1. (5 points) We prefer the $t$ procedures to the $z$ procedures for inference about a population mean because

A. $z$ requires that you know the population standard deviation $\sigma$.

B. $z$ can be used only for large samples.

C. $z$ requres that you can regard your data as an SRS from the population.

2. (5 points) A study of the use of social media asked a sample of 488 American adults under the age of 40 and a sample of 421 American adults aged 40 or over about their use of social media. Based on their answers, each subject was assigned a social media usage score on a scale of 0 to 25. Higher scores indicate greater usage. The subjects were chosen by random digit dialing of telephone numbers. Are the conditions for two-sample $t$ inference satisfied?

A. No: scores in a range between 0 and 25 cant be Normal.

B. Yes: the SRS condition is OK and large sample sizes make the Normality condition unnecessary.

C. Maybe: the SRS condition is OK but we need to look at the data to check Normality.

3. (5 points) You are testing $H_0 : \mu = 10$ against $H_a : \mu < 10$ based on an SRS of 16 observations from a Normal population. The data give $\bar{x} = 8$ and $s = 4$. The value of the $t$ statistic is

A. $-8$

B. $-0.5$

C. $-2$

4. (5 points) You are testing $H_0 : \mu = 0$ against $H_a : \mu \neq 0$ based on an SRS of 12 observations from a Normal population. What values of the $t$ statistic are statistically significant at the $\alpha = 0.005$ level?

A. $t < -3.497$ or $t > 3.497$

B. $t < -3.428$ or $t > 3.428$

C. $t > 3.497$

5. (20 points) The National Assessment of Educational Progress (NAEP) includes a long-term trend study that tracks reading and mathematics skills over time and obtains demographic information. In the 2008 study, a random sample of 9600 17-year-old students was selected. The NAEP sample used a multistage design, but the overall effect is quite similar to an SRS of 17-year-olds who are still in school.

(a) In the sample, 46% of students had at least one parent who was a college graduate. Estimate with 99the proportion of all 17-year-old students in 2008 who had at least one parent who was a college graduate.

(b) The sample does not include 17-year-olds who dropped out of school, so your estimate is valid only for students. Do you think that the proportion of all 17-year-olds with at least one parent who was a college graduate would be higher or lower than 46%? Explain.

6. (20 points) How well materials conduct heat matters when designing houses, for example. Conductivity is measured in terms of watts of heat power transmitted per square meter of surface per degree Celsius of temperature difference on the two sides of the material. The National Institute of Standards and Technology (NIST) provides data on properties of materials. Here are 9 NIST measurements of the heat conductivity of a particular type of fibrous-glass board:

0.0339 0.0337 0.0334 0.0334 0.0333 0.0333 0.0333 0.0332 0.0330

(a) We can consider this an SRS of all specimens of fibrous-glass board of this type. Make a stemplot. Is there any sign of major deviation from Normality?

(b) Give a 95% confidence interval for the mean conductivity.

(c) Is there significant evidence at the 5% level that the mean conductivity of this type of fibrous-glass board is not 0.0330?

7. (20 points) A subliminal message is below our threshold of awareness but may nonetheless influence us. Can subliminal messages help students learn math? A group of students who had failed the mathematics part of the City University of New York Skills Assessment Test agreed to participate in a study to find out.

All received a daily subliminal message, flashed on a screen too rapidly to be consciously read. The treatment group of 10 students (chosen at random) was exposed to Each day I am getting better in math. The control group of 8 students was exposed to a neutral message, People are walking on the street. All students participated in a summer program designed to raise their math skills, and all took the assessment test again at the end of the program. The table below gives data on the subjects scores before and after the program.

Is there good evidence that the treatment brought about a greater improvement in math scores than the neutral message? How large is the mean difference in gains between treatment and control? (Use 90% confidence.)

| Treatment Group | | Control Group | |
|---|---|---|---|
| Before | After | Before | After |
| 18 | 24 | 18 | 29 |
| 18 | 25 | 24 | 29 |
| 21 | 33 | 20 | 24 |
| 18 | 29 | 18 | 26 |
| 18 | 33 | 24 | 38 |
| 20 | 36 | 22 | 27 |
| 23 | 34 | 15 | 22 |
| 23 | 36 | 19 | 31 |
| 21 | 34 | | |
| 17 | 27 | | |

8. (20 points) In a randomized comparative experiment on the effect of color on the performance of a cognitive task, researchers randomly divided 69 subjects (27 males and 42 females ranging in age from 17 to 25 years) into three groups. Participants were asked to solve a series of 6 anagrams. One group was presented with the anagrams on a blue screen; one group saw them on a red screen; and one group had a neutral screen. The time, in seconds, taken to solve the anagrams was recorded. The paper reporting the study gives $\bar{x} = 11.58$ and $s = 4.37$ for the times of the 23 members of the neutral group.

(a) Give a 95% confidence interval for the mean time in the population from which the subjects were recruited.

(b) What conditions for the population and the study design are required by the procedure you used in (a)? Which of these conditions are important for the validity of the procedure in this case?