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## නව නිර්දේශය/பුதிய பாடத்திட்டம்/New Syllabus

වාාපාර සංඛ්නානය

ഖഞ്ഞികப് புள்ளிவிவரவியல்

**Business Statistics** 



පැය දෙකයි இரண்டு மணித்தியாலம் **Two hours** 

## **Instructions:**

- \* Answer all questions.
- \* Write your Index Number in the space provided in the answer sheet.
- \* Statistical tables will be provided. Use of calculator is not allowed.

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- \* Instructions are given on the back of the answer sheet. Follow those carefully.
- \* In each of the questions 1 to 50, pick one of the alternatives from (1), (2), (3), (4), (5) which is correct or most appropriate and mark your response on the answer sheet with a cross (x) on the number of the correct option in accordance with the instructions given at the back of the answer sheet.
- 1. Which of the following statements is true?
  - (1) Making a statistical conclusion with probable error is an example for misusing of statistics.
  - (2) The difference between the population parameter and the estimate for the parameter is called the sampling error.
  - (3) Non-response error is an example for non-sampling errors.
  - (4) If in a study answers are needed to many complicated questions, self-enumeration method is the most suitable method.
  - (5) In focus group interviews, participants have to answer questions included in a pre-prepared document.
- 2. Consider the following statements.
  - A Pie diagram is a circular representation of the data which can also be represented by a single bar of a percentage component bar-chart.
  - B A Lorenz curve can not be constructed when the income is given in the form of a frequency distribution.
  - C If the Gini coefficient is zero, it indicates that everyone in a population receives the same amount of income.

The true statement/s from the above is/are,

(1) only A

(2) only C

(3) only A and B

(4) only A and C

- (5) all A, B and C
- 3. Consider the following statements regarding scales of measurements.
  - A Categorising of social classes as upper class, middle class and lower class is an example for nominal scale.
  - B The main difference between ordinal scale and interval scale is that interval scale uses unit of measurements.
  - C The class interval in a frequency distribution is an example for interval scale.

The true statement/s from the above is/are,

(1) only B

(2) only A and B

(3) only A and C

(4) only B and C

(5) all A, B and C

- 4. Which of the following statements is true?
  - (1) Stem-and-leaf diagram cannot be constructed for observation with decimal values.
  - (2) If the boxes of box-and-whiskers plot are equal, the distribution is exactly symmetric.
  - (3) In a box-and-whiskers plot, the right whisker contains the largest 25% of values.
  - (4) Multiple bar diagram is an alternative way of representing data which can also be represented by component bar chart.
  - (5) If class intervals are unequal, the area under the frequency polygon is not equal to the sum of the areas of the rectangles in a histogram.
- 5. Milk is sold at the prices of 60, 100, 120 and 150 rupees per liter in four consecutive different months respectively. If a family spent Rs. 600 on milk per month in the four months, the average price in rupees per liter of milk for the family per month was,
  - (1) Rs. 96.00
- (2) Rs. 102.00
- (3) Rs. 107.50
- (4) Rs. 110.00
- (5) Rs. 150.00
- **6.** The geometric mean of 10 observations on a certain variable was calculated as 14.2. It was later discovered that the observed value 21 had been taken as 12 in calculation. The corrected geometric mean is,
  - (1)  $14.2(1.75)^{\frac{1}{10}}$

(2)  $14.2(0.57)^{\frac{1}{10}}$ 

 $(3) \quad (24.85)^{\frac{1}{10}}$ 

(4) 8.11

- (5) 24.85
- 7. Consider the following statements about dispersion.
  - A Mean deviation is less affected by the extreme values as compared to standard deviation.
  - B If a constant is added to all values of a data set, the coefficient of variation of the resulting values will not change.
  - C Both variance and standard deviation have same unit of measurements.

The true statement/s from the above is/are,

(1) only A

(2) only A and B

(3) only A and C

(4) only B and C

- (5) all A, B and C
- **8.** Consider the following stem-and-leaf diagram.

0	8							
1	3	4	5					
2	0	1	2	3	3	5		
3	0	0	1	4	6	7	8	8
4	0	0	2	4	7	7	8	8
0 1 2 3 4 5	0	2	3					

For this distribution Kelly's coefficient of skewness is,

- (1) 0.29
- (2) 0.23
- (3) 0.22
- (4) 0.22
- (5) 0.23
- 9. The value 5.1 is subtracted from each of 100 observations. The sum of the deviations and the sum of square of deviations are -10 and 401 respectively. The coefficient of variation of the distribution is
  - (1) 13%
- (2) 38%
- (3) 40%
- (4) 78%
- (5) 80%

- 10. Which of the following statements is false?
  - (1) The quartile deviation is not affected by the extreme values.
  - (2) The sum of deviation of a data set from its mean is always zero.
  - (3) Pearson's coefficient of skewness cannot be calculated when a distribution has open-ended classes.
  - (4) For a symmetric distribution the median is the mean of the first quartile and the third quartile.
  - (5) For a normal distribution the percentage kurtosis coefficient is zero.

11.	In a	distribution	Pearson's	coefficient	of	skewness	is	0.5,	the	coefficient	of	variation	is	40%	and
	the r	node is 80.	The mean	of the dis	tril	oution is,									

- (1) 40
- (2) 100
- (3) 160
- (4) 200

(5) 320

12. Bowley's coefficient of skewness for a certain distribution is -0.8. If the sum of the lower and upper quartiles is 100 and the median is 58, find the lower and upper quartiles.

- (1)  $Q_1 = 20$ ,  $Q_3 = 80$
- (2)  $Q_1 = 25$ ,  $Q_3 = 75$
- (3)  $Q_1 = 30$ ,  $Q_3 = 70$
- (4)  $Q_1 = 35$ ,  $Q_3 = 65$
- (5)  $Q_1 = 40$ ,  $Q_3 = 60$
- 13. Which of the following statements is true about regression and correlation?
  - (1) High correlation between X and Y implies that X causes change in Y and Y causes change in X.
  - (2) If an additional independent variable is included in a simple linear regression equation, the error term will increase.
  - (3) If a constant is subtracted from all the values of X, the regression coefficient of Y on X will change.
  - (4) Spearman's rank correlation coefficient cannot be calculated for quantitative data.
  - (5) Spearman's rank correlation coefficient is equal to the Karl Pearson's product moment correlation coefficient between ranks.
- 14. Consider the following statements regarding the regression.
  - A If the regression of Y on X is simple linear, the expected value of Y vary exactly on a straight line when X vary.
  - B If the regression equation of Y on X is  $\hat{Y} = -10 + 5x$ , then the regression equation of X on Y is  $\hat{X} = 0.2y 2$ .
  - C If the estimated regression equation is  $\hat{Y} = \hat{\beta}_0 + \hat{\beta}_1 x_1 + \hat{\beta}_2 x_2$ , the coefficient  $\hat{\beta}_2$  represent the change of  $\hat{Y}$  for a unit change of  $x_2$  if  $x_1$  is kept constant.

The true statement/s from the above is/are,

(1) only A

(2) only B

(3) only A and B

(4) only A and C

- (5) all A, B and C
- 15. The fitted regression equation for paddy yield (Y) on fertilizer (X) is given below.

$$\hat{Y} = 36.4 + 0.05x$$

The true statement with respect to the above equation is,

- (1)  $\hat{Y}$  is the paddy yield when fertilizer level is x.
- (2)  $\hat{Y}$  is the expected value of paddy yield when fertilizer level is x.
- (3)  $\hat{Y}$  is the estimate of the expected value of paddy yield when fertilizer level is x.
- (4) If the fertilizer level is increased by one unit, the paddy yield will increase by 36.45 units.
- (5) If the fertilizer level is increased by one unit, the paddy yield will increase by 36.4 units.
- 16. Consider the following statements about the approaches to probability.
  - A Subjective probability approach is more appropriate when the experiment cannot be repeated.
  - B If the random experiment is to select an item at random from a lot, the probability of an event can be obtained without performing the experiment.
  - C The probability of an event obtained under the relative frequency approach may be different from the true probability of the event.

The true statement/s from the above is/are,

(1) only B

(2) only A and B

(3) only A and C

(4) only B and C

(5) all A, B and C

of A is,

(1)  $\frac{1}{5}$ 

that there are 2 boys and 1 girl or 1 boy and 2 girls.

(2)  $\frac{3}{10}$ 

17. In a group there are 3 boys and 2 girls. If 3 are selected at random from this group, find the probability

18. Suppose A and B are two independent events. The probability that both A and B occur is  $\frac{1}{8}$  and the probability that neither of them occur is  $\frac{3}{8}$ . If P(A) > P(B), the probability of the occurrence

19. Suppose that A and B are any two events. The probability that both A and B occur, the probability that A occurs and B does not occur, and the probability that B occurs and A does not occur are

all equal to k. The probability that at least one event occurs from the events A and B is,

(2)  $\frac{1}{4}$  (3)  $\frac{1}{3}$  (4)  $\frac{1}{2}$  (5)  $\frac{3}{4}$ 

(3)  $\frac{1}{2}$ 

	(1) k	(2) 2k	(3)	3k	(4) $3k^2$	(5) $k^3$
20.	If A and B are any	two events with P	(A) =	$= p_1, \ P(B) = p_2$	and $P(A \cap B) = p_3$	then $P(A' B')$ is,
	$(1) \ \frac{p_1 + p_2 - p_3}{1 - p_1}$		(2)	$\frac{p_1 + p_2 - p_3}{1 - p_2}$		
	$(3) \ \frac{1 - p_1 - p_2 + p_3}{1 - p_2}$		(4)	$\frac{1 - p_1 - p_2 + p_3}{1 - p_1}$	-	
	$(5) \ \frac{1 - p_1 - p_2 - p_3}{1 - p_2}$					
21.	Consider the following	ng statements.				
	the probable $B$ - The expect $C$ - If $X$ is a	bilities of possible ted value of a randor random variable an	value $n var$ $nd c$	es of $X$ . iable is the valu	e which occurs with	e with weights being maximum probability. $= cVar(X) \pm d$ .
	The true statement/s (1) only A (3) only A and C (5) all A, B and G		(2)	only A and B only B and C		
22.	The manufacturer of accepts a box of 100 probability that a box	nails if it contains of nails will be a	not ccep	more than 4 detected by the buye	lefective nails. Fin er.	d the approximate
	(1) 0.1088	(2) 0.2424	(3)	0.5438	(4) 0.7576	(5) 0.8912
23.	A student sit for a test student answers each of the must get at least 6	question by selecting 0% correct answers.	one Wha	answer randoml	y as the correct ans ility that the studen	wer. To pass the exam t passes the exam?
	(1) 0.0064	(2) 0.0328	(3)	0.9672	(4) 0.9936	(5) 0.9991
24.	The yield of Potato standard deviation 30	-				th mean 650kg and
	(1) 578kg	(2) 612kg	(3)	688kg	(4) 719kg	(5) 962kg
25.	In an area 50% of t persons selected from the proposal?	_		_		
	(1) 0.1587	(2) 0.1841	(3)	0.3159	(4) 0.3413	(5) 0.3682
						[see page five

- 26. Consider the following statements about the cluster sampling.
  - A If the variation among clusters is small cluster sampling is more suitable.
  - B Cluster sampling can be used even when a complete sampling frame is not available.
  - C If the intra-cluster correlation coefficient is close to 1 cluster sampling is as efficient as simple random sampling.

The true statement/s from the above is/are,

(1) only A

(2) only A and B

(3) only A and C

(4) only B and C

- (5) all A, B and C
- 27. Consider the following statements about sampling.
  - A The results of a sample survey may be more reliable than the results of a whole population survey.
  - B Method of systematic sampling can be used only when  $\frac{N}{n}$  is an integer.
  - C In systematic sampling the standard error cannot be calculated using a single sample.

The true statement/s from the above is/are,

(1) only A

(2) only A and B

(3) only A and C

(4) only B and C

- (5) all A, B and C
- 28. In simple random sampling with replacement from a population with the population proportion  $\pi$  the standard error of the sample proportion of sample size n is,

$$(1) \sqrt{\left(\frac{N-n}{N-1}\right)\frac{\pi(1-\pi)}{n}}$$

$$(2) \quad \frac{\pi(1-\pi)}{\sqrt{n}}$$

$$(3) \ \frac{\sqrt{\pi(1-\pi)}}{\sqrt{n}}$$

(4) 
$$\sqrt{\left(\frac{N-n}{N}\right)\frac{\pi(1-\pi)}{n}}$$

$$(5) \quad \frac{\sqrt{\pi(1-\pi)}}{n}$$

- **29.** Which of the following statements is true?
  - (1) If the sample size n is small t-distribution depends on the mean of the normal distribution.
  - (2) The standard deviation of a sampling distribution of an estimator is called the standard error of the estimator.
  - (3) When degrees of freedom increases  $\chi^2$  distribution becomes more skewed.
  - (4) If the sample size is small the sampling distribution of the sample proportion is unknown.
  - (5) The central limit theorem can be used only for deciding the sampling distribution of the sample mean.
- 30. Which of the following statements is true?
  - (1) If  $\hat{\theta}_1$  and  $\hat{\theta}_2$  are two unbiased estimators for the parameter  $\theta$ , the efficiency of  $\hat{\theta}_1$  relative to  $\hat{\theta}_2$  is defined as  $\frac{Var(\hat{\theta}_1)}{Var(\hat{\theta}_2)}$
  - (2) A biased estimator cannot be a consistent estimator.
  - (3) If the population mean  $\mu$  is known,  $\frac{1}{n}\sum_{i}(x_i \mu)^2$  is an unbiased estimator for population variance  $\sigma^2$ .
  - (4) The difference between the population parameter and the estimate for the parameter is called bias of the estimator.
  - (5) Any function of a random sample is called a statistic.
- 31. It is required to estimate population proportion  $\pi$  from the sample proportion p with maximum probable error within the range  $\pi \pm 0.02$  with probability 0.9544. What is the sample size required to satisfy this requirement?
  - (1) 900
- (2) 1681
- (3) 1785
- (4) 2401
- (5) 2500

32. In a random sample of size 25 from a normal population with mean  $\mu$  and unknown variance  $\sigma^2$ , the sample mean was  $\overline{x} = 60$  and the sample variance  $s^2 = 16$ . If the calculated confidence interval for  $\mu$  is (57.76, 62.24), what is the confidence level?

(1) 80%

- (2) 90%
- (3) 95%
- (4) 98%
- (5) 99%

33. Which of the following statements is false?

- (1) The variable which is used to construct confidence intervals for a population parameter contains the parameter and a point estimator for the parameter.
- (2) The confidence interval with 99% confidence level is better than confidence interval with 95% confidence level.
- (3) A confidence interval for the difference of population means  $\mu_1 \mu_2$  is obtained by adjusting the point estimator  $\bar{X}_1 \bar{X}_2$  for its probable error.
- (4) For the mean of a normal population there can be more than one 95% confidence intervals.
- (5) The 95% confidence interval for the mean of a normal population with unknown variance is wider than 95% confidence interval with known variance.
- 34. Consider the following statements about testing hypotheses.
  - A The hypothesis test with the minimum probability of type II error for a given value of probability of type I error is called the most powerful test.
  - B The probability of accepting  $H_1$  hypothesis when  $H_0$  hypothesis is false is called the power of the test.
  - C The sampling distribution of a test statistic depends on the population parameter being tested.

The true statement/s from the above is/are,

(1) only A

(2) only A and B

(3) only A and C

(4) only B and C

- (5) all A, B and C
- 35. For testing the population proportion  $H_0$ :  $\pi = 0.1$  against  $H_1$ :  $\pi \neq 0.1$  at 5% significance level a random sample of size 100 was obtained. If the sample proportion is p = 0.16, the conclusion is,
  - (1) reject  $H_0$  since p-value = 0.0228 < 0.05
  - (2) reject  $H_0$  since p-value = 0.0456 < 0.05
  - (3) do not reject  $H_0$  since p-value = 0.0526 > 0.05
  - (4) do not reject  $H_0$  since p-value = 0.2104 > 0.05
  - (5) reject  $H_0$  since Z = 1.62 < 1.96
- 36. The mean and variance of the life time of type A bulbs of a random sample of size 120 were  $\bar{x} = 945$  and  $s_1^2 = 240$  and the mean and variance of the life time of type B bulbs of a random sample of 100 were  $\bar{y} = 940$  and  $s_2^2 = 200$ . If the critical region for testing the equality of population means  $H_0$ :  $\mu_1 = \mu_2$  against  $H_1$ :  $\mu_1 > \mu_2$  is given by  $\bar{X} \bar{Y} > 4$ , the probability of type I error is
  - (1) 0.0228
- (2) 0.0250
- (3) 0.1103
- (4) 0.3897
- (5) 0.4772
- 37. The critical region for testing mean of a normal population  $H_0$ :  $\mu$ =120 against  $H_1$ :  $\mu$ =122 by taking a random sample of size 60 is given by  $\bar{X} > 121.4$ . If the population variance is  $\sigma^2 = 240$  the power of the test is
  - (1) 0.1179
- (2) 0.2420
- (3) 0.3821
- (4) 0.6179
- (5) 0.8821
- 38. The number of deaths occurred in 50 days in a certain hospital are given in the following table.

No. of deaths	0	1	2	3	4	5	6	7
No. of days	2	8	12	13	8	4	2	1
<b>Expected frequency</b>	3	8	11	11	8	5	3	1

The critical value for testing at 5% significance level whether the poission distribution with mean 3 is the relevant distribution for this data is,

- (1) 7.82
- (2) 9.50
- (3) 11.10
- (4) 12.60
- (5) 14.10

39. Three samples of size 5 each were randomly taken from three varieties of paddy to test whether the mean yields are equal. The calculated sum of squares are as follows;

Total sum of squares SST=224

Between varieties of paddy sum of squares SSB=128

The critical region for testing the hypothesis that population means are equal at 5% level is given by,

(1) F = 5.34 > 3.49

(2) F = 8 > 3.89

(3) F = 8 < 19.4

(4) F = 8 > 3.34

- (5) F = 8.67 > 3.81
- 40. The mean of the first five years of a time series from 2010 to 2019 is 32.6 and the mean of the second five years is 42.6. The trend equation obtained by the method of semi-average is,
  - (1)  $\hat{Y} = 26.6 + t$

(2)  $\hat{Y} = 26.6 + 2t$ 

 $\hat{Y} = 29.24 + 1.67t$ 

(4)  $\hat{Y} = 32.6 + 2t$ 

- (5)  $\hat{Y} = 42.6 + t$
- 41. Consider the following statements about moving averages.
  - A Moving averages may generate movements which were not present in the original data.
  - B Moving averages are not useful in forecasting the values of a variable on the basis
  - C Moving averages cannot be used to estimate trend if the shape of the appropriate trend line or curve is unknown.

The true statement/s from the above is/are,

(1) only A

(2) only A and B

(3) only A and C

(4) only B and C

- (5) all A, B and C
- **42.** In a time series with no cyclical variation from 2010 to 2014, the five year totals of trend eliminated percentage for each quarter are given below,

$Q_1$	$Q_2$	$Q_3$	$Q_4$
450	550	525	500

The seasonal indices for the first quarter and the third quarter are approximately given by,

- (1) 89, 104
- (2) 90, 105
- (3) 91,106
- (4) 92, 107
- (5) 101, 106
- **43.** Trend line fitted for the yearly data of the time series 2010 2014 is given by  $\hat{Y} = 50 + 16t$  (t = 0 for 2012). If the actual value for the second quarter of the year 2013 is 72, the trend eliminated percentage value for this quarter is approximately
  - (1) 103
- (2) 104
- (3) 109
- (4) 113
- (5) 116
- 44. If all the sample points lie within control limits in  $\overline{X}$  chart but exhibit some trend by these points it indicates that,
  - (1) process is in control.
  - (2) presence of chance causes.
  - (3) variability has increased.
  - (4) presence of assignable causes.
  - (5) presence of errors in selecting random samples.
- 45. If the inspection unit varies in size, the statistical chart which should be used to control the number of defects per unit of a product is,
  - (1) p chart
- (2) *C* chart
- (3) U chart (4)  $\overline{X}$  chart (5) np chart

**46.** Consider the following statements about *OC*-curve.

- A OC curve shows the ability of an acceptance sampling plan to distinguish between good lots and bad lots.
- B If the OC-curve for a product is not satisfactory it can be improved by changing the sample size and acceptance number.
- C OC-curve represents the probability of rejecting the lot for variations in the fraction defective in the lot.

The true statement/s from the above is/are,

(1) only A

(2) only A and B

(3) only A and C

(4) only B and C

- (5) all A, B and C
- 47. Consider an accepting sampling plan with N=1000, n=100 and acceptance number c=1. If AQL = 0.01 and LTPD = 0.07, the respective consumer's risk and producer's risk are,
  - (1) 26.42%, 0.73%

(2) 26.42%, 99.27%

(3) 36.79%, 0.09%

(4) 63.21%, 0.09%

- (5) 73.58%, 0.73%
- 48. A certain firm expects its sale for an item to increase by 50% in next year. If the aim of the firm is to double the gross income, by what percentage should it increase the selling price?
  - (1) 30%
- (2)  $33\frac{1}{3}\%$
- (3) 50%
- (4) 100%
- (5) 150%

- **49.** Consider the following statements about index numbers.
  - A Marshall-Edgeworth index satisfies the time reversal test but it does not satisfy the factor reversal test.
  - B In a situation where prices are increasing Laspeyers's price index tends to be smaller than Paasche's price index.
  - C The simple aggregate price index does not take into account the relative importance of various commodities.

The true statement/s from the above is/are,

(1) only A

(2) only C

(3) only A and B

(4) only A and C

- (5) all A, B and C
- 50. Two raw materials (I and II) are used in different proportions for the production of goods A and B, but the price of each raw material is equal for both products.

	Product A	Product B
Weight for raw material I (w <sub>1</sub> )	60	70
Weight for raw material II (w <sub>2</sub> )	40	30
Index of production Cost	170	165

The price indices for raw material I and II are respectively,

- (1) 15, 20
- (2) 50,45
- (3) 64.5, 187.5 (4) 150, 200
- (5) 285, 235