BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF COMMERCE

DEPARTMENT OF ECONOMICS

PROGRAMMES: BSc HONOURS DEGREE IN ECONOMICS

EC 108: STATISTICS FOR ECONOMISTS 2

DURATION: 3 HOURS NOV 2024

INSTRUCTIONS:

1. Attempt all questions.
2. Each question carries 25 marks.
3. NO CELLPHONES ALLOWED IN THE EXAMINATION ROOM.

Question 1

a. Suppose you have a finite population with five members given as P, Q, R, S, and T. You are asked to use simple random sample to select samples of size 3.

   i. List the any 10 samples that can be independently drawn from this population. **(3 marks)**

   ii. Using simple random sampling, what is the probability that each sample of size 3 is selected? **(3 marks)**

   iii. Assume random number 1 corresponds to P; random number 2 corresponds to Q, and so on. List the simple random sample of size 2 that will be selected by using the random digits in the parenthesis (8 0 5 7 5 3 2) **(3 marks)**

b. Explain any three other sampling methods besides simple random sampling and explain the rationale behind their use. **(7 marks)**

c. Suppose you have selected a random sample of n=36 observations from population with mean equal to 80 and standard deviation equal to *6*. It is known that the population is not extremely skewed.

i. Sketch the relative frequency distributions for the population and for the sampling distribution of the sample mean, $\overline{X}$ **(4 marks)**

ii. Find the probability that $\overline{X}$ will be larger than 82. **(5 marks)**

Question 2

The average weight for male wrestlers is 95kg and the average weight for female wrestlers is 106kg. Using these values as the population means for men and women and assuming that the population standard deviation is 14kgs for both wrestlers. Suppose a random sample of 30 male wrestlers and another simple random sample of 45 female wrestlers will be taken.

i. Show the sampling distribution of for male wrestlers. **(4 marks)**

ii. What is the probability that the sample mean is within 3kgs of the population mean for the sample of male wrestlers? **(4 marks)**

iii. What is the probability that the sample mean is within 3kgs of the population mean for the sample of female wrestlers? **(4 marks)**

iv. In which case, part (ii) or part (iii), is the probability of obtaining a sample mean within 3kgs of the population mean higher? Why? **(5 marks)**

v. Show mathematically that $E(\overline{X}) = \mu$ and $\sigma_{\overline{X}} = \frac{\sigma}{\sqrt{n}}$ for an infinite population. **(8 marks)**

Question 3

a. In an attempt to find fertility rates per litter of imported pig breed, a simple random sample with n =54 provided a sample mean 12.5 and a sample standard deviation of 4.4. The country of origin for the pig breed argues that the fertility standard deviation is 3 piglets.

i. Suppose you doubt the assertion about the standard deviation from the country of origin, develop a 95% confidence interval for the population mean. **(4 marks)**

ii. Develop a 99% confidence interval for the population mean. What happens to the margin of error and the confidence interval as the confidence level is increased? **(4 marks)**

iii. How large a sample should be selected to provide a 95% confidence interval with a margin of error of 10? Assume that the population standard deviation is 4. **(4 marks)**

b. In an attempt to determine the quality of chicks from a poultry breeder, a simple random sample of 800 chicks indicated that 240 chicks were defective.

i. Provide a 90% confidence interval for the non defective population proportion. **(4 marks)**

ii. Provide a 95% confidence interval for the defective population proportion. **(4 marks)**

iii. Suppose the permitted defective proportion for chicks is 0.35, what sample size should be drawn to provide a 95% confidence interval with a margin of error of 0.05?**(5 marks)**

Question 4

a. Suppose you are hired for production consultancy by a local firm. A new production method is being proposed but will only be implemented if a hypothesis test supports the conclusion that the new method reduces the mean operating cost per hour.

   i. State the appropriate null and alternative hypotheses if the mean cost for the current production method is $450 per hour. **(4 marks)**

   ii. What is the Type I error in this situation? What are the consequences of making this error? **(5 marks)**

   iii. What is the Type II error in this situation? What are the consequences of making this error? **(5 marks)**

b. A local car dealer advertises that mean fuel mileage for his new hybrid luxury SUV vehicle is 33.8km per liter of city driving. You find that on social media people doubt the claim anticipating that the mean fuel mileage is well below the one advertised.

   i. Develop appropriate hypotheses such that rejection of null hypothesis will support the dealer's claim. **(4 marks)**

   ii. A sample of 40 cars provides a sample mean mileage of 23.1km with a sample standard deviation of 4.9km. Calculate the *p*-value and comment on whether you could reject the null hypothesis at the 5% significance level. **(7 marks)**

END OF PAPER