STAT 3611 Lab 5 S2015 Maghsoodloo

1(a, 3 points). Use Minitab to work Exercise 58 of J. L. Devore (8e) on his page 338, describing the exact relationship between his value of 1.616 & 0.29504 on my Excel Data-file Before proceeding, change Devore's first sentence to: A random sample of "**size n = 30**" soil specimen was obtained ….. **"LOS = Level Of Significance"**

Do the above part by first, i.e., testing H_0:μ = 3.00 recognizing that **σ** is truly unknown and using William Sealy Gosset's t-statistic and then the normal (or the Z as an approximate test) using the sample S_X = 1.61564 as a rough approximate value of process-parameter σ.

1(b, 3 points). Use Minitab to estimate the power of the nominal statistical 5%-level test (i.e., the LOS α = 0.05) if the true process mean organic matter μ were equal to 3. 40%. This represents an upward shift of 0.40 in the process mean μ. Go to Stat → Power and Sample Size; first select 1-Sample t followed by 1-sample Z, and compare your power results.

J.L. Devore (8e) seems to imply at the end of his Exercise-58 on p. 338-statement that the assumption of underlying normality is almost tenable. Do you agree? Why, or why not. Provide precise statistical answer using Minitab's Stat → Basic Statistics → Graphical Summary, and the resulting AD-Statistic *P*-value to draw conclusion about the normality assumption of the data-underlying distribution (the smaller a *P*-value is, the stronger a null-hypothesis of Normality must be rejected). Secondly, on your data-sheet, approximately (& roughly) compute the Pr(X ≤ 0), where X = % Organic Matter, using the normality assumption. Use this last left-tail Pr (below zero) to ascertain if you agree with J. L. Devore's (8e) assertion of acceptable normality pattern.

Definition. In the field of Statistics [where QC (Quality Control) is strictly an application area], an OC (Operating Characteristic) curve is always the graph of "type II error, or error of " (= "accepting a false null hypothesis H_0") Pr, denoted β, as a function of the parameter under the null hypothesis H_0. For example, in the above Problem 1, the null hypothesis is H_0: μ = 3.00%, i.e., $\mu_0 \equiv$ 3.00%, then the OC curve will graph β = Type II error Pr = P_a(at a given μ) as a function of μ (where μ is the abscissa), and β (at a specified μ) = P_a(μ) will be the ordinate (or the so-called y-axis of the OC curve). See Table A.17 on p. Appendix A-28 of Devore (8e), but please change his title from β Curves to OC Curves. Please also note that Statistical-Literature (specially QC-literature) always Studentdizes the OC-Curve-abscissa to construct OC curves on mean(s), i.e., uses the Non- central t-distribution. However, if for example null hypothesis were H_0:σ = 0.25 cm versus H_1: σ < 0.25 (a left-tail test), then the corresponding OC-Curve will graph β = Error Pr of 2nd-kind = P_a(at a given σ) versus the unitless abscissa Lambda = σ/σ_0.

<u>**2(4 points).**</u> Use MS Excel to draw the (0.05-Level, i.e. the LOS of the test is set nominally at α = 0.05) OC curve of the above problem 1 by assuming the true process σ were equal to 1.4790 ($\rightarrow$ the Z-test), and computing the acceptance probability $\beta = P_a(H_0: \mu = 3.00\%)$ VS the 2-sided alternative hypothesis H_1: $\mu \neq 3.00\%$. Thus, I am making the assumption that the parent-variable X = % Organic Matter ~ N(unknown μ, σ^2 = 2.187441), which you will find out is not quite tenable. In order to draw this OC (Operating Characteristic) curve, compute β at $\mu = 3.00 \pm 1.2\sigma_X$, $\delta = \pm 1\sigma_X$, $\pm 0.80\sigma_X$, $\pm 0.6\sigma_X$, $\pm 0.4\sigma_X$, $\mu_0 \pm 0.20\sigma_X$, starting your μ-Column in Excel at $\mu = 3.00 - 1.20\times1.4790$. However, before the μ-Column provide another column headed by δ whose first value will be -1.20×1.4790; the adjacent columns are described in my Excel-SOLN file on the Lab-screen. The quantity δ represents the amount of shift-in-μ in terms of σ_X from the null-value of $\mu_0 \equiv 3.00\%$. A negative-value of δ always implies a downward-shift μ, and vice a versa.

Next use the above information to also draw the power curve ($1-\beta$ versus μ) for testing H_0: μ = 3.00 at the 5% LOS, where power of a Statistical test graphs the Pr of rejecting a false hypothesis for a specified parameter-value. By Statistical power we mean the apriory Pr of rejecting a false H_0.