1. Practice on the mechanics of a test. In each case test whether the sample mean is compatible with the null hypothesis or not. Note that one test has a one‑sided alternative.

a) Ho: mean= 5.0

H1: mean ≠ 5.0

Significant level = 5%

Sample size n = 10

s.d = 1.9

Sample mean = 3.9

b) Ho: mean = 21.5

H1: mean < 21.5

Significant level = 5%

Sample size n = 6

s.d = 1.7

Sample mean = 20.0

c)Ho: mean= 16.4

H1: mean ≠ 16.4

Significant level = 1%

Sample size n = 8

s.d = 1.13

Sample mean = 18.06

1. Experience shows that a fixed dose of a certain drug causes an average increase in pulse rate of 10 beats per minute. Nine patients are selected at random from a group who are suffering from a particular heart disease and are given the standard dose. They showed the following increases:

13 15 14 10 8 12 16 9 20

Is there sufficient evidence (at a 5% significance level) to decide that the average increase in this group is different from that of the population?

1. A shop labels its minced meat as 'contains not more than 25% fat'. Six samples of mince gave the following %fat:

25.6 24.3 25.8 26.8 25.4 26.9

Does this suggest that the claim should be rejected at 5% significance?

*H0: mean fat = 25%*

*H1: mean fat > 25%*

1. The figures below are for protein content of nine samples of wheat grown in a particular district. Given that protein determinations are approx. normally distributed show that the data is consistent with the assumption of a mean protein of 12.66 for the district

13.5 12.9 13.4 12.4 12.8 13.0 12.7 12.4 13.9

Tutorial examples on confidence intervals and tests of proportion on page 24-25

1. *Out of 250 patients treated with a particular drug, 206 recovered completely. Find a 95% confidence interval for overall proportion of patients who can be expected to recover when treated with this drug.*
2. *A hospital treated 412 skin cancer patients over a period of time. Of these 197 were female. Find a 95% C.I. for the proportion of females among skin cancer patients.*
3. *For a certain genetic cross it is predicted that one quarter of the offspring will be deficient in a particular enzyme.*

*Of 48 offspring examined, 8 exhibited this deficiency. Test whether these data are consistent with the theoretical proportion.*

1. In a seed test four trays of 100 seeds were planted and left to grow under controlled conditions. The numbers germinating were 92, 82, 80, 82. The claimed % germination is 88%. Are the figures compatible with such a claim?
2. A cell culture method usually has a failure rate of 20% (caused by aseptic technique failing etc.). Using a changed method, six failures occurred in 50 test cultures. Does this imply that the change has reduced the failure rate?

**PROBABILITY**

Example 1: What is the probability of rolling a dice and its value is less than 4 knowing that the value is an odd number?

2/3  
Example 2: What is the probability of rolling a dice and its value is 1 knowing that the value is an odd number?

1/3

2. At P-Town High School, the probability that a student takes Computer Programming and Spanish is 0.15. The probability that a student takes Computer Programming is 0.4.  
What is the probability that a student takes Spanish given that the student is taking Computer Programming?

|  |  |  |  |
| --- | --- | --- | --- |
|  | Too Expensive | Affordable | Too Cheap |
| Child in college | 55% | 4% | 0% |
| Child not in college | 30% | 8% | 3% |

**Baye Theorem**

1. 1% of the population has X disease. A screening test accurately detects the disease for 90% if people with it. The test also indicates the disease for 15% of the people without it (the false positives). Suppose a person screened for the disease tests positive. What is the probability they have it?

2. You go to see the doctor about an ingrowing toenail. The doctor selects you at random to have a blood test for swine flu, which for the purposes of this exercise we will say is currently suspected to affect 1 in 10,000 people in Australia. The test is 99% accurate, in the sense that the probability of a false positive is 1%. The probability of a false negative is zero. You test positive. What is the new probability that you have swine flu?

**Binominal Dis**

1/ Hospital records show that of patients suffering from a certain disease, %75% die of it. What is the probability that of 6 randomly selected patients, 4 will recover?

2/ A (blindfolded) marksman finds that on the average he hits the target 4 times out of 5. If he fires 4 shots, what is the probability of

(a) more than 2 hits?

(b) at least 3 misses?

**POISSON**

1/ Suppose the average number of car accidents on the highway in one day is 4. What is the probability of no car accident in one day? What is the probability of 1 car accidence in two days?

2/ Suppose the average number of calls by 104 in one minute is 2. What is the probability of 10 calls in 5 minutes?

**C.I AND HYPOTHESIS**

1. A sample of size n = 100 produced the sample mean = 16. Assuming the population standard deviation σ = 3, compute a 95% confidence interval for the population mean µ.

2. Assuming the population standard deviation σ = 3, how large should a sample be to estimate the population mean µ with a margin of error not exceeding 0.5?

3. We observed 28 successes in 70 independent Bernoulli trials. Compute a 90% confidence interval for the population proportion p.

4. The operations manager of a large production plant would like to estimate the mean amount of time a worker takes to assemble a new electronic component. Assume that the standard deviation of this assembly time is 3.6 minutes.

After observing 120 workers assembling similar devices, the manager noticed that their average time was 16.2 minutes. Construct a 92% confidence interval for the mean assembly time.

5. Suppose a consumer advocacy group would like to conduct a survey to find the proportion p of consumers who bought the newest generation of an MP3 player were happy with their purchase. The advocacy group took a random sample of 1000 consumers who recently purchased this MP3 player and found that 400 were happy with their purchase. Find a 95% confidence interval for *p*.

6. In order to ensure efficient usage of a server, it is necessary to estimate the mean number of concurrent users. According to records, the sample mean and sample standard deviation of number of concurrent users at 100 randomly selected times is 37.7 and 9.2, respectively.

a) Construct a 90% confidence interval for the mean number of concurrent users.

b) Do these data provide significant evidence, at 1% significance level, that the mean number of concurrent users is greater than 35?

7. To assess the accuracy of a laboratory scale, a standard weight that is known to weigh 1 gram is repeatedly weighed 4 times. The resulting measurements (in grams) are: 0.95, 1.02, 1.01, 0.98. Assume that the weighings by the scale when the true weight is 1 gram are normally distributed with mean µ.

a) Use these data to compute a 95% confidence interval for µ.

b) Do these data give evidence at 5% significance level that the scale is not accurate? Answer this question by performing an appropriate test of hypothesis.

8. In their advertisements, a new diet program would like to claim that their program results in a mean weight

loss (µ) of more than 10 pounds in two weeks. To determine if this is a valid claim, the makers of the diet

should test the null hypothesis H0 : µ = 10 against the alternative hypothesis:

(A) H1: µ < 10

(B) H1: µ > 10

(C) H1: µ ≠ 10

(D) H1: µ ≠ 0

(E) None of the above

9. Suppose we would like to estimate the mean amount of money (µ) spent on books by CS students in a semester. We have the following data from 10 randomly selected CS students: X =$249 and S = $30. Assume that the amount spent on books by CS students is normally dis- tributed. To compute a 95% confidence for µ, we will use the following critical point:

(A) z0.025 = 1.96

(B) z0.05 = 1.645

(C) t9,0.025 = 2.262

(D) t10,0.025 = 2.228

(E) t9,0.05 = 1.833

10. Installation of a certain hardware takes a random amount of time with a standard deviation of 5 minutes. A computer technician installs this hardware on 64 different computers, with the average installation time of 42 minutes. Compute a 95% confidence interval for the mean installation time.

11. An exit poll of 1000 randomly selected voters found that 515 favoured candidate A. Is the race too close to call? Answer this question by performing an appropriate test of hypothesis at 1% level of significance.

12. Bags of a certain brand of tortilla chips claim to have a net weight of 14 ounces. The net weights actually vary slightly from bag to bag and are normally distributed with mean µ. A representative of a consumer advocacy group wishes to see if there is any evidence that the mean net weight is less than advertised. For this, the representative randomly selects 16 bags of this brand and determines the net weight of each. He finds the sample mean to be X = 13.82 and the sample standard deviation to be S = 0.24. Use these data to perform an appropriate test of hypothesis at 5% significance level.

13. The time needed for college students to complete a certain maze follows a normal distribution with a mean of 45 seconds. To see if the mean time µ (in seconds) is changed by vigorous exercise, we have a group of nine college students exercise vigorously for 30 minutes and then complete the maze. The sample mean and standard deviation of the collected data is 49.2 seconds and 3.5 seconds respectively. Use these data to perform an appropriate test of hypothesis at 5% level of significance.