COURSE: VECTOR SPACES, SAMPLING THEORY & OPTIMIZATION
COURSE CODE: 21MAT31A
MODULE – 4: PROBABILITY DISTRIBUTON

<table>
<tr><th>Q. No.</th><th>Questions</th></tr>
<tr><td>1</td><td>The Random Variable X has the following probability mass function, find (i) k (ii) P(X<3) (iii) P(3<X≤ 5) (iv) Mean
<table>
<tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>P(X)</td><td>K</td><td>3K</td><td>5K</td><td>7K</td><td>9K</td><td>11K</td></tr>
</table></td></tr>
<tr><td>2</td><td>A random variable X has the following probability distributions. Find (i) k (ii) p(x<6) (iii) p(x>6) (iv) Mean
<table>
<tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>P(x)</td><td>0</td><td>k</td><td>2k</td><td>2k</td><td>3k</td><td>k^2</td><td>$2k^2$</td><td>$7k^2 + k$</td></tr>
</table></td></tr>
<tr><td>3</td><td>Find the mean and variance of Binomial Distribution.</td></tr>
<tr><td>4</td><td>The probability that a pen manufactured by a factory be defective is 1/10. If 12 such pens are manufactured, what is the probability that (i) exactly 2 are defective (ii) atleast 2 are defective (iii) none of them are defective.</td></tr>
<tr><td>5</td><td>Derive mean and variance for the Poisson Distribution</td></tr>
<tr><td>6</td><td>The number of misprints on a page of the Daily Mercury has a Poisson distribution with mean 1.2. Find the probability that the number of errors (i) on page four is 2 (ii) on page three is less than 3.</td></tr>
<tr><td>7</td><td>A continuous random variable has the following density function P(x)=$\begin{cases} kx^2, -3 \le x \le 3 \\ 0 \quad elsewhere \end{cases}$ Evaluate (i) k, (ii) P(1≤ $x \le 2$), (iii) P($x \le 2$), (iv) P(x>1).</td></tr>
<tr><td>8</td><td>The probability density function of continuous random variable is given by $(x) = ke^{-|x|}, -\infty < x < \infty$. Prove that $k = {}^{1}/_{2}$ and also find mean and variance.</td></tr>
<tr><td>9</td><td>The mean weight of 1,000 students during medical examination was found to be 70kg and S.D weight 6kg. Assume that the weight are normally distributed, find the number of students having weight (i) less than 65kg (ii) more than 75kg (iii) between 65kg to 75kg.[P(0.83)=0.2967</td></tr>
<tr><td>10</td><td>In examination 7% of students score less than 35% marks and 89% of students score less than 60% marks, Find the mean and standard deviation, if the marks are normally distributed. It is given that if p (z) =$\frac{1}{\sqrt{2\pi}}\int_0^z e^{-z^2/2}\,dz$ then p(1.2263) = 0.39 , p(1.4757) = 0.43.</td></tr>
<tr><td>11</td><td>Explain the following
i) Null hypothesis
ii) Alternative hypothesis
iii) Type I and type II error
iv) Level of significance</td></tr>
</table>

	v) Standard error
12	A population has mean 75 and standard deviation 12. a) Random samples of size 121 are taken. Find the mean and standard deviation of the sample. b) How would the answers to part a) change if the size of the samples were 400 instead of 121?
13	A population has mean 5.75 and standard deviation 1.02. a) Random samples of size 81 are taken. Find the mean and standard deviation of the sample. b) How would the answers to part a) change if the size of the samples were 25 instead of 81?
14	The weights of 1500 ball bearings are normally distributed with a mean of 635 gms and S.D of 1.36gms. If 300 random samples of size 36 are drawn from this population, determine the expected mean and S.D of the sampling distribution of means if sampling is done a) with replacement b) without replacement.
15	500 ball bearings have a mean weight of 142.30 gms and S.D. of 8.5 gms. Find the probability that a random sample of 100 ball bearings chosen from this group will have a combined weight a) between 14061 and 14175 gms b) more than 14460 gms ($\phi(1.99)=0.4767$, $\phi(0.65)=0.2422$, $\phi(2.706)=0.4971$)
16	The life X of certain computer is approximately normally distributed with mean 800 hours and standard deviation 40 hours. If a random sample of 30 computers has an average life of 788 hours, test the hypothesis that $\mu = 800$ hours against the alternate hypothesis $\mu \neq 800$ hours at 5% and 1% level of significance.
17	The mean and S.D of the maximum loads supported by 60 cables are 11.09 tonnes and 0.73 tonnes respectively. Find a) 95% b) 99% confidence limits for mean of the maximum loads of all cables by the company.
18	The sample of 900 men is found to have a mean height of 64inch. If this sample has been drawn from a normal population with standard deviation 20 inch, find the a) 95% b) 99% confidence limits for the mean height of the men in the population
19	Ten individuals are chosen at random from a population and their heights in inches are found to be 63,63,66,67,68,69,70,70,71,71. Test the hypothesis that the mean height of the universe is 66 inches. ($t_{0.05}=2.262$ for 9 d.f.)
20	A certain stimulus administered to each of 12 patients resulted in the following increases of blood pressure: $5, 2, 8, -1, 3, 0, 6, -2, 1, 5, 0, 4$. Can it be concluded that the stimulus will in general be accompanied by an increase in blood pressure. ($t_{0.05} = 2.201$ for 11 d.f.)