(10 pts.) 1. The Palmer Drought Severity Index (PDSI) is a measure of prolonged abnormal dryness or wetness. It indicates general conditions and is not affected by local variations. An index value of −4 indicates extreme drought, and +4 represents very wet conditions. A random sample of 21 regions in the Eastern United States for the week ending July 6, 2013 had a sample mean, $\bar{x}$ = 1.38 and sample standard deviation, s = 1.633.

(1 pt.) a) Should a z or t distribution be used? Remember to explain your answer.

(6 pts.) b) Is there any evidence to suggest the true mean PDSI is different from 0? Assume the underlying distribution is normal and use α = 0.01. Include the complete four step hypothesis test including all of the work.

(2 pts.) c) Calculate and interpret the 99% confidence interval for the mean.

(1 pt.) d) Explain why parts b) and c) state the same thing. That is, what in part b) is consistent with what in part c).

(11 pts.) 2. According to U. S. Inspect, roofing shingles weighed approximately 240 pounds per square foot prior to 1973, and modern shingles weigh approximately 190 pounds per square foot, depending on the material and the manufacturer. Suppose a brand of recycled synthetic shingles is advertised to weigh 185 pounds per square foot. A random sample of 32 of these shingles was obtained which has a sample mean, $\bar{x}$ = 186.3. Assume the population standard deviation, σ = 2.7.

(1 pt.) a) Should a z or t distribution be used? Remember to explain your answer.

(6 pts.) b) Is there any evidence to suggest that the true mean weight of these recycled shingles is different from 185 pounds per square foot? Perform the hypothesis tests at a 5% significance level. Include the complete four step hypothesis test including all of the work.

(2 pts.) c) Calculate and interpret the 95% confidence interval for the mean.

(1 pt.) d) Explain why parts b) and c) state the same thing. That is, what in part b) is consistent with what in part c).

(1 pt.) e) From the information provided in parts b) – d), do you think the true mean weight of these recycled shingles is different from 185 pounds per square foot? Hint: Think about the practicality of the situation.

(3 pts.) 3. Lake Vostok is Antarctica's largest and deepest subsurface lake. It is buried under approximately 2 miles of ice, and scientists believe it contains evidence of thousands of tiny organisms and fish. The accepted mean depth of the lake is 344 meters. A random sample of 28 depths of this lake was obtained, with a sample mean of 325 meters. Assume the underlying distribution is normal with σ = 30 meters. There is some belief that the level of the lake might be lower than the accepted mean value 344 meters which is stated above.

(1 pt.) a) State the hypotheses that are being tested. Be sure to include both the null and alternative hypotheses.

(1 pt.) b) Find the probability of a type II error if the true mean depth of the lake is 315 meters; that is, find β(315). Assume that α = 0.01.

(1 pt.) c) Find β(310). Assume that α = 0.01.