K22U 1323

Reg. No. : ....

Name : ....

II Semester B.Sc. Hon's (Mathematics) Degree
(C.B.C.S.S. – OBE – Regular) Examination, April 2022
(2021 Admission Only)
2B06BMH : Distribution Functions and Combinatorics

Time : 3 Hours Max. Marks : 60

PART – A

Answer **any 4** questions. **Each** question carries **one** mark. **(4×1=4)**

1. Name a family of parametric distribution in which mean is equal to variance.
2. What is the moment generating function of a Bernoulli distribution ?
3. If $X \sim N(5, 1)$, then write the probability density function for the normal variable X.
4. If C is a chess board made up of pairwise disjoint subboards $C_1, C_2, \ldots\ldots\ldots, C_n$ then $r(C, x) =$ __________
5. Write sequence generated by $f(x) = 3e^x$.

PART – B

Answer **any 6** questions. **Each** question carries **two** marks. **(6×2=12)**

6. In five tossing a fair coin, find the chance of getting three head.
7. If a Poisson variate X is such that $P(X = 1) = P(X = 2)$. Then find $P(X = 4)$.
8. Show that the mean of a Uniform distribution is $\frac{b+a}{2}$.
9. A man rolls a fair die again and again until he obtains a 5 or 6. Calculate the probability that he will require 5 throws.
10. What is a standard normal distribution ?

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11. Find d_4 and write all the derangements of 1, 2, 3, 4.
12. State the principle of Inclusion and Exclusion.
13. Find the coefficient of x^4 in $(1 - 3x)^{-5}$.
14. Find the exponential generating function for the sequence 0!, 1!, 2!, 3!, ...

PART – C

Answer **any 8** questions. **Each** question carries **four** marks. **(8×4=32)**

15. It has been found that on an average, the number of mistakes per typed page of a typist is 1.5. Find the probability that there are 3 or less mistakes.
16. The mean and variance of a binomial distribution are 2 and 1 respectively, then find $P(X \le 1)$.
17. Obtain the moment generating function of a geometric distribution and hence find its mean and variance.
18. If a random variable X follows normal distribution with mean 40 and variance 25 . Find the probabilities for the values of X specified as $P(45 \le X \le 50)$.
19. A distribution with unknown mean μ have variance equal to 1.5. By using central limit theorem, find how large a sample should be taken in order that the probability will be atleast 0.95 that the sample mean will be within 0.5 of the population mean.
20. State and prove the lack of memory property of the geometric distribution.
21. Determine the co-efficient of x^{10} in $\frac{1}{(x-3)(x-2)^2}$.
22. Find the generating function for the number of integer solutions of the equation $C_1 + C_2 + C_3 + C_4 = 20$ where $-3 \le C_1$, $-3 \le C_2$, $-5 \le C_3 \le 5$ and $0 \le C_4$.

23. If $n \in Z^+$, prove that $\phi(2n) = 2\phi(n)$ when n is even and $\phi(2n) = \phi(n)$ when n is odd.
24. In how many ways can a police captain distribute 24 rifle shells to four police officers so that each officer gets at least three shells but no more than eight ?
25. A pair of dice : one red and the other green and is rolled six times. What is the probability that we obtain all six values on both the red and green dice if the ordered pairs (1, 2), (2, 1), (2, 5), (3, 4), (4, 1), (4, 5) and (6, 6) did not come up ?
26. Find the number of non-negative integer solutions to the equation $x_1 + x_2 + x_3 + x_4 = 18$ where $x_i \le 7$ for $1 \le i \le 4$.

PART – D

Answer **any 2** questions. **Each** question carries **six** marks. **(2×6=12)**

27. Calculate the coefficient of variation for the uniform distribution in (0, b) given that the probability law of the distribution is $P(X \le x) = \frac{x}{b}$.
28. For a normal distribution, show that mean = median = mode = μ.
29. Derive a formula for Euler's phi function, $\phi(n)$ using principle of Inclusion and Exclusion.
30. If a fair die is rolled 12 times, what is the probability that the sum of the rolls is 30 ?