1. Suppose that we wanted to estimate the true average number of eggs a queen bee lays with 95% confidence. The margin of error we are willing to accept is 0.5. Suppose we also know that s is about _____ What sample size should we use?

2. Researchers are concerned about the impact of students working while they are enrolled in classes, and they'd like to know if students work too much and therefore are spending less time on their classes than they should be. First, the researchers need to find out, on average, how many hours a week students are working. They know from previous studies that the standard deviation of this variable is about 5 hours. 20. A survey of 200 students provides a sample mean of 7.10 hours worked. What is a 95% confidence interval based on this sample?

3. The executives at Sandbachian, Inc. having recently solved their widget crises, have another major problem with one of their products. Many cities are sending complaints that their manhole covers are defective and people are falling into the sewers. Sandbachian, Inc. is pretty sure that only 4% of their manhole covers are defective, but they would like to do a study to confirm this number. They are hoping to construct a 95% confidence interval to get within 0.01 of the true proportion of defective manhole covers. How many manhole covers need to be tested?

4. Suppose we are interested in finding a 95% confidence interval for the mean SAT Verbal score of students at a certain high school. Five students are sampled, and their SAT Verbal scores are 560, 500, 470, 660, and 640.

    1. What is the standard error of the sample mean?
    2. What is the 95% confidence interval for the population mean?

**Which of the following values cannot represent a correlation coefficient?**
A) $r = 1.08$
B) $r = 0.95$
C) $r = 0$
D) $r = -1.0$

5.

**Compute the value of Pearson product moment correlation coefficient for the data below:**

| X | -2 | -5 | 3 |
|---|----|----|---|
| Y | 7  | -1 | 2 |

A) $r = 0.002$
B) $r = 0.235$
C) $r = -0.235$
D) $r = -0.002$

6.

If the differences between the ranks of two variables are (-1, -4, 2, 1, -2, 2, 2), find Spearman rank correlation coefficient.
A) $r_s = -0.607$
B) $r_s = 0.393$
C) $r_s = -0.393$
D) $r_s = 0.607$

7.

6. Compute Spearman rank correlation coefficient for the following data:

| Variable 1 | 6 | 7 | 5 | 4 | 3 | 1 |
|---|---|---|---|---|---|---|
| Variable 2 | -1 | 9 | 2 | 3 | 4 | 7 |

    A) -0.143
    B) -0.116
    C) -1.143
    D) 0.143

8.

9. A researcher wants to determine if there is a relationship between the number of hours a person goes without sleeping ($x$) and the number of mistakes he makes on a simple test ($y$). The following data are recorded:
$$n = 10, \ \Sigma x = 50, \ \Sigma y = 20, \ \Sigma xy = 114, \ \Sigma x^2 = 300$$
The equation of the regression line is:

    A) $y' = 0.6 + 0.28\,x$
    B) $y' = 0.28 - 0.6\,x$
    C) $y' = -0.6 + 0.28\,x$
    D) $y' = 0.28 + 0.6\,x$

9.

12. The equation of the regression line between the age of a car in years ($x$) and its price in Riyals ($y$) is given by:
$$y' = 65.3 - 9.25\,x$$

The correct statement that represents this equation is:

A) When the age of the car increases one year, its price decreases (65.3) Riyals on average.

B) When the price of the car increases one Riyal, the age decreases (9.25) years on average.

C) When the age of the car increases one year, its price decreases (9.25) Riyals on average.

D) When the price of the car increases one Riyal, the age decreases (65.3) years on average.

10.

Compute Pearsons coefficient of correlation between advertisement cost and sales as per the data given below:

| Advertisement Cost in 1000's | 39 | 65 | 62 | 90 | 82 | 75 | 25 | 98 | 36 | 78 |
|---|---|---|---|---|---|---|---|---|---|---|
| Sales in lakhs | 47 | 53 | 58 | 86 | 62 | 68 | 60 | 91 | 51 | 84 |

11.

Calculate the simple correlation coefficient between wing length & tail length of the following 12 birds of a particular species. Also test its significant.

| Wing length (cm)x | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10.4 | 10.8 | 11.1 | 10.2 | 10.3 | 10.2 | 10.7 | 10.5 | 10.8 | 11.2 | 10.6 | 11.4 |
| Tail length (cm)y | 7.4 | 7.6 | 7.9 | 7.2 | 7.4 | 7.1 | 7.4 | 7.2 | 7.8 | 7.7 | 7.8 | 8.3 |

12.

13. **Using Spearman Rank**

The following data relates to the yield in grams(y) and the matured pods (x) of 10 groundnut plants. Work out the correlation coefficient and test its significance.

| X: | 14 | 34 | 20 | 16 | 11 | 11 | 20 | 17 | 22 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|
| Y: | 16 | 40 | 21 | 18 | 14 | 13 | 20 | 35 | 17 | 27 |

14. In a group of 371 Pitt students, 42 were left-handed. Is this significantly lower than the proportion of all Americans who are left-handed, which is .12?

15. A university has found over the years that out of all the students who are offered admission, the proportion who accept is .70. After a new director of admissions is hired, the university wants to check if the proportion of students accepting has changed significantly. Suppose they offer admission to 1200 students and 888 accept. Is this evidence of a change from the status quo?

16. Nationally, the proportion of candidates who pass their driving test, on their first attempt, is 39%. A driving instructor claims his pass rate is higher because from his last 50 candidates 24 passed their test on their first attempt. Assuming that the 50 candidates of this driving instructor represent a random sample, test, at the 5% level of significance, the instructor's claim.

17. An investigation in 2001 into the University destination of the students from the Borough of Eastfield found that in a random sample of 200 students, 45 went to a Russell Group University. In 2011 , in a random sample of 160 students from the same borough, 55 went to a Russell Group University.
1. a) Assuming that the proportion of students who went to Russell Group University has not changed, obtain the best estimate of this proportion.

2. b) Carry out a test at 2% significance level of whether the proportion of students who went to a Russell Group University has increased from 2001 to 2011.

18. In a random sample of 600 people from a certain city there are 360 men of whom 210 are smokers, and 240 women of whom 110 are smokers. Test, at the 5% level of significance, whether the proportion of smokers in that city is higher among men compared to the proportion of women.

19. Ten cartons are taken at random from an automatic filling machine. The mean net weight of the 10 cartons is 11.8kg and standard deviation is 0.15kg. Does the sample mean differ significantly from the intended weight of 12kg, $\alpha=0.05$

20. Prices of shares of a company on the different days in a month were found to be: 66, 65, 69, 70, 69, 71, 70, 63, 64 and 68. Discuss whether the mean price of the price of the shares in the month is 65.

**Example:** A movie producer is bringing out a new movie. In order to map out her advertising, she wants to determine whether the movie will appeal most to a particular age group or whether it will appeal equally to all age groups. The producer takes a random sample from persons attending a pre-reviewing show of the new movie and obtained the result in the table below. Use Chi-square ($\chi^2$) test to arrive at the conclusion ($\alpha=0.05$).

| Persons | Age-groups (in years) | | | | |
|---|---|---|---|---|---|
| | Under 20 | 20-39 | 40– 59 | 60& over | Total |
| Liked the movie | 320 | 80 | 110 | 200 | 710 |
| Dislikedthe movie | 50 | 15 | 70 | 60 | 195 |
| Indifferent | 30 | 5 | 20 | 40 | 95 |
| Total | 400 | 100 | 200 | 300 | 1,000 |

21.

2. A manufacturing company has just introduced a new product into the market. In order to assess consumers' acceptability of the product and make efforts towards improving its quality, a survey was carried out among the three major ethnic groups in Nigeria and the following results were obtained:

| Persons | Ethnic groups | | | | |
|---|---|---|---|---|---|
|  | Igbo | Yoruba | Hausa | Ijaw | Total |
| Acceptthe product | 48 | 76 | 56 | 70 | 250 |
| Do not Accept | 57 | 44 | 74 | 30 | 205 |
| Total | 105 | 120 | 130 | 100 | 455 |

Using the above information, does the acceptability of the product depend on the ethnic group of the respondents? (Take $\alpha=1\%$)

22.

23. The table below gives the retail prices of a commodity in some shops selected at random in four cities of Lagos, Calabar, Kano and Abuja. Carry out the Analysis of Variance (ANOVA) to test the significance of the differences between the mean prices of the commodity in the four cities. Find if they have the same mean

| City | Price per unit of the commodity in different shops | | | |
|---|---|---|---|---|
| Lagos | 9 | 7 | 10 | 8 |
| Calabar | 5 | 4 | 5 | 6 |
| Kano | 10 | 8 | 9 | 9 |
| Abuja | 7 | 8 | 9 | 8 |

24. Concord Bus Company just bought four different Brands of tyres and wishes to determine if the average lives of the brands of tyres are the same or otherwise in order to make an important management decision. The Company uses all the brands of tyres on randomly selected buses. The table below shows the lives (in '000Km) of the tyres:

| Brand 1: | 10, | 12, | 9, | 9 | |
|---|---|---|---|---|---|
| Brand 2: | 9, | 8, | 11, | 8, | 10 |
| Brand 3: | 11, | 10, | 10, | 8, | 7 |
| Brand 4: | 8, | 9, | 13, | 9 | |

Test the hypothesis that the average life for each of brand of tyres is the same. Take $\alpha = 0.01$

25. **Using ANOVA deduce if the samples means are equal**

| | Age | |
|---|---|---|
| **16–20** | **26–30** | **36–40** |
| 18 | 12 | 23 |
| 11 | 28 | 3 |
| 33 | 2 | 8 |
| 14 | 8 | 7 |
| 26 | 28 | 11 |
| 1 | 19 | |
| | 15 | |

## 26. Using ANOVA deduce if the samples means are equal

| Number of seconds on platform (sum of 10 "best" daily scores) | | | |
| --- | --- | --- | --- |
| Group 1 Hand-reared / choke chain (wolves) | Group 2 Mother-reared / choke chain (wolves) | Group 3 Hand-reared / pellets (wolves) | Group 4 Mother-reared / choke chain (Malamutes) |
| 221 | 267 | 413 | 523 |
| 345 | 241 | 565 | 905 |
| 362 | 564 | 657 | 990 |
| 63 | 397 | | 540 |

Given the data below, conduct a hypothesis test, at the 5% significance level, to see whether there is an association between eye colour and hair colour.

| Observed values | | Hair colour | | | Row totals |
| --- | --- | --- | --- | --- | --- |
| | | Brown | Blonde | Red | |
| Eye colour | Brown | 63 | 31 | 6 | 100 |
| | Blue | 26 | 20 | 14 | 60 |
| | Green | 11 | 19 | 10 | 40 |
| Column totals | | 100 | 70 | 30 | 200 |

27. Answer

In a school, the IGCSE results of 380 students are compared to see if there is an association between the grade gained in Mathematics and the grade gained in English. The results are shown in the table.

| | | Mathematics grade | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | | A | B | C | D | E |
| English grade | A | 33 | 23 | 9 | 4 | 1 |
| | B | 23 | 44 | 24 | 8 | 1 |
| | C | 14 | 30 | 28 | 11 | 2 |
| | D | 7 | 17 | 25 | 17 | 4 |
| | E | 1 | 6 | 19 | 22 | 7 |

28.