INSTRUCTIONS: Read the questions carefully and completely. Answer each question and show all your work in the space provided. Credit cannot be given if work is not shown. When asked to explain, describe, or comment, do so in the context of the problem.

1. (2 pts each) Choose the best response and write the answer in capital letters on the line to the left of the question.

(a) ______ All other things being equal, as the level of confidence increases, the margin of error of the confidence interval will (A) decrease (B) stay the same (C) increase.

(b) ______ All other things being equal, as the sample size increases, the margin of error of the confidence interval will (A) decrease (B) stay the same (C) increase.

(c) ______ The p-value of a hypothesis test is (A) the probability the alternative hypothesis is true (B) the probability of getting the observed statistic or a value more extreme if the alternative hypothesis is true (C) the probability the null hypothesis is true (D) the probability of getting the observed statistic or a value more extreme if the null hypothesis is true.

(d) ______ In calculating the test statistic for a hypothesis test, we assume the value of the parameter stated in the null hypothesis is (A) true (B) false.

(e) ______ In a hypothesis test, the p-value is determined to be 0.015. What is your decision if the α level of the hypothesis test is 0.05? (A) Reject H₀ (B) Do not reject H₀ (C) Accept H₁ (D) Accept H₀.

(f) ______ In a hypothesis test, the p-value is determined to be 0.015. What is your decision if the α level of the hypothesis test is 0.01? (A) Reject H₀ (B) Do not reject H₀ (C) Accept H₁ (D) Accept H₀.

(g) ______ In a hypothesis test, the null hypothesis is rejected for α = 0.05. What would your decision be if the α level for the test was changed to α = 0.01? (A) Reject H₀ (B) Do not reject H₀ (C) Accept H₀ (D) Don’t have enough information

(h) ______ For a particular hypothesis test, the cost of rejecting the null hypothesis is very high. In this case, you would want the α level of the test to be (A) very small (B) moderate (C) very high.

(i) ______ A confidence interval gives us a range of value where we know the population parameter lies. (A) True (B) False.
(j) From a study in 1980, 44% of the population was estimated to be current or former smokers. In a new study, 38% of a sample of 1000 US adults reported they were either current or former smokers. Is this evidence that the rate of smoking in the US has decreased?

i. ______ What is the appropriate null hypothesis for this hypothesis test? (A) \( H_O : p = 0.38 \) (B) \( H_O : p \geq 0.38 \) (C) \( H_O : p \geq 0.44 \) (D) \( H_O : p = 0.44 \).

ii. ______ What is the appropriate alternative hypothesis for this hypothesis test? (A) \( H_A : p < 0.38 \) (B) \( H_A : p < 0.44 \) (C) \( H_A : p \neq 0.38 \) (D) \( H_A : p \neq 0.44 \).

(k) Historically, around 7% of all students enrolled in Statistics 101 will drop the course before the drop deadline. Several semesters ago, Supplemental Instruction assistance was dropped from Statistics 101. For the Fall 2004 semester, 39 out of 504 students (or 7.74%) dropped Statistics 101 before the drop deadline. If this evidence the drop rate for Statistics 101 has increased?

i. ______ What is the appropriate null hypothesis for this hypothesis test? (A) \( H_O : p = 0.07 \) (B) \( H_O : p \geq 0.07 \) (C) \( H_O : p \geq 0.0774 \) (D) \( H_O : p = 0.0774 \).

ii. ______ What is the appropriate alternative hypothesis for this hypothesis test? (A) \( H_A : p \neq 0.0774 \) (B) \( H_A : p > 0.0774 \) (C) \( H_A : p > 0.07 \) (D) \( H_A : p \neq 0.07 \).

(l) Public health officials believe that 90% of children have been vaccinated against measles. A random survey of medical records at many schools across the country found that among more than 13,000 children, 89.4% had been vaccinated. Is this evidence that the proportion of children vaccinated against measles is different than 90%?

i. ______ What is the appropriate null hypothesis for this hypothesis test? (A) \( H_O : p = 0.894 \) (B) \( H_O : p = 0.90 \) (C) \( H_O : p \geq 0.90 \) (D) \( H_O : p \geq 0.894 \).

ii. ______ What is the appropriate alternative hypothesis for this hypothesis test? (A) \( H_A : p < 0.90 \) (B) \( H_A : p < 0.894 \) (C) \( H_A : p \neq 0.90 \) (D) \( H_A : p \neq 0.894 \).
2. (14 pts) A Pew Foundation poll from 2000 found that 33% of the 1600 respondents obtained at least part of their news from the internet.

   (a) (5 pts) Calculate a 95% confidence interval for the population proportion who obtain at least part of their news from the internet.

   (b) (4 pts) Give the interpretation of the confidence interval you calculated in part (a) in the context of the problem.

   (c) (5 pts) We would like to conduct this survey again today to determine what proportion of the population obtains at least part of their news from the internet. How large should our sample be if we want to obtain a 90% confidence interval with a margin of error of no more than 2%?
3. (19 pts) A company's old antacid formula provided relief from heartburn for 70% of the people who used it. The company develops a new formula in hopes of improving on the proportion of users who obtain relief. In a random sample of 100 people, 78% had relief of their heartburn. Is this enough evidence to show that the new formula is better than the old formula? Complete the appropriate hypothesis test to answer this question. Use $\alpha = 0.05$. Hint: don’t forget to include all 8 parts of a hypothesis test.
4. (17 pts) Out of the 335 students who completed the computer survey at the beginning of the semester, 195 out of 335 students were female. From this population, take a random sample of size 30.

(a) (2 pts) What is the value of $p = \text{proportion of females in the population}$.

(b) (5 pts) What is the sampling distribution of $\hat{p} = \text{the sample proportion of females from a sample of size 30}$.

(c) (4 pts) What is the probability that a sample of size 30 from this population will have 18 or more females?

(d) (6 pts) What is the probability that a sample of size 30 from this population will have between 15 and 24 females?
Formulas

\[ z = \frac{\hat{p} - p}{\sqrt{\frac{\hat{p}(1 - \hat{p})}{n}}} \]

\[ \hat{p} \pm z^* \sqrt{\frac{\hat{p}(1 - \hat{p})}{n}} \]

\[ z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1 - p_0)}{n}}} \]

\[ n = \frac{(z^*)^2(0.5)(0.5)}{(ME)^2} \]

<table>
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<th>( C% )</th>
<th>90</th>
<th>95</th>
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<th>99</th>
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<td>( z^* )</td>
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