ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
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Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka
ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
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අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2017 අගෝස්තු
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2017 ஆகஸ்ற்
General Certificate of Education (Adv. Level) Examination, August 2017

ව්‍යාපාර සංඛ්‍යානය	I	
வணிகப் புள்ளிவிவரவியல்	I	**31 E I**
Business Statistics	**I**	

පැය දෙකකි
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. Calculators are **not** allowed.
* 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 (×)** 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) When the reliable secondary data are available, there is no need to collect primary data.
   (2) The subject of statistics may be regarded as the study of 'variation'.
   (3) Both the sampling errors and the non-sampling errors can be controlled by employing more supervisors.
   (4) Pilot survey is conducted only for testing a survey questionnaire.
   (5) The non-response rate in mailed questionnaire method is usually higher than that of interviewer method.

2. Which of the following statement/s is/are true?
   A - For the qualitative data such as honesty and intelligence the mode is the most appropriate average.
   B - Z-chart is used for presenting the observed data, cumulative data and the totals in the same chart.
   C - Profile chart is used for comparing a specific situation with the common situation.

   (1) A only   (2) A and B only   (3) A and C only   (4) B and C only   (5) All A, B and C

3. The following stem and leaf diagram provides the number of days needed to settle the medical insurance claims.

Stem	Leaf
4	4
5	5, 7
6	2, 3, 4, 5
7	1, 3, 4, 5, 6, 7, 8
8	0, 1, 2, 3, 4, 5, 9
9	1, 2, 4, 5, 6, 8, 9

   Bowley's coefficient of skewness of the distribution is

   (1) $-\dfrac{1}{24}$ (2) $-\dfrac{1}{12}$ (3) $\dfrac{1}{12}$ (4) $\dfrac{1}{6}$ (5) $3\dfrac{1}{6}$

4. A taxi runs 4 trips to a city 50km away. The speed of the trips are 50km per hour for the first trip, 30km per hour for the second trip, 15km per hour for the third trip and 25km per hour for the fourth trip. The average speed for a trip km per hour is in
   (1) 6.25.   (2) 24.   (3) $(50\times30\times15\times25)^{1/4}$.
   (4) 25.   (5) 30.

5. The mean age of 50 workers of a particular company has been calculated as 50 years. Later, it was found that the ages 52, 60 and 28 years were recorded as 27, 35 and 33 years respectively by mistake. The correct mean age of worker should be
   (1) 31.67   (2) 39.17   (3) 46.67   (4) 49.10   (5) 50.90

6. In a certain factory, the wage per day for 100 skilled workers is Rs. 5000.00, for 150 semi-skilled workers is Rs. 3000.00 and for 250 unskilled workers is Rs. 2000.00. The average wage for a worker in this factory is
   (1) Rs. 2900.00.   (2) Rs. 3100.00.   (3) Rs. 3107.00.   (4) Rs. 3333.33.   (5) Rs. 3400.00.

7. In a moderately asymmetrical distribution, the mean and median are 270 and 283 respectively. The mode of the distribution is approximately
   (1) 231.0   (2) 276.5   (3) 278.7   (4) 289.5   (5) 309.0

8. In case of a skewed distribution, the most appropriate measures for central tendency and dispersion are respectively
   (1) mean and quartile deviation.   (2) mean and standard deviation.
   (3) median and quartile deviation.   (4) median and standard deviation.
   (5) mode and quartile deviation.

9. Which of the following statement/s is/are true?
   A - The standard deviation is the most appropriate measure for comparing the dispersion of different distributions.
   B - The median lies at the mid point of other two quartiles in a symmetric distribution.
   C - For a distribution skewed to the right mode is less than the median and median is less than the mean.
   (1) A only   (2) A and B only   (3) A and C only   (4) B and C only   (5) All A, B and C

10. If the mean, mode and coefficient of variation for a frequency distribution are 40, 48 and 80% respectively, the Karl Pearson's coefficient of skewness is
    (1) − 0.48   (2) − 0.25   (3) − 0.16   (4) 0.16   (5) 0.25

11. Which of the following statement/s is/are true about the measures of central tendency?
    A - In case of even number of observations median can be calculated only approximately.
    B - Median cannot be calculated for distributions with open-ended classes.
    C - Geometric mean is the most appropriate measure in averaging rates of increase or decrease.
    (1) A only   (2) B only   (3) A and B only   (4) A and C only   (5) All A, B and C

12. Open-ended classes are used in a grouped frequency distribution to
    (1) keep the number of classes between 5 and 20.
    (2) calculate the summary measures more easily.
    (3) make the class frequencies smaller.
    (4) reduce the number of classes with few frequencies.
    (5) draw the histogram conveniently.

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13. The coefficient of correlation between X and Y with 50 pairs of observations is 0.7. If the value of 10 is subtracted from each value of X and the value of 6 is subtracted from each value of Y, then the original value of correlation coefficient will
    (1) decrease by 10%.   (2) decrease by 6%.
    (3) increase by 16%.   (4) decrease by 16%.
    (5) remain unaffected.

14. Which of the following statement/s is/are true about the method of least squares?
    A - It is based on the assumption that the sum of squares of differences between the observed values and the errors is minimum.
    B - It is based on the assumption that the sum of the squares of differences between the observed values and the estimated values is minimum.
    C - It is based on the assumption that the sum of the squares of differences between the observed values and estimated values is maximum.
    (1) A only   (2) B only   (3) C only   (4) A and B only   (5) All A, B and C

15. Which of the following statement/s is/are **not** true about the rank correlation coefficient?
    A - It is a useful measure of association for qualitative data.
    B - It is a more accurate measure of association than Karl Pearson's coefficient of correlation.
    C - It is more appropriate for measuring association of continuous data.
    (1) A only   (2) B only   (3) A and B only   (4) A and C only   (5) B and C only

16. Which of the following statement/s is/are true about the probability?

A - Subjective probability approach is more appropriate when the experiment cannot be performed repeatedly.

B - The Mathematical definition of probability includes both classical and relative frequency definitions probability as particular cases.

C - Under the relative frequency approach to the probability, the true value of probability can be obtained by repeating the experiment a large number of times.

(1) A only   (2) B only   (3) A and B only   (4) B and C only   (5) All A, B and C

17. If A and B are any two events with $P(A)=r_1$, $P(B)=r_2$ and $P(A \cap B)=r_3$, then the value of $P(A \cup (A' \cap B))$ is

(1) $1-r_1+r_3$ (2) r_2-r_3 (3) $1-r_1-r_2+r_3$

(4) $r_1+r_2-r_3$ (5) $1-r_3$

18. If A and B are two independent events, the probability that both A and B occurs is $\frac{1}{8}$, the probability that neither of them occur is $\frac{3}{8}$ and if $P(A) < P(B)$, then the value of $P(A)$ is,

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

19. The probabilities that three men hit a target are $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{1}{6}$ respectively. If each shoots once at the target, the probability that exactly one of them hits the target is,

(1) $\frac{1}{72}$ (2) $\frac{11}{72}$ (3) $\frac{31}{72}$ (4) $\frac{3}{4}$ (5) $\frac{71}{72}$

20. The demand for a certain item per week in a store has the following probability distribution.

Demand (x)	50	60	70	80	90	100
Probability $f(x)$	0.04	0.06	0.37	0.43	0.07	0.03

The number of items that should be ordered for next week in order to be 90% sure of having enough items is

(1) 60   (2) 62   (3) 70   (4) 80   (5) 90

21. Which of the following statements is true?

(1) The value of the expectation of a discrete random variable cannot have decimal values.

(2) If X is a continuous random variable and a is a constant, $P(X=a)$ is always zero.

(3) If X is a random variable and c and d are constants, $Var(cX+d) = c^2 Var(X)+d$.

(4) If $S = \{ HH, HT, TH, TT \}$ is a sample space, $X = \{ HH, HT, TH, TT \}$ is a random variable defined on the S.

(5) If $E(X)$ is the expectation of the random variable X, then $E(X^2) = [E(X)]^2$.

22. If X has a binomial distribution with mean 4 and variance 2, the value of $P(X>2)$ is

(1) $\frac{9}{256}$ (2) $\frac{37}{256}$ (3) $\frac{219}{256}$ (4) $\frac{228}{256}$ (5) $\frac{247}{256}$

23. For which of the random variables given below, would the binomial distribution provide a satisfactory model?

(1) The number of girls in the families of farmers in a certain village

(2) The number of items required to examine until a defective one is observed from a production process

(3) The number of deaths by suicide in a large city in a certain year

(4) The number of defective items in n randomly selected items with replacement from M items K of which are defective

(5) The number of defective items in n randomly selected items without replacement from M items K of which are defective

24. Customers enter a large shop randomly at an average rate of 120 per hour. If their arrival can be assumed to have a poisson distribution the probability that during a 2 minute interval at least one customer will enter the shop is

(1) 0.0183   (2) 0.0732   (3) 0.5940   (4) 0.9667   (5) 0.9817

25. The random variable X has a normal distribution with mean 20 and variance σ^2. If $P(X > 22)=0.0228$ then the value of $P(20 < X < 21)$ is

(1) 0.1587   (2) 0.3413   (3) 0.5772   (4) 0.8413   (5) 0.9772

26. Which of the following statements is true?
    (1) The difference between the estimate of a parameter and the true value of the parameter is called the precision of the estimate.
    (2) If the sampling fraction $\frac{n}{N}$ is close to one, the finite population correction factor may be ignored.
    (3) In systematic sampling, If $\frac{N}{n}$ is not a whole number, some possible sample sizes may be smaller than n.
    (4) The errors due to using an incomplete sampling frame affects the sampling error.
    (5) Non-sampling error cannot occur in complete enumeration.

27. Which of the following statements is true?
    (1) Systematic sampling can be regarded as a cluster sampling of taking one cluster from k clusters of size n.
    (2) Cluster sampling cannot be used when there is no proper sampling frame.
    (3) When there are cyclical trends in a population, the systematic sampling is always very efficient.
    (4) In simple random sampling, a sample is selected giving each unit of the population a known probability to be selected.
    (5) If the variation within clusters is small, the cluster sampling is more effective.

28. Which of the following statements is true?
    (1) Since the sample mean $\bar{X}$ is an unbiased estimator for population mean μ, $\bar{X}^2$ is an unbiased estimator for μ^2.
    (2) If $E(\hat{\theta}) \to \theta$ and $Var(\hat{\theta}) \to 0$ as the sample size $n \to \infty$ then $\hat{\theta}$ is a consistent estimator for θ.
    (3) The value calculated using a sample to estimate a population parameter is called an estimator.
    (4) The square root of the variance of the sampling distribution of an estimator is called standard deviation of the estimator.
    (5) Any function of a random sample is called a statistic.

29. Which of the following statement/s is/are true about the sampling distributions?
    A - The tails of t-distribution have a greater probability than the tails of the standard normal distribution.
    B - The central limit theorem says that the sampling distribution of the mean of a sample taken from a normal population is normal, if the sample size is large.
    C - F-distribution is used for comparing the population means of several populations.
    (1) A only   (2) A and B only   (3) A and C only   (4) B and C only   (5) All A, B and C

30. Let $\bar{X}$ and $\bar{Y}$ be the means of random samples of sizes $n_1=30$ and $n_2=50$ from populations $N(64, 150)$ and $N(62, 200)$ respectively. The value of $P(\bar{X} > \bar{Y} + 5)$ is
    (1) 0.1179   (2) 0.1587   (3) 0.2514   (4) 0.3413   (5) 0.3821

31. If p is the sample proportion and π is the population proportion, assuming $\pi = \frac{1}{2}$. Find the value of sample size n such that $P(-0.1 < p - \pi < 0.1) = 0.9544$.
    (1) 10   (2) 25   (3) 50   (4) 100   (5) 200

32. Which of the following statement/s is/are true about the confidence intervals?
    A - The end values of an interval estimator are random variables.
    B - The width of the confidence interval for the mean of a normal population is larger when σ^2 is known than when the variance σ^2 is unknown.
    C - In a $(1-\alpha)\,100\%$ confidence interval for the mean of a normal population with known variance, the term $Z_{\alpha/2}\frac{\sigma}{\sqrt{n}}$ is called the probable error of estimator.
    (1) A only   (2) A and B only   (3) A and C only   (4) B and C only   (5) All A, B and C

33. For the population proportion π we want to test H_0: $\pi = 0.5$ against H_1: $\pi \neq 0.5$. What is the P-value of the test, if the sample proportion of a random sample of size 100 is 0.58?
    (1) 0.0548   (2) 0.1032   (3) 0.1096   (4) 0.4452   (5) 0.4528

34. Which of the following statement/s is/are true about hypothesis testing?

A - If the probability distribution of the population is completely specified when a hypothesis is true, it is a simple hypothesis.

B - A hypothesis test with smaller type I error is always better than a hypothesis test with greater type I error.

C - The P-value of a hypothesis test is a measure of the credibility of the null hypothesis.

(1) A only   (2) A and B only   (3) A and C only   (4) B and C only   (5) All A, B and C

35. Which of the following statements is true?

(1) In hypothesis testing type II error is considered as the most serious error.

(2) A confidence interval can also be constructed using the sampling distribution of a test statistic.

(3) Test statistic is defined under the assumption that the null hypothesis is true.

(4) The power of a test is related to the type I error.

(5) If the P-value for a test is 0.014, then H_0 is acceptable at the 5% level and also at 1% level.

36. Let $\overline{X}$ be the mean of a random sample of size 20 from $N(\mu, 80)$ distribution. If the critical region for testing $H_0: \mu = 65$ against $H_1: \mu = 68$ is given by $\overline{X} > 67$, the probability of type II error is

(1) 0.0987.   (2) 0.1915.   (3) 0.3085.   (4) 0.4013.   (5) 0.8085.

37. A producer says that at least 50% of customers come to super markets to buy his product. In random sample of 100 such customers, 40 say that they buy this product. The producer's claim is rejected at 5% level since

(1) $-2 < -1.96$ (2) $-2 < -1.64$ (3) $-2.04 < -1.96$ (4) $-2.04 < -1.64$ (5) $0.0456 < 0.05$

38. For 100 digits taken from a random number table had the following frequency distribution.

Digit	0	1	2	3	4	5	6	7	8	9
Frequency	11	9	10	10	9	10	9	11	11	10

For testing randomness of these digits, the value of the test statistic is

(1) 0.40   (2) 4.45   (3) 4.50   (4) 9.00   (5) 10.00

39. To compare the means of 5 normal populations with equal variances, random samples of sizes 10, 9, 10, 8, 8 were taken respectively. The F table value for testing the equality of means at 1% significant level is

(1) 3.13   (2) 3.51   (3) 3.83   (4) 9.24   (5) 13.70

40. Which of the following statement/s is/are true about the time series analysis.

A - The additive model for decomposition of time series assumes that all the four components of the time series operate independently of one another.

B - The seasonal variations are the oscillatory movements in a time series with period of oscillation greater than one year.

C - The multiplicative time series model assumes that the components are not necessarily independent and they can affect one another.

(1) A only   (2) B only   (3) C only   (4) A and C only   (5) All A, B and C

41. You are given the trend equation $Y_t = 95 + 3t$ with the origin as 1985. Time unit = 1 year. If the origin is shifted to 1993, then the new trend equation is

(1) $Y_t = 95 + 8t$ (2) $Y_t = 95 + 24t$
(3) $Y_t = 103 + 3t$ (4) $Y_t = 119 + 3t$
(5) $Y_t = 119 + 24t$

42. The sale of a company rose from Rs.60 000 in the month of August to Rs.65 000 in the month of September. The seasonal indices for these two months are 120 and 140 respectively. The owner of the company was not at all satisfied with the rise of sale in the month of September by Rs.5 000. He expected much more sales because of the seasonal index for that month. What was his estimate of sales for the month of September?

(1) Rs.70 000   (2) Rs.72 000   (3) Rs.78 000   (4) Rs.84 000   (5) Rs.91 000

43. Total of the four quarterly seasonal indices is 404. If the first quarter index is 101, what is the adjusted seasonal index for the first quarter?

    (1) 95.00   (2) 100.00   (3) 101.00   (4) 102.01   (5) 400.00

44. If in 1994, nominal GDP is Rs. 540 billion and real GDP is Rs. 500 billion, then what is the price index for 1994?

    (1) 92.5   (2) 108.0   (3) 140.0   (4) 357.0   (5) 385.0

45. Which of the following statement/s is/are true about index numbers?

    A - The simple aggregate price index is affected by the units which are used to express prices.

    B - In general, Laspeyer's price index under estimates the price changes while Paasche's price index over estimates them.

    C - Fisher's price index can be obtained if the Fisher's value index and quantity index are given.

    (1) A only   (2) A and B only   (3) A and C only   (4) B and C only   (5) All A, B and C

46. If the current year total expenditure is expressed as a percentage of total expenditure for a base year basket of goods, the resulting index is called

    (1) Value index.   (2) Paasche's price index.

    (3) Laspeyer's price index.   (4) Simple aggregate price index.

    (5) Simple price index.

47. Which of the following statements is true?

    (1) When a point represents an out of control condition, the resulting control limits will be more narrower.

    (2) Use of defective raw material is an example for cause of chance variation.

    (3) A control chart shows when to leave the process alone or when to take action to correct the process.

    (4) If one or more points lie outside the control limits, it indicates presence of random causes.

    (5) When the process is shown to be out of control, inspection of the process becomes unnecessary.

48. In statistical quality control, an acceptance sampling plan may be used to

    (1) estimate the lot quality.

    (2) control the process and improve the quality systematically.

    (3) provide a direct way to control the lot quality.

    (4) make a decision to accept or reject the lot.

    (5) confirm whether the supplier has an excellent quality history.

49. The number of defective items found during inspection of the first 10 samples of size 100 each are as follows.

    8, 9, 16, 13, 6, 12, 5, 10, 9, 12

The 3σ upper control limit of *np*-chart is

    (1) 10.00   (2) 12.85   (3) 13.00   (4) 19.00   (5) 19.49

50. Which of the following statement/s is/are true about product control?

    A - The risk of accepting a lot of unsatisfactory quality is known as the producer's risk.

    B - The maximum defective percentage included in a lot, which is considered a good lot by the consumer is called Acceptable Quality Level (AQL).

    C - The effectiveness of an accepting sampling plan can be judged by looking at the shape and the slope of an OC-curve.

    (1) A only   (2) A and B only   (3) A and C only   (4) B and C only   (5) All A, B and C

* * *

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
இலங்கைப் பரீட்சைத் திணைக்களம் இலங்கைப் பரீட்சைத் **Department of Examinations, Sri Lanka** பரீட்சைத் திணைக்களம் இலங்கைப் பரீட்சைத் திணைக்களம்
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ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
இலங்கைப் பரீட்சைத் திணைக்களம் இலங்கை **Department of Examinations, Sri Lanka** களம் இலங்கைப் பரீட்சைத் திணைக்களம்

ව්‍යාපාර සංඛ්‍යානය	II		පැය තුනයි
வணிகப் புள்ளிவிவரவியல்	II	**31 E II**	மூன்று மணித்தியாலம்
Business Statistics	II		**Three hours**

Instructions:

* Answer *five* questions selecting at least *two* questions from each part.
* Statistical tables and graph papers will be provided. Calculators are *not* allowed.

Part I

1. (a) Explain the following charts giving an example for each.
        (i)   Pie chart
        (ii) Multiple bar chart
        (iii) Profile chart   (06 *marks*)

    (b) The weights of 100 students selected from a school are given in the following frequency distribution.

Weight (kg)	30-34	35-39	40-44	45-49	50-54	55-59	60-64
No. of students	05	08	20	30	23	10	04

    (i)   Draw the histogram and frequency polygon on the same diagram.
    (ii) Draw the less than cumulative frequency curve.
    (iii) Find the mode of the distribution using the histogram.
    (iv) Find the percentage of students with the weight is greater than 47kg.   (08 *marks*)

    (c) The following table provides some figures related to the quality index measurements of a computer hard disk brand produced by three machines. The target value of the quality index is 100.

	Machine – A	**Machine – B**	**Machine – C**
Maximum value	107	116.5	116
Minimum value	85	65	90
First quartile (Q_1)	96.5	83	99.5
Second quartile (Q_2)	100	92	103
Third quartile (Q_3)	103.5	99.5	105

    Draw Box-and-Whiskers plots for these index figures of three machines and comment on the quality of hard disks produced by three machines.   (06 *marks*)

2. (a) Explain what you mean by central tendency and dispersion of a distribution.   (03 *marks*)

    (b) Describe the importance of the following measures in measuring the central tendency of a distribution.
        (i)   Geometric mean
        (ii) Harmonic mean
        (iii) Weighted average   (03 *marks*)

(c) In a one week study of the productivity of workers, the following data were obtained on the total number of acceptable items produced by 100 workers.

No. of acceptable items produced	20-29	30-39	40-49	50-59	60-69	70-79	80-89
No. of workers	04	13	18	25	19	14	07

(i) Find the mean, median, mode and standard deviation of the distribution of the acceptable items produced by workers.

(ii) Calculate Karl Pearson's coefficient of skewness and comment on the shape of the distribution.

(10 *marks*)

(d) Some measures of the monthly wages (in rupees millions) paid to the workers in two firms **X** and **Y** in the same industry are given in the following table.

	Firm-X	Firm-Y
Number of workers	525	595
Average monthly wages (Rs. million)	475	430
Variance of the wage distribution of workers	9 000	10 000

(i) Which firm pays the higher amount of monthly wages?

(ii) In which firm is there a higher variability in wages?

(04 *marks*)

3. (a) What is an index number? What are the uses of a consumer price index? (04 *marks*)

(b) The following table gives the cost of living index numbers for different commodity groups together with respective weights for 2004. (Base year=1981)

Group	Food	Clothing	Fuel and Lighting	Rent	Miscellaneous
Group Index (I)	425	475	300	400	250
Group Weight (W)	62	04	06	12	16

(i) Calculate the overall cost of living index number.

(ii) Suppose a person was earning Rs. 60 000 in 1981. What should be his earning in 2004, if his standard of living in the year 2004 is to be the same as in 1981? (06 *marks*)

(c) (i) What are the advantages and disadvantages of method of moving average as a method of measuring trend?

(ii) The following table gives the annual cement production of a certain factory.

Year	2010	2011	2012	2013	2014	2015	2016
Production (in metric tonnes)	12	10	14	11	13	15	16

Fit a trend line by the method of least squares and predict the production for the year 2020. (10 *marks*)

4. (a) The following table shows the yearly advertising expenditures and sales of a large business firm for 10 year period.

Advertising expenditures (Rs. million) (X)	4	6	8	10	12
Sales (Rs. million) (Y)	5	8	12	15	20

$\sum X = 40$, $\sum Y = 60$, $\sum X^2 = 360$, $\sum Y^2 = 858$, $\sum XY = 554$

(i) Calculate the coefficient of determination and interpret it.

(ii) Estimate the regression equation of sales on advertising expenditure.

(iii) Estimate the sales when advertising expenditure is Rs. 15 million.

(iv) What should be the expected advertising expenditure if the business firm wants to achieve the sales target of Rs. 25 million? (10 *marks*)

(b) Explain the difference between the terms of each pair given below.
   (i) Producer's risk and Consumer's risk
   (ii) Acceptance number and Acceptable quality level   (04 *marks*)

(c) A producer receives large lots of components daily. A lot is accepted if it contains less than or equal to 2 defective components in a random sample of size 50.
   (i) Find the probabilities that lot is accepted if it contains 2%, 4% and 8% defective components.
   (ii) Draw the OC-curve and comment on the shape of the curve.   (06 *marks*)

Part II

5. (a) Describe what is meant by 'subjective probability'. Explain **two** cases where subjective probability approach has to be used.   (03 *marks*)

   (b) A committee of 04 people is to be appointed from 04 officers of the production department, 05 officers of the purchase department, 03 officers of the sales department and the general manager. Find the probabilities of selecting the committee if,
      (i) there must be one from each department.
      (ii) it should consist of at least one from the sales department.
      (iii) the general manager must be in the committee.   (06 *marks*)

   (c) (i) State the law of total probability.
      (ii) The probability that doctor *A* will diagnose a certain disease is 3/5. The probability that a patient will die by his treatment after correct diagnose is 2/5 and the probability of death by wrong diagnose is 7/10. What is the probability of a patient treated by doctor *A* dying of this disease?   (06 *marks*)

   (d) (i) Explain what do you mean by independence of two events, *A* and *B*.
      (ii) Show that if *A* and *B* are independent events, *A'* and *B'* are also independent events.
      (iii) The probability that a candidate selects a certain question is 3/10. If he selects it, the probability that the answer is correct is 2/3. Find the probability that the examiner will find at least one correct answer for that question in the first three scripts which he marks.   (05 *marks*)

6. (a) Define the binomial distribution stating the conditions under which it is relevant.

   A person claims that he can distinguish between a cup of instant coffee and a cup of normal coffee 80% of the times. It is agreed that his claim will be accepted if he distinguishes at least 4 of the 5 cups. Find the probability that,
      (i) his claim is accepted.
      (ii) his claim is rejected when his claim is true.   (05 *marks*)

   (b) State the probability function of the Poisson distribution. Give **three** examples where poisson distribution may be applied.

   A bulb producer finds that 1% of the bulbs he produced is defective. The bulbs are packed in boxes containing 500 bulbs. An electrical shop buys 100 boxes from this producer of bulbs. Using a poisson distribution, find the number of boxes with
      (i) no defective bulbs.
      (ii) at least two defective bulbs.   (05 *marks*)

   (c) (i) State the conditions under which the normal distribution may be used as an approximation to poisson distribution.
      (ii) A merchant knows that the number of certain kind of items he can sell per week follows a poisson distribution with mean 5. How many items should be stock at the beginning of the week so that he will have probability at lest 0.95 of having enough items to meet demand for a five day week?   (05 *marks*)

   (d) (i) State the main characteristics of a normal distribution.
      (ii) In an examination 60% of the students failed when mean of the marks was 50 and standard deviation 5. Later it was decided to relax the conditions of passing by lowering the pass mark to show the pass percentage 70%. Assuming a normal distribution, find the minimum mark required for a student to pass.   (05 *marks*)

7. (a) Describe the method of systematic sampling. Explain the relation of systematic sampling to
         (i)   Simple random sampling.
         (ii) Stratified random sampling.
         (iii) Cluster sampling.   (04 marks)

    (b) (i) What is quota sampling?
         (ii) Describe **three** advantages and **three** disadvantages of quota sampling.   (04 marks)

    (c) Describe the method of simple random sampling. Explain how would you select a simple
         random sample of size 100 from a population of size 1 000 using a random number table.

         In a simple random sample of 100 students selected from a school with 1 000 students,
         33 students said that they use public transport to come to school. Find a 95% confidence
         interval

         (i) for the percentage of students who use public transport.
         (ii) for the total number of students who use public transport.   (08 marks)

    (d) Let $\overline{X}$ be the mean of a random sample of size n from $N(\mu, \sigma^2)$ distribution. Find the
         probability that the interval $\left(\overline{X} - 2.5\dfrac{\sigma}{\sqrt{n}}, \overline{X} + 2.5\dfrac{\sigma}{\sqrt{n}}\right)$ includes the population mean μ. (04 marks)

8. (a) Explain the difference between terms of each of the following pairs.
         (i)   Estimator and Estimate
         (ii) Standard error and Probable error
         (iii) Critical region and Critical value
         (iv) Type II error and Power of the test   (04 marks)

    (b) In a certain experiment to compare two types of animal foods **A** and **B**, the following
         values were observed for the gain in weights of animals.

	Food-A	Food-B
Sample size	12	11
Sample mean (kg)	27	25
Sample variance	08	6.2

         (i) Find a 90% confidence interval for the mean difference of gain in weight.
         (ii) Test whether the Food **A** is better than Food **B** at 1% significance level.   (08 marks)

    (c) The output of a certain item produced by three different machines are given in the
         following table.

Machine 1	Machine 2	Machine 3
10	09	20
08	08	15
12	06	10
10	07	15

         (i) Write down the analysis of variance model for analysing these data.
         (ii) Test whether the mean output of three machines are same and state your conclusions. (08 marks)

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