R V COLLEGE OF ENGINEERING
(An autonomous institution affiliated to VTU, Belgaum)

SAMPLING DISTRIBUTIONS AND ESTIMATION

Q No	Question
1	A rowing team consists of four rowers whose weights are 69, 71, 73, 75kgs. Find all possible random samples of size 2 (a) with replacement and (b) without replacement. In each case, compute mean and standard deviation of the sampling distribution of means. Also find the mean and standard deviation of the population. Verify the formulas for $\mu_{\bar{x}}$ and $\sigma_{\bar{x}}$ in each case.
2	A rowing team consists of four rowers whose weights are 65, 69, 73, 77kgs. Find all possible random samples of size 2 (a) with replacement and (b) without replacement. In each case, compute mean and standard deviation of the sampling distribution of means. Also find the mean and standard deviation of the population. Verify the formulas for $\mu_{\bar{x}}$ and $\sigma_{\bar{x}}$ in each case.
3	A rowing team consists of four rowers whose weights are 50, 60, 70, 80kgs. Find all possible random samples of size 2 (a) with replacement and (b) without replacement. In each case, compute mean and standard deviation of the sampling distribution of means. Also find the mean and standard deviation of the population. Verify the formulas for $\mu_{\bar{x}}$ and $\sigma_{\bar{x}}$ in each case
4	A population consists of four numbers 152, 156, 160, 164. Consider all possible samples of size 2 which can be drawn from the population (a) with replacement and (b) without replacement. Find the mean and standard deviation in the population and in the sampling distribution of means. Verify the formulas for $\mu_{\bar{x}}$ and $\sigma_{\bar{x}}$
5	A population consists of four numbers 125, 150, 175, 200. Consider all possible samples of size 2 which can be drawn from the population (a) with replacement and (b) without replacement. Find the mean and standard deviation in the population and in the sampling distribution of means. Verify the formulas for $\mu_{\bar{x}}$ and $\sigma_{\bar{x}}$
6	A population has a mean 128 and standard deviation 22. Find the mean and standard deviation of $\bar{X}$ for samples of size 36. Find the probability that the mean of a sample of size 36 will be (i) within 10 units of the population mean (ii) more than 10 units of the population mean (iii) Between 10 and 15 units of the population mean
7	Suppose speeds of vehicles on a particular stretch of roadway are normally distributed with mean 36.6mph and standard deviation 1.7mph. Find the probability that the mean speed $\bar{X}$ of 20 randomly selected vehicles is (i) between 35 and 40mph. (ii) Above 36mph. (iii) Below 37mph
8	The daily wages of 3000 workers in a factory are normally distributed with mean equal to Rs 68 and standard deviation equal to Rs 3. If 80 samples consisting of 25 workers each are obtained, what would be the mean and standard deviation of the sampling distribution of means if sampling were done (a) with replacement (b) without replacement? In how many samples will the mean is likely to be (i) between Rs 66.8 & Rs 68.3 and (ii) less than Rs 66.4?
9	The average height of male students in a university is 170 cm with a standard deviation of 6 cm. A random sample of 25 students is selected. (i) Calculate the mean and standard deviation of the sampling distribution. (ii) What is the probability that the sample mean height is less than 168 cm? (iii) What is the probability that the sample mean lies between 169 and 172 cm?

10	A population of students has a mean test score of 72 with a standard deviation of 8. A random sample of 64 students is taken. (i) What are the mean and standard deviation of the sample mean? (ii) What is the probability that the sample mean lies between 70 and 74? (iii) Find the probability that the sample mean is greater than 75.
11	A recent study asked working adults if they worked most of their time remotely. The study found that 30% of employees spend the majority of their time working remotely. Suppose a sample of 150 working adults is taken. (i) What is the mean and standard deviation of the sample proportion? (ii) What is the probability that at most 27% of the workers in the sample work remotely most of the time? (iii) What is the probability that at least 51 of the workers in the sample work remotely most of the time? (iv) What is the probability that between 32% and 35% of the workers in the sample work remotely most of the time?
12	According to a recent study, 17.5% of the adult population of Canada are smokers. Suppose a random sample of 200 adult Canadians is taken. Determine (i) The mean and standard deviation of the sample proportion. (ii) What is the probability that less than 32 of the adults in the sample are smokers? (iii) The probability that more than 20% of the adults in the sample are smokers? (iv) The probability that between 34 and 44 of the adults in the sample are smokers?
13	According to a health survey, 12% of adults in a certain city are considered obese. Suppose a random sample of 250 adults from this city is selected. Determine: (i) The mean and standard deviation of the sample proportion. (ii) What is the probability that fewer than 25 of the adults in the sample are obese? (iii) The probability that more than 15% of the adults in the sample are obese? (iv) The probability that between 28 and 38 of the adults in the sample are obese?
14	1. A report states that 22% of college students use public transportation regularly. A random sample of 300 students is selected. Determine: (i) The mean and standard deviation of the sample proportion. (ii) What is the probability that fewer than 60 students in the sample use public transportation regularly? (iii) The probability that more than 25% of the students in the sample are regular public transport users? (iv) The probability that between 58 and 75 of the students in the sample are regular public transport users?
15	A study finds that 9% of the population is left-handed. A teacher randomly selects 180 students from her district. Determine: (i) The mean and standard deviation of the sample proportion. (ii) What is the probability that fewer than 10 of the students are left-handed? (iii) The probability that more than 12% of the students are left-handed? (iv) The probability that between 14 and 20 of the students are left-handed?
16	The mean score for freshmen on an aptitude test at a certain college is 540, with a standard deviation of 50. Assume the means to be measured to any degree of accuracy. Determine the probability that two groups selected at random, consisting of 32 and 50 students, respectively, will differ in their mean scores by (i) more than 20 points (ii) an amount between 5 and 10 points.
17	The average math score on a standardized test for high school juniors in a state is 620 with a standard deviation of 40. If two groups of students are selected at random one with 36 students and the other with 49 students, then determine:

	(i) The probability that the difference in their mean scores exceeds 15 points. (ii) The probability that the difference in mean scores is between 5 and 12 points
18	At School A, students score an average of 82 on a standardized science test with a standard deviation of 6. At School B, students average 79 with a standard deviation of 8. Suppose 30 students are randomly selected from each school. (i) Find the mean and standard deviation of the sampling distribution of $\overline{X}_A - \overline{X}_B$. (ii) What is the probability that School A's sample mean exceeds School B's by more than 5 points? (iii) What is the probability that the difference in sample means falls between 0 and 4 points?
19	A fast-food chain wants to compare average customer wait times at two of its locations. At Location 1, the mean wait time is 3.2 minutes and standard deviation 0.6, and at Location 2 it is 2.8 minutes and standard deviation 0.5. Random samples of 40 customers from Location 1 and 35 from Location 2 are selected. (i) What is the expected value and standard deviation of the difference in sample means $\bar{X}_1 - \bar{X}_2$? (ii) What is the probability that the average wait time at Location 1 exceeds that at Location 2 by at least 0.7 minutes? (iii) What is the probability that the sample mean wait time at Location 2 is actually greater than that at Location 1?
20	A study compares the fuel efficiency of two brands of hybrid cars. Brand A has a population mean fuel efficiency of 52 miles per gallon (mpg) with a standard deviation of 4 mpg, and Brand B has a mean of 49 mpg with a standard deviation of 5 mpg. A random sample of 36 cars from each brand is selected. (i) Find the mean and standard error of the sampling distribution of the difference in sample means $\bar{X}_A - \bar{X}_B$.. (ii) What is the probability that Brand A's sample mean exceeds Brand B's by more than 4 mpg? (iii) What is the probability that the difference in sample means is less than 1 mpg?
21	A quality control manager takes a survey of 500 phone batteries from factory A, where 5% of the batteries have a defect. The manager also takes an independent survey of 250 batteries from factory B, where 9% of the batteries have a defect. The manager will then look at the difference $B - A$ between the proportions of defective batteries in each sample. What are the mean and standard deviation of the sampling distribution of the difference in sample proportions? What is the probability that the proportion of defective batteries of A will exceed that of batteries of B by 2% or more
22	In a survey in 2006, 95% of new cars came with a spare tire. In 2017, 72% came with a spare tire. Suppose a researcher takes separate random samples of 250 cars made in each year, then looks at the difference between the sample proportions $P_{2006} - P_{2017}$ of cars with spare tires in each sample. What are the mean and standard deviation of the sampling distribution of $P_{2006} - P_{2017}$? What is the probability that proportion of cars having a spare tire in 2006 will exceed than that in 2017 by 20% or more?
23	In Twiggy National Park, 35% of all eagles are male and in Dusty National Park, 20% of all eagles are male. A sample of 40 eagles is taken from Twiggy National Park and a sample of 50 eagles is taken from Dusty National Park. Find the probability that the proportion of male eagles sampled in Twiggy National Park is less than the proportion of male eagles sampled in Dusty National Park

24	A 2023 survey reports that 90% of electric vehicles (EVs) in Europe have fast -charging capability, while in 2015 only 70% had it. Suppose random samples of 120 EVs from 2023 and 150 from 2015 are taken. (i) Find the mean and standard deviation of the difference in sample proportions $\hat{p}_{2023} - \hat{p}_{2015}$. (ii) What is the probability that the 2023 sample shows at least a 15% increase over 2015?
25	At a university, 60% of science majors and 50% of humanities majors report doing internships. Suppose samples of 180 science and 200 humanities students are taken. (i) Find the mean and standard deviation of the difference in sample proportions $\hat{p}_{\text{science}} - \hat{p}_{\text{humanities}}$? (ii) What is the probability that the observed difference is less than 5%?