

Technical Graduates Selection Examination, 2007

Statistics Paper III: Subject Specialization

Marks 100

Time: 150 minutes

Section A

Part a. Tick on the box corresponding to the right answer (30 marks)

1. Let Ω be the certain event. For a probability function the following is true

- $p(\Omega) = 0$
- $p(\Omega) = 1$
- None of the above

2. If two events A and B are independent then the following property is true

- $p(A \cap B) = p(A/B).p(B)$
- $p(A \cap B) = p(A).p(B)$
- None of the above

3. The mean of a Bernoulli distribution is

- $1-p$
- P
- None of the above

4. The mean of a binomial distribution is

- np
- P
- None of the above

5. The variance of a Poisson distribution is

- λ

- λ^2
- None of the above

6. The standard deviation (σ) of the normal distribution has the following property

- $\sigma < 0$
- $\sigma > 0$
- None of the above

7. The exponential distribution is usually used to model for

- Lifetimes of various things
- Certain happenings
- None of the above

8. The coefficient of variation (CV) is defined as

- $CV(y) = \frac{\bar{y}}{S}$
- $CV(y) = \frac{S}{\bar{y}}$
- None of the above

9. The following property of Jensen's Inequality is true

- $E[g(x)] \leq g(E[x])$
- $E[g(x)] \geq g(E[x])$
- None of the above

10. The following property of expectation is true

- $E(cg(x)) = cE(g(x))$
- $E(cg(x)) = E(g(x))$
- None of the above

11. Let X be a random variable. Then the following statement is true

$Var(aX + b) = a^2Var(X) + b^2$

$Var(aX + b) = a^2Var(X)$

None of the above

12. Let X have mean μ and standard deviation σ . Define $Z = \frac{X - \mu}{\sigma}$ is the standard normal distribution. Then the following is true

$E(Z) = 1$

$E(Z) = 0$

None of the above

13. The following property of correlation coefficient is true

$|\rho_{x,y}| > 1$

$|\rho_{x,y}| \leq 1$

None of the above

14. Given a sequence X_1, X_2, \dots, X_n , of random variables, we say that X_n converges almost surely to X if

$p\left\{\lim_{n \rightarrow \infty} |X_n - X| = 0\right\} = 1$

$p\left\{\lim_{n \rightarrow \infty} |X_n - X| = 0\right\} = 0$

None of the above

15. Given a sequence X_1, X_2, \dots, X_n , of random variables, we say that X_n converges in probability to X if for any $\varepsilon > 0$

$\lim_{n \rightarrow \infty} p\{|X_n - X| < \varepsilon\} = 0$

$\lim_{n \rightarrow \infty} P\{|X_n - X| < \varepsilon\} = 1$

None of the above

16. If p is the proportion of voters in the population that will trust the new upcoming government, then the maximum variation will be at

$p = \frac{1}{16}$

$p = \frac{1}{4}$

$p = \frac{1}{2}$

17. Let X_1, X_2, \dots, X_n be a random sample from the cdf (pop'n) F , whose mean is μ and variance σ^2 . Then

$E(\bar{x}) = \mu$

$E(\bar{x}) = \frac{\mu}{n}$

None of the above

18. Let X_1, X_2, \dots, X_n be a random sample from the cdf (pop'n) F , whose mean is μ and variance σ^2 . Then

$Var(\bar{x}) = \sigma^2$

$Var(\bar{x}) = \frac{\sigma^2}{n}$

None of the above

19. The sample mean \bar{x} is a

Estimate

Parameter

None of the above

20. One major difference of inference in survey sampling from "classical" inference is that the population it deals with is

- Infinite
- Finite
- None of the above

21. High precision for an estimator can be viewed in terms of

- High MSE
- Low MSE
- None of the above

22. If an estimator becomes exactly equal to the population value when $n=N$, then the estimator is

- Consistent
- Efficient
- None of the above

23. In simple random sampling, the following statement is true

- Every one of distinct sample has an equal chance of being selected
- Every one of distinct units has an equal chance of being selected
- None of the above

24. If $E(\hat{\theta}) = \theta$, then the following is true

- Unbiased
- Efficient
- None of the above

25. With replacement sampling is like sampling from

- Infinite population
- Finite population

None of the above

26. If the variable of interest in a survey is very rare, then the sample size required is

Very small

Very Large

None of the above

27. Systematic sampling is a type of equal probability sampling that is

Necessarily dependent on the frame

Not necessarily dependent on the frame

None of the above

28. Simple Random Sampling is appropriate sample selection scheme if the units in the population are

Heterogeneous

Homogeneous

None of the above

29. In a heterogeneous population of large size, the following is the appropriate method of sample selection

Probability proportional to size

Stratification

None of the above

30. If we want to measure the change in \bar{y} from one occasion to the next in repetitive surveys, it is advantageous to use

The same sample

Different samples

None of the above

Part b. Answer the following questions briefly (20 Marks)

1. Write down the relationship between Mean Square Error, Variance and Bias in the form of an equation in the space provided below.

2. Describe briefly why we need to estimate variation in addition to the point estimate.

3. Write briefly the factors you would take into account when choosing a sample size.

4. Justify to a politician why official statistics is important.

Section B

Answer only one of the two questions that follow (50 Marks)

1. Third year Economics students in Sherubtse College, Kanglung want to conduct a socio economic survey of Trashigang town. They have the frame which is a list of the households of the town but they do not have time and resources to interview all the households. You are being approached by them and asked to help them with an appropriate sample design (which includes both sample selection plan and estimation procedures). Discuss thoroughly how you would help them.

2. Of all the subjects (experimental design, sampling, regression, etc.) you have taken during your course, name one subject that you are most knowledgeable about. . Discuss thoroughly how you would apply that subject to a relevant Bhutanese data after you join office.