

# 2015

## STATISTICS

Full Marks : 100

Time : 3 Hours

The figures in the margin indicate full marks for the questions.

1. Answer the following questions : 1x10=10
  - (a) Find the value of  $\Delta^3 (1 - ax) (1 - bx^2)$ .
  - (b) If A and B are two mutually exclusive events, then  $P (A \cap B) = \underline{\hspace{2cm}}$ .  
(Fill in the blank)
  - (c) If  $P (E) = 1$ , then E is called            event. (Fill in the blank)
  - (d) State the condition under which  $P (A/B) = P(A)$ .
  - (e) If  $V(X + Y) = V(X) + V(Y)$ , then X and Y are            random variables.  
(Fill in the blank)
  - (f) Under what condition binomial distribution will be symmetrical ?
  - (g) What is the variance of standard normal distribution ?
  - (h) For a large sample, the sample size  $n \geq \underline{\hspace{2cm}}$ . (Fill in the blank)
  - (i) If  $E (t) = \theta$ , then t is called            estimate of  $\theta$ . (Fill in the blank)
  - (j) Define null hypothesis.
  - (k)            is a function of sample values. (Fill in the blank)
  - (l) Complete census is free from sampling error. (Write True or False)
2. If  $f (x) = e^{a+bx}$ , where a and b are constants, then find the value of  $\Delta^n f (x)$ . 3
3. State Newton's forward interpolation formula and state its uses. 3
4. Prove by Lagrange's interpolation formula,  

$$U_1 = U_3 - 0.3 (U_5 - U_{-3}) + 0.2 (U_{-3} - U_{-5})$$
 3
5. Define mathematical definition of probability. State its limitations. 3
6. If  $P (A) = \frac{1}{2}$ ,  $P (B) = \frac{1}{3}$  and  $P (A/B) = \frac{1}{2}$   
 find  $P(A \cap B)$  and  $P (A \cup B)$ . Show that events A and B are independent. 3
7. If A and B are two independent events, then show that  $\bar{A}$  and  $\bar{B}$  are also independent. 3
8. Explain discrete random variable with example. 3
9. State the characteristics of Poisson distribution. 3
10. If  $X \sim N (\mu = 50, \sigma = 5)$   
 find : (a)  $\Pr (X > 60)$  (b)  $\Pr (55 < X < 65)$  (c)  $\Pr (X < 35)$ . 3
11. Explain type-I and type-II errors in relating to test of significance. 3
12. Write the large sample test for the significance of an observed proportion. 3
13. State the uses of chi-square test. 3

14. Define sampling distribution, standard error and level of significance. 3
15. Write three causes (sources) of non-sampling errors. 3
16. Show that the probability of selecting any specified sampling unit is equal whether the sampling is done in SRSWR or SRSWOR. 3
17. Explain stratified random sampling. 3
18. Estimate  $f(3)$  and  $f(9)$  from the following data by interpolation :  $2\frac{1}{2}+2\frac{1}{2}=5$

$x :$	2	4	6	8	10
$f(x) :$	4	13	25	43	64

19. What do you mean by Numerical Integration ? Evaluate.

$$\int_0^6 \frac{dx}{1+x}$$

by Simpson's  $\frac{1}{3}$ rd rule.

20. (a) For two events A and B, given that  $P(A) = 0.4$ ,  $P(A \cup B) = 0.7$  and  $P(B) = p$ . For what values of  $p$  the events A and B are mutually exclusive and independent ? 3

(b) Show that  $P(A/B) = P(\bar{A}/B) = 1$  2

21. A continuous random variable X has the following probability density function:  
 $f(x) = cx(1-x)$  ;  $0 < x < 1$  (c is constant)

Find :

- (a) c (b)  $E(X)$  5  
 (c)  $V(X)$  (d)  $E(2X + 5)$   
 (e)  $V(2X + 5)$

22. (a) Find the variance of binomial distribution. 3

(b) Under what conditions binomial distribution tends to Poisson distribution? 2

23. 10 students are chosen at random from a population and their heights in inches found to be 62, 60, 61, 65, 59, 71, 70, 68, 60 and 61. Test whether the population mean height is 66" ?

[Given that :  $t_{0.05}(9 \text{ d.f.}) = 2.26$ ] 5

24. In a random sample of 500 students, out of 300 boys, 170 take tea and others take coffee. Again out of 200 girls, 90 take coffee and others take tea. Test whether choice of drink is independent of sex.

[Given that :  $\chi_{0.05}^2(1 \text{ d.f.}) = 3.841$ ] 5

25. Draw all possible samples of size 3 obtained by the method of simple random sampling without replacement from the population given by  $\{2, 4, 6, 8, 10\}$  and show that sample mean is an unbiased estimate of population mean. 5