Pittsburgh 6" Caliper Bolt Cent-Tech Digital Multi-meter CTD 10 pack of electrical resistors (gold, yellow, red, yellow) mall Beaker Digital Stopwatch Procedure: This experiment utilizes the billeted above. The experiment is broken down into three sections. First take the caliper and the bolt, calibrate the caliper to make sure that accurate measurements are collected. Measure the complete length of the bolt, thickness of the head, width of the threads and the length of the bolt to the base of the head.

Repeat the measurement a total of twenty times split evenly between the roof members and record the results. Second, take a mall beaker and a stopwatch to the sink and turn the water faucet on to attain a constant flow rate of water. Use the stopwatch to measure the time it takes from the first drop of water entering the beaker to the instant the water begins to overflow from the top of the beaker. Empty the beaker of water repeat this measurement a total of twenty times split evenly between the group members and record the results. For the last portion of this lab, take a pack of resistors and the multi-meter.

Set the millimeter to the appropriate reference resistance and begin measuring each of the sisters one at a 4 time. Each member will measure the set of resistors twice for a total of twenty resistance measurements per each member of the group. Record the measurements from each member

and calculate the true mean resistance. Procedure Changes: The only change/ improvement made to the experiment was during the batch measurement section. It was found that more accurate readings of each resistor could be attained by taping the resistor pack to the table to keep it in place while using the probes to measure the resistance.

This change will allow the group to move quicker through the experiment and not to make any mistakes such as possibly measuring the same resistor twice in a row. The experimental procedure is very straight forward and the group should not encounter any difficulties. Results/Discussion This lab required three different modules to be completed with two different types of measurements: batch and repeatability. The bolt measurement along with the volume flow rate were to be completed using repeatability, while the resistance module used batch measurements.

The data was to be recorded and put into tables and analyzed using the mean, standard deviation, and true mean to determine whether the measurements were in the desired confidence intervals. 5 Linear Dimension Module: The first set of data was recorded using a manual caliper and a bolt. Four measurements were to be taken from the bolt: length, cap thickness, bolt length, and major diameter. These measurements lead to some error as expected, mostly human error and calibration of the manual calipers. There was also some error due to the uneven sides of the bolt and the angle at which the calipers were held against the bolt.

Table la. Shows the summarized data falls within the 95% Confidence Interval. Measurement Total Length (A) Cap Thickness (B) Bolt Length (C)

Major Diameter (D) B+C Sample Mean (in.) (in.) 2. 2661 0. 0033 0. 2825 0. 0031 1 . 9791 0. 0262 . 30327 0. 0007 2. 2616 0. 0268 Table la. Statistics of Bolt Measurements (95%) [2. 265, 2. 267] [0. 2810, 0. 2839] [1. 967, 1. 991] [0. 3024, 0. 3030] [2. 249, 2. 274] The second part of the linear module was to compare the difference between the total length (A) and the sum of cap thickness and bolt length (B+C).

The results show that there was a lower CLC with the total length measurement than with the addition of two parts. This is most likely because of the accuracy of two measurements has more mom for error from the angle of the calipers and human error. Table b. Shows the comparison of the two measurements. The full experimental data for the linear module is listed in Table A in the Appendix. Table b. Comparison of bolt statistics Flow Rate Module: Measurement of the flow rate from a sink using a stopwatch and beaker was the second of the repeatability measurements.

This module produced the most error most likely from human error with stopping and starting of the stopwatch. The inconsistent flow from the sink also contributed to some of the error. The standard aviation in this experiment was high, but after 6 calculating the true mean range for a 90% and 95% confidence interval, the sample mean falls within both ranges with a few outliers. Table LLC. Shows the summary of the data. The full experimental data is listed in Table B in the Appendix . (ECMA/min) 5300. 95 CLC (ECMA/metro) 138. 835 [5247. 27, 5354. 3] Table LLC. Flow Rate Module Statistics 95% CLC (ECMA/metro) [5235. 97, 5365. 93] Resistance Module: In the final part of this lab, resistors were to be measured in batches from each

of the group members. This section of the lab showed the most precision with the least error. From the color coded bands on the ten resistors, it was concluded that the value of the resistors was 470 sq. All of the results in table old. Show that the resistors were only reading 400 sq. All 60 recorded measurements were close to 400 ink which could be from mislabel resistors.

The pooled mean of the three samples does fall within the 90% and 95% confidence intervals even with including some outliers in the data. The full experimental data can be found in Table C in the Appendix. Sample Mean (Q) 400. 033 99% (Q) 1. 588 [399. 02, 401. 05] Table old. Resistance Module Statistics 95% CLC (sq) [399. 29, 400. 78] Conclusion: This laboratory focused on repeatability measurements, batch measurements, and statistical concepts/ principles to analyze the collected data. This was achieved through the use of a caliper, stopwatch, and a digital multi-meter for measurement purposes.

Using these tools, the group is able to measure length, flow rate, and resistance. The statistical concepts used in this lab were sample mean, standard deviation, true mean, and the range and level of confidence. The results of the linear dimension module prove that there is always going to be a small amount of human error when using devices such as a manual caliper. That error is relatively larger when trying to sum two measurements as compared to measuring a total length . The measurement of the bolt as a whole has a narrower CIA and true mean range of [2. 265, 2. 267].

The 7 standard deviation for total length (A) [0. 0033 in.] supports the theory that measuring the entire length at once is more accurate than

summing the cap thickness (B) and bolt length (C) together, which is evident by analyzing the standard deviation of (B+C) [0. 0268 in.]. The results of the flow rate module show that there is significantly far more human error when trying to measure the time it takes for water o fill a beaker. This can be attributed to response time of starting/stopping the stopwatch. The standard deviation [138. 835 /min] seems high, but calculations show that the sample mean [5300. 5 /min] falls within the true mean range for CLC [5247. 27, 5354. 63 /metro] and also for 95% CLC [5235. 97, 5365. 93 /min]. The results of the resistance module indicated a difference between the sample mean [400. 033 sq] of the batch measurements and the supposed value of the resistors [470 sq] according to the color coded bands. This was the most precise module with a standard deviation of [1. 588 sq] and all the pooled means fall within he 95% CLC with a true mean range of [399. 29, 400. 78 sq], and the 99% CLC with a range of [399. 02, 401. 05 sq].

This laboratory experiment allowed the group to differentiate between repeatability measurements and batch measurements and apply the statistical theories learned in lecture to analyze the collected data. To minimize error percentage, calibrating the caliper before each measurement might be advantageous. Another advantage might be making markings on the bolt where each member of the group takes measurements instead of at random/different spots each time.