PES University, Bangalore

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UE19CS203 – STATISTICS FOR DATA SCIENCE

Unit-4 - Hypothesis and Inference

QUESTION BANK

Large sample tests for a Population proportion:

Exercises for section 6.3: [Text Book Exercise 6.3– Pg. No. [416 – 417]]

1. A random sample of 300 electronic components manufactured by a certain process are tested, and 25 are found to be defective. Let p represent the proportion of components manufactured by this process that are defective. The process engineer claims that $p \leq 0.05$. Does the sample provide enough evidence to reject the claim?

2. The article "HIV-positive Smokers Considering Quitting: Differences by Race/Ethnicity" (E. Lloyd- Richardson, C. Stanton, et al., *Am J Health Behav*, 2008:3–15) surveyed 444 HIV-positive smokers. Of these, 281 were male and 163 were female. Consider this to be a simple random sample. Can you conclude that more than 60% of HIV-positive smokers are male?

3. Do bathroom scales tend to underestimate a person's true weight? A 150 lb test weight was placed on each of 50 bathroom scales. The readings on 29 of the scales were too light, and the readings on the other 21 were too heavy. Can you conclude that more than half of bathroom scales underestimate weight?

4. Do patients value interpersonal skills more than technical ability when choosing a primary care physician? The article "Patients' Preferences for Technical Versus Interpersonal Quality When Selecting a Primary Care Physician" (C. Fung, M. Elliot, et al., *Health Services Research*, 2005:957–977)

reports the results of a study in which 304 people were asked to choose a physician based on two hypothetical descriptions. One physician was described as having high technical skills and average interpersonal skills, and the other was described as having average technical skills and high interpersonal skills. Sixty-two percent of the people chose the physician with high technical skills. Can you conclude that more than half of patients prefer a physician with high technical skills?

5. In a survey of 500 residents in a certain town, 274 said they were opposed to constructing a new shopping mall. Can you conclude that more than half of the residents in this town are opposed to constructing a new shopping mall?

6. The article "Application of Surgical Navigation to Total Hip Arthroplasty" (T. Ecker and S. Murphy, *Journal of Engineering in Medicine*, 2007:699–712) reports that in a sample of 113 people undergoing a certain type of hip replacement surgery on one hip, 65 of them had surgery on their right hip. Can you conclude that frequency of this type of surgery differs between right and left hips?

7. In a sample of 150 households in a certain city, 110 had high-speed internet access. Can you conclude that more than 70% of the households in this city have high-speed internet access?

8. A grinding machine will be qualified for a particular task if it can be shown to produce less than 8% defective parts. In a random sample of 300 parts, 12 were defective. On the basis of these data, can the machine be qualified?

9. Let *A* and *B* represent two variants (alleles) of the DNA at a certain locus on the genome. Assume that 40% of all the alleles in a certain population are type *A* and 30% are type *B*. The locus is said to be in Hardy- Weinberg equilibrium if the proportion of organisms that are of type *AB* is *(*0.40*)(*0.30*)* = 0.12. In a sample of 300 organisms, 42 are of type *AB*. Can you conclude that this locus is not in Hardy-Weinberg equilibrium?

10. In a simple random sample of 70 automobiles registered in a certain state, 28 of them were found to have emission levels that exceed a state standard.

Can it be concluded that less than half of the automobiles in the state have pollution levels that exceed the standard?

11. During a recent drought, a water utility in a certain town sampled 100 residential water bills and found that 73 of the residences had reduced their water consumption over that of the previous year. Can it be concluded that more than 60% of the residences in the town reduced their water consumption?

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12. The following MINITAB output presents the results of a hypothesis test for a population proportion p.

```
Test and CI for One Proportion: X

Test of p = 0.4 vs p < 0.4

                                        95%
                                      Upper
Variable   X    N  Sample p     Bound  Z-Value  P-Value
X         73  240  0.304167  0.353013    -3.03    0.001
```

a. Is this a one-tailed or two-tailed test?
b. What is the null hypothesis?
c. Can H_0 be rejected at the 2% level? How can you tell?
d. Someone asks you whether the null hypothesis $H_0: p \geq 0.45$ versus $H_1: p < 0.45$ can be rejected at the 2% level. Can you answer without doing any calculations? How?
e. Use the output and an appropriate table to compute the P-value for the test of $H_0: p \leq 0.25$ versus $H_1: p > 0.25$.
f. Use the output and an appropriate table to compute a 90% confidence interval for p.

13. The following MINITAB output presents the results of a hypothesis test for a population proportion p. Some of the numbers are missing. Fill in the numbers for (a) through (c).

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Test and CI for One Proportion: X

Test of p = 0.7 vs p < 0.7

                                        95%
                                      Upper
Variable    X    N  Sample p     Bound  Z-Value  P-Value
X         345  500     (a)    0.724021     (b)      (c)
```