Problem 1 (6 points, 1 point for each part)

This section consists of some true/false questions regarding concepts of statistical inference. Indicate if a statement is true if it is always true or false otherwise. You do not need to explain why it is true or false.

(1) The quantity $(\bar{y} - \mu)/\sqrt{\sigma^2/n}$ has the t-distribution with $n - 1$ degrees of freedom.

(2) When the test statistic is t and the number of degrees of freedom is > 30, the critical value of t ($t_{n,\alpha}$) is very close to that of z (the standard normal) (z_α).

(3) The variance of a binomial proportion is npq [or $np(1 - p)$].

(4) The sampling distribution of a proportion is approximated by the t distribution.

(5) The t-test can be applied with absolutely no assumptions about the distribution of the population.

(6) The degrees of freedom for the t-test do not necessarily depend on the sample size used in computing the sample mean.

Problem 2 (18 points)

A local congressman indicated that he would support the building of a new dam on the Yahoo River if more than 60% of his constituents supported the dam. His legislative aide sampled 225 registered voters in his district and found 145 favored the dam.

(1) (**11 points**) At the level of significance of 0.10 should the congressman support the building of the dam? Specify five steps for the hypothesis testing. For this part, you can use either the rejection region approach, the p-value approach, or the confidence interval approach.

(2) (**5 points**) Find the two-sided 95% confidence interval of the proportion of his constituents who supported the dam. Show sufficient details about your calculations.

(3) (**2 points**) Check if the normal assumption is satisfied here.

Problem 3 (8 points)

Use the function `t.test()` to answer Part (2) and Part (5) of Problem 1 in Week 10 HW. You do not need to specify 5 steps of hypothesis testing but need to report the test statistic, the p-value, and the appropriate confidence interval.

Problem 4 (12 points)

A certain soft drink bottler claims that less than 10% of its customers drink another brand of soft drink on a regular basis. A random sample of 100 customers yielded 18 who did in fact drink another brand of soft drink on a regular basis. Do these sample results support the bottler's claim? (Use a level of significance of 0.05).

(1) (**5 points**) Use the R function `prop.test()` to solve this problem. You do not need to specify 5 steps of hypothesis testing but need to specify the null and alternative hypothesis, report the statistic (the chi-square statistic and the z statistic), the p-value, and the confidence interval.

(2) (**5 points**) Construct the appropriate 95% CI of the proportion of its customers who drink another brand of soft drink on a regular basis. Show sufficient details about your calculations. Your calculations should be based on formulas covered in the class.

(3) (**2 points**) Check if the normal assumption is satisfied here.