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312301 – Applied Mathematics (Sem II)

As per MSBTE's K Scheme

CO / CM / IF / AI / AN / DS

Unit V	PROBABILITY DISTRIBUTION	Marks - 12

Qs. No.	Solution
1.	**An unbiased coin is tossed 5 times. Find the probability of getting a head.** $n=5, p=\frac{1}{2}, q=\frac{1}{2}, r=1$ $p(r)=nc_r(p)^r(q)^{n-r}$ $p(1)=5c_1\left(\frac{1}{2}\right)^1\left(\frac{1}{2}\right)^{5-1}$ $=\frac{5}{32}$ *or* 0.156
2.	**An unbiased coin is tossed 5 times. Find the probability of getting three heads.** $n=5\ ,\ p=\frac{1}{2}\ ,\ q=\frac{1}{2}\ ,\ r=3$ $\therefore P(r)={}^nC_r p^r q^{n-r}$ $\therefore P(3)={}^5C_3\left(\frac{1}{2}\right)^3\left(\frac{1}{2}\right)^{5-3}$ $\therefore P(3)=\frac{5}{16}$ or 0.3125
3.	**If the coin is tossed three times. Find the probability of getting exactly two Heads.** $S=\{HHH, HHT, THH, HTH, HTT, THT, TTH, TTT\}$ $\therefore n(S)=8$ $A=\{HHT, THH, HTH\}$ $\therefore n(A)=3$ $\therefore P(A)=\frac{n(A)}{n(S)}=\frac{3}{8}=0.375$
4.	**An unbiased coin is tossed 5 times. Find the probability of getting 2 tails.**

	Here $n=5,\ p=0.5,\ q=0.5,\ r=2$ $P(x=r)={}^{n}C_{r}p^{r}q^{n-r}$ $\therefore P(2)={}^{5}C_{2}(0.5)^{2}(0.5)^{3}$ $\therefore P(2)=\frac{5}{16}$ or 0.3125
5.	If two coins tossed simultaneously. Find the probability ofgetting at least one head. Here, p = 1/2 , q = 1/2 N = 2, r = at least 1 By Binomial Distribution, P(at least 1) = 1-p(0) P(at least 1) = 1-0.25 P(at least one) = 0.75
6.	Three fair coins are tossed. Find the probability that at leasttwo heads appear. $\therefore n(S)=8$ atleast two heads $A=\{HHH, HTH, HHT, THH\}$ $n(A)=4$ $\therefore p(A)=\frac{n(A)}{n(S)}$ $\therefore p(A)=\frac{4}{8}=\frac{1}{2}$ or 0.5
7.	An unbiased coin is tossed 6 times. Find probability ofgetting 2 Heads.

	Here $n=6,\ p=0.5,\ q=0.5,\ r=2$ $P(x=r)={}^{n}C_{r}p^{r}q^{n-r}$ $\therefore P(2)={}^{6}C_{2}(0.5)^{2}(0.5)^{4}$ $\therefore P(2)=\frac{15}{64}$ or 0.2344
8.	If unbiased coin is tossed 6 times, find the probability of getting 4 heads. Here, p =1/2, q = ½ N = 6 & r = 4 By Binomial Distribution, P(4)= 0.2343
9.	An unbiased coin is tossed 6 times. Find the probability ofgetting (i) 2 head (ii) Exactly 4 heads. Here, p =1/2, q = ½ N = 6 i) r=2 By Binomial Distribution, P(2) =0.234 ii) r=4 By Binomial Distribution, P(4)= 0.232
10.	A person fires 10 shots at target. The probability that anyshot will hit the target 3/5. Find the probability that the target is hit exactly 5 times. $n=10, p=\frac{3}{5}$ $q=1-p=1-\frac{3}{5}=\frac{2}{5}$ $r=5$ $p(r)={}^{n}c_{r}(p)^{r}(q)^{n-r}$ $p(5)={}^{10}c_{5}\left(\frac{3}{5}\right)^{5}\left(\frac{2}{5}\right)^{10-5}$ $=0.2007$

11. If 20% of the bolts produce by a machine are defective.Find the probability that out of 4 bolts drawn,

i) One is defective.
ii) At the most two are defective.
iii) At least one is defective.

Given $p = 20\% = \frac{20}{100} = 0.2, n = 4$ and $q = 1 - p = 0.8$

$p(r) = {}^nC_r p^r q^{n-r}$

(1) $p(\text{one is defective})$

$= p(1) = 4C_1 (0.2)^1 (0.8)^{4-1}$

$= 0.4096$

(2) $p(\text{at the most two are defective.})$

$= p(0) + p(1) + p(2)$

$= 4C_0 (0.2)^0 (0.8)^{4-0} + 4C_1 (0.2)^1 (0.8)^{4-1} + 4C_2 (0.2)^2 (0.8)^{4-2}$

$= 0.9728$

12. The probability that a man aged 65 will live to 75 is 0.65.
What is the probability that out of 10 men which are now65, 7 will live to 75.
Given p=0.65, q=1-0.65-0.35, n=10, r=7

$\because p(r) = {}^n C_r (p)^r (q)^{n-r}$

$\therefore p(7) = {}^{10} C_7 (0.65)^7 (0.35)^{10-7}$

$\therefore p(7) = 0.2522$

13. The probability that a bomb dropped from a Plane will strike the target is 1/5. If six bombs are dropped, find the
probability that exactly two will strike the target.

Given

$p = \frac{1}{5} = 0.2$, $q = 1 - 0.2 = 0.8$

$n = 6$, $r = 2$

$\because p(r) = {}^n C_r (p)^r (q)^{n-r}$

$\therefore p(2) = {}^6 C_2 (0.2)^2 (0.8)^{6-2}$

$\therefore p(2) = 0.2458$

14. **On an average 2% of the population in an area suffer from T. B. What is the probability that out of 5 persons chosen at random from this area, at least two suffer from T. B.?**

$$n = 5 \quad , \quad p = 2\% = \frac{2}{100} = 0.02$$

Mean $m = np$

$$\therefore m = 5 \times 0.02 = 0.1$$

$$p(r) = \frac{e^{-m} m^r}{r!}$$

$$\therefore p(\text{atleast two}) = 1 - [p(0) + p(1)]$$

$$= 1 - \left[\frac{e^{-0.1}(0.1)^0}{0!} + \frac{e^{-0.1}(0.1)^1}{1!}\right]$$

$$= 0.0047$$

15. **10% of the component manufactured by company are defective. If twelve components selected at random, find the probability that at least two will be defective.**

Given $p = 10\% = \frac{10}{100} = 0.1, n = 12$ and $q = 1 - p = 0.9$

$$p(r) = {}^nC_r p^r q^{n-r}$$

$$p(\text{atleast two}) = 1 - [p(0) + p(1)]$$

$$= 1 - \left[{}^{12}C_0 (0.1)^0 (0.9)^{12-0} + {}^{12}C_1 (0.1)^1 (0.9)^{12-1}\right]$$

$$= 0.3409$$

16. **Fit a poisson's distribution for the following observations.**

x_i	20	30	40	50	60	70
fi	8	12	30	10	6	4

$$\text{Mean} = m = \frac{\sum f_i x_i}{\sum f_i}$$

$$\therefore m = \frac{20(8) + 30(12) + 40(30) + 50(10) + 60(6) + 70(4)}{8 + 12 + 30 + 10 + 6 + 4}$$

$$\therefore m = \frac{2860}{70} = 40.85$$

Poisson distribution is ,

$$P(x = r) = \frac{e^{-m} m^r}{r!}$$

$$\therefore P(r) = \frac{e^{-40.85}(40.85)^r}{r!}$$

17. **Assuming that 2 in 10 industrial accidents are due to fatigue. Find the probability that exactly 2 out of 8 accidents will be due to fatigue.**

Here, p = 2/10 = 0.5

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	q= 0.5 n = 8, r = 2 By Binomial Distribution, P(2)= 0.2936
18. Ans	If 3% of the electric bulbs manufacture by a companyare defective. Find the probability that in a sample of100 bulbs. Exactly 5 bulbs are defective (Given $e^{-3} = 0.0497$). Here, p = 3% = 3/100 = 0.03 N = 100 m= np=100*0.03 = 3 By Poisson's Distribution, P(5)= 0.1013
19.	A company manufacture electric motors. The probabilitythat an electric motor is defective is 0.01. What is the probability that a sample of 300 electric Motors will contains exactly 5 defective motors? (Given $e^{-3} = 0.0498$) $p = 0.01, n = 300\ , r = 5$ $\therefore m = np = 0.01 \times 300 = 3$ $p(r) = \frac{e^{-m} \cdot (m)^r}{r!}$ $p(5) = \frac{e^{-3} \cdot (3)^5}{5!}$ $p(5) = \frac{(0.0498) \cdot (3)^5}{5!}$ $=0.1008$
20.	In a sample of 1000 cases the mean of certain test is 14 andstandard deviation is 2.5. Assuming the distribution to be normal, find i) How many students score above 18? ii) How many students score between 12 and 15?[Given : A(0.4) = 0.1554, A(0.8) = 0.2881, A(1.6) = 0.4452]

	Given $\bar{x} = 14 \quad \sigma = 2.5 \quad N = 1000$ (1) $z = \frac{x - \bar{x}}{\sigma} = \frac{18 - 14}{2.5} = 1.6$ $\therefore p(\text{ score above } 18) = A(\text{greater than } 1.6)$ $= 0.5 - A(1.6)$ $= 0.5 - 0.4452 = 0.0548$ $\therefore \text{No.of students} = N \cdot p$ $= 1000 \times 0.0548 = 54.8 \text{ i.e., } 55$ (2) $z = \frac{x - \bar{x}}{\sigma} = \frac{12 - 14}{2.5} = -0.8$ $z = \frac{x - \bar{x}}{\sigma} = \frac{15 - 14}{2.5} = 0.4$ $\therefore p(\text{score between 12 and 15}) = A(-0.8) + A(0.4)$ $= 0.2881 + 0.1554$ $= 0.4435$ $\therefore \text{No.of students} = N \cdot p = 1000 \times 0.4435$ $= 443.5 \text{ i.e., } 444$
21.	If 2% of the electric bulbs manufactured by company are defective, find the probability that in a sample of 100 bulbs, i) 3 bulbs are defective, ii) At the most two bulbs will be defective.(e^{-2} = 0.1353) $p = 2\% = 0.02 \quad , \quad n = 100$ $\therefore \text{mean } m = np$ $\therefore m = 100 \times 0.02 = 2$ Poisson's distribution is, $P(r) = \frac{e^{-m} \cdot m^r}{r!}$ (i) 3 bulbs are defective $\quad \therefore r = 3$ $\therefore P(3) = \frac{e^{-2}(2)^3}{3!}$ $\therefore P(3) = 0.1804$ (ii) At the most two bulbs will be defective $\quad \therefore r = 0,1,2$ $\therefore P(r) = P(0) + P(1) + P(2)$ $\therefore P(0) = \frac{e^{-2}(2)^0}{0!} + \frac{e^{-2}(2)^1}{1!} + \frac{e^{-2}(2)^2}{2!}$ $= 0.6767$

22.	In a test on 2000 electric bulbs, it was found that the life of particular make was normally distributed with average life of 2040 hours and standard deviation of 60 hours. Estimate the number of bulbs likely to burn for: i) Between 1920 hours and 2160 hours. ii) More than 2150 hours. Given that: A (2) = 0.4772 A (1.83) = 0.4664 Given $\bar{x} = 2040 \quad \sigma = 60 \quad N = 2000$ $i)$ For $x = 1920$ $z = \frac{x-\bar{x}}{\sigma} = \frac{1920-2040}{60} = -2$ For $x = 2160$ $z = \frac{x-\bar{x}}{\sigma} = \frac{2160-2040}{60} = 2$ $\therefore p(\text{between } 1920 \text{ and } 2160) = A(\text{ between } -2 \text{ and } 2)$ $= A(-2) + A(2)$ $= 0.4772 + 0.4772$ $= 0.9544$ $\therefore$ No.of $bulbs = N \cdot p$ $= 2000 \times 0.9544 = 1908.8 \approx 1909$ $ii)$ For $x = 2150$ $z = \frac{x-\bar{x}}{\sigma} = \frac{2150-2040}{60} = 1.83$ $\therefore p(\text{more than } 2150) = A(\text{more than } 1.83)$ $= 0.5 - A(1.83)$ $= 0.5 - 0.4664$ $\therefore p(\text{more than } 2150) = 0.0336$ $\therefore$ No.of students $= N \cdot p = 2000 \times 0.0336$ $= 67.2 \approx 67$
23.	If the probability of a bad reaction from the certain injection is 0.001, determine the chance that out of 2000 individualsmore than two will get a bad reaction. (Given $e^2 = 7.4$)

	$p = 0.001, n = 2000$ $\therefore m = np = 0.001 \times 2000 = 2$ $p(\text{more than } 2) = p(3) + p(4) + p(5) + \ldots$ $= 1 - [p(0) + p(1) + p(2)]$ $= 1 - \left[\frac{e^{-2} \cdot (2)^0}{0!} + \frac{e^{-2} \cdot (2)^1}{1!} + \frac{e^{-2} \cdot (2)^2}{2!} \right]$ $= 0.3233$

24.	**In a sample of 1000 cases the mean of certain test is 14 and S.D is 2.5. Assuming the distribution to be normal. Find** **i) How many students score between 12 and 15?** **ii) How many students score above 18?** **[Given : A (0.8) = 0.2881, A (0.4) = 0.1554, A (1.6) = 0.4452]** Given $\bar{x} = 14 \quad \sigma = 2.5 \quad N = 1000$ (1) $z = \frac{x - \bar{x}}{\sigma} = \frac{18 - 14}{2.5} = 1.6$ $\therefore p(\text{ score above } 18) = A(\text{greater than } 1.6)$ $= 0.5 - A(1.6)$ $= 0.5 - 0.4452 = 0.0548$ $\therefore$ No.of students $= N \cdot p$ $= 1000 \times 0.0548 = 54.8$ *i.e.*, 55 (2) $z = \frac{x - \bar{x}}{\sigma} = \frac{12 - 14}{2.5} = -0.8$ $z = \frac{x - \bar{x}}{\sigma} = \frac{15 - 14}{2.5} = 0.4$ $\therefore p(\text{score between 12 and 15}) = A(-0.8) + A(0.4)$ $= 0.2881 + 0.1554$ $= 0.4435$ $\therefore$ No.of students $= N \cdot p = 1000 \times 0.4435$ $= 443.5$ *i.e.*, 444
25.	**The number of road accidents met with by taxi drivers follow Poisson distribution with mean 2 out of 5000 taxi in the city, find the number of drivers.** **i) Who does not meet an accident?** **Who met with an accidents more than 3 items? (Given e^{-2} = 0.1353)** Let $N = 5000$, Mean $m = 2$ $p(r) = \frac{e^{-m} m^r}{r!}$ (i) $r = 0 \quad \therefore p(0) = \frac{e^{-2} 2^0}{0!}$ $\therefore p(0) = 0.1353$ Number of taxi drivers $= N \times p = 5000 \times 0.1353 = 676.5 \cong 677$ (ii) More than three $= 1 - \left[\frac{e^{-2} 2^0}{0!} + \frac{e^{-2} 2^1}{1!} + \frac{e^{-2} 2^2}{2!} + \frac{e^{-2} 2^3}{3!} \right]$ $= 0.1429$ Number of taxi drivers $= N \times p = 5000 \times 0.1429 = 714.5 \approx 715$

24.	**In a sample of 1000 cases the mean of certain test is 14 and S.D is 2.5. Assuming the distribution to be normal. Find** **i) How many students score between 12 and 15?** **ii) How many students score above 18?** **[Given : A (0.8) = 0.2881, A (0.4) = 0.1554, A (1.6) = 0.4452]** Given $\bar{x}=14 \quad \sigma=2.5 \quad N=1000$ (1) $z=\frac{x-\bar{x}}{\sigma}=\frac{18-14}{2.5}=1.6$ $\therefore p(\text{ score above } 18)=A(\text{greater than } 1.6)$ $=0.5-A(1.6)$ $=0.5-0.4452=0.0548$ $\therefore$ No.of students $=N\cdot p$ $=1000\times 0.0548=54.8$ *i.e.*, 55 (2) $z=\frac{x-\bar{x}}{\sigma}=\frac{12-14}{2.5}=-0.8$ $z=\frac{x-\bar{x}}{\sigma}=\frac{15-14}{2.5}=0.4$ $\therefore p(\text{score between 12 and 15})=A(-0.8)+A(0.4)$ $=0.2881+0.1554$ $=0.4435$ $\therefore$ No.of students $=N\cdot p=1000\times 0.4435$ $=443.5$ *i.e.*, 444
25.	**The number of road accidents met with by taxi drivers follow Poisson distribution with mean 2 out of 5000 taxi in the city, find the number of drivers.** **i) Who does not meet an accident?** **Who met with an accidents more than 3 items? (Given e^{-2} = 0.1353)** Let $N=5000$, Mean $m=2$ $p(r)=\frac{e^{-m}m^{r}}{r!}$ (i) $r=0 \quad \therefore p(0)=\frac{e^{-2}2^{0}}{0!}$ $\therefore p(0)=0.1353$ Number of taxi drivers $=N\times p=5000\times 0.1353=676.5\cong 677$ (ii) More than three $=1-\left[\frac{e^{-2}2^{0}}{0!}+\frac{e^{-2}2^{1}}{1!}+\frac{e^{-2}2^{2}}{2!}+\frac{e^{-2}2^{3}}{3!}\right]$ $=0.1429$ Number of taxi drivers $=N\times p=5000\times 0.1429=714.5\approx 715$

	Number of taxi drivers $= N \times p = 5000 \times 0.1429 = 714.5 \approx 715$
26.	Weight of 4000 students are found to be normally distributed with mean 50 kgs and standard deviation 5 kgs. Find the number of students with weights i) less than 45 kgs ii) between 45 and 60 kgs (Given : For a standard normal variate z area under thecurve between z = 0 and z = 1 is 0.3413 and that between z = 0 and z = 2 is 0.4772) Given $\bar{x} = 50$, $\sigma = 5$, $N = 4000$ (i) For $x = 45$, $z = \frac{x - \bar{x}}{\sigma} = \frac{45-50}{5} = -1$ $\therefore p(\text{less than } 45) = A(\text{less than } -1)$ $= 0.5 - A(1)$ $= 0.5 - 0.3413$ $= 0.1587$ $\therefore$ No.of students $= N \cdot p$ $= 4000 \times 0.1587 = 634.8$ *i.e.*, 635 (ii)For $x = 45$, $z = \frac{x - \bar{x}}{\sigma} = \frac{45-50}{5} = -1$ For $x = 60$, $z = \frac{x - \bar{x}}{\sigma} = \frac{60-50}{5} = 2$ $\therefore p(\text{ between 45 and 60}) = A(-1) + A(2)$ $= 0.3413 + 0.4772$ $= 0.8185$ $\therefore$ No.of students $= N \cdot p = 4000 \times 0.8185$ $= 3274$
27.	If 2% of the electric bulbs manufactured by company are defective, find the probability that in a sample of 100 bulbs, i) 3 bulbs are defective, ii) At least two are defective.

	$p = 2\% = 0.02$, $n = 100$ $\therefore$ mean $m = np$ $\therefore m = 100 \times 0.02 = 2$ Poisson's distribution is, $P(r) = \frac{e^{-m} \cdot m^r}{r!}$ (i) 3 bulbs are defective $\therefore r = 3$ $\therefore P(3) = \frac{e^{-2}(2)^3}{3!}$ $\therefore P(3) = 0.1804$ (ii) At least two are defective $\therefore P(\text{at least two are defective}) = 1 - [P(0) + P(1)]$ $\therefore P(\text{at least two are defective}) = 1 - \left[\frac{e^{-2}(2)^0}{0!} + \frac{e^{-2}(2)^1}{1!}\right]$ $= 0.5939$
28.	In a sample of 1000 cases the mean of certain test is 14 andstandard deviation is 2.5. Assuming the distribution to be normal, find iii) How many students score above 18? iv) How many students score between 12 and 15?Given Frequency 0 to 0.8 = 0.2881 Frequency 0 to 0.4 = 0.1554 Frequency 0 to 1.6 = 0.4452. Given $\bar{x} = 14$ $\sigma = 2.5$ $N = 1000$ (1) $z = \frac{x - \bar{x}}{\sigma} = \frac{18 - 14}{2.5} = 1.6$ $\therefore p(\text{ score above } 18) = A(\text{greater than } 1.6)$ $= 0.5 - A(1.6)$ $= 0.5 - 0.4452 = 0.0548$ $\therefore$ No.of students $= N \cdot p$ $= 1000 \times 0.0548 = 54.8$ *i.e.*, 55

	(2) $z=\frac{x-\bar{x}}{\sigma}=\frac{12-14}{2.5}=-0.8$ $z=\frac{x-\bar{x}}{\sigma}=\frac{15-14}{2.5}=0.4$ $\therefore p(\text{score between 12 and 15})=A(-0.8)+A(0.4)$ $=0.2881+0.1554$ $=0.4435$ $\therefore \text{No.of students}=N\cdot p=1000\times 0.4435$ $=443.5$ *i.e.*, 444
29.	In a certain examination 500 students appeared. Mean scoreis 68 with S.D. 8 Find the number of students scoring i) Less than 50 ii) Scoring more than 60 Given, Area between *z* = 0 and *z* = 2.25 is 0.4878Area between *z* = 0 and *z* = 1 is 0.3413 Given $\bar{x}=68$ $\sigma=8$ $N=500$ *i)* $z=\frac{x-\bar{x}}{\sigma}=\frac{50-68}{8}=-2.25$ $\therefore p(\text{Less than 50})=A(\text{less than }-2.25)$ $=0.5-A(z = 0 \text{ to } z = 2.25)$ $=0.5-0.4878$ $=0.0122$ $\therefore \text{No.of students}=N\cdot p$ $=500\times 0.0122=6.1$ *i.e.*, 6 *ii)* $z=\frac{x-\bar{x}}{\sigma}=\frac{60-68}{8}=-1$ $\therefore p(\text{More than 60})=A(\text{more than }-1)$ $=A(z = 0 \text{ to } z = 1)+0.5$ $=0.3413+0.5$ $=0.8413$ $\therefore \text{No.of students}=N\cdot p=500\times 0.8413$ $=420.65$ *i.e.*, 421

30.	If 30% of the bulbs produced are defective, find theprobability that out of 4 bulbs selected i) One is defective ii) at the most two are defective
	$p = 30\% = \frac{30}{100} = 0.3 \quad q = 1 - 0.3 = 0.7$ $n = 4$ $(i) \because p(r) = {}^{n}C_{r}(p)^{r}(q)^{n-r}$ $\therefore p(1) = {}^{4}C_{1}(0.3)^{1}(0.7)^{4-1} = 0.4116$ ii) r =at most 2 are defective. P(at most 2) = p(0) + p(1) + p(2) P(at most 2) = 0.2401 + 0.4116 + 0.2646 P(at most 2) = 0.9163

31.	**I.Q.'s are normally distributed with mean 100 and standard deviation 15. Find the probability that a randomly selected person has** **i) An I.Q more than 130** **ii) An I.Q. between 85 and 115.** **Given [z = 2, Area = 0.4772 and z = 1, Area = 0.3413]** Given $\bar{x} = 100 \quad \sigma = 15$ $i) \quad z = \frac{130-100}{15} = 2$ $\therefore P(130 \le x) = P(2 \le z)$ $= 0.5 - P(0 \le z \le 2)$ $= 0.5 - 0.4772$ $= 0.0228$ $2) \; z = \frac{85-100}{15} = -1 \qquad z = \frac{115-100}{15} = 1$ $\therefore P(85 \le x \le 115) = P(-1 \le z \le 1)$ $= P(-1 \le z \le 0) + P(0 \le z \le 1)$ $= 0.3413 + 0.3413$ $= 0.6826$
32.	**3% of a given lot of manufactured parts are defective. What is the probability that in a sample of 4 items none will be defective?** Here p = 3% = 0.03 q = 0.97 n = 4 & r = 0 By Binomial Distribution, P(0)= 0.8853
33.	**In a town 10 accidents took place in a period of 50 days. Assuming Poisson distribution, find the probability that there will be 3 or more accidents per day.** P(3 or more)= 0.012
34.	**The probability of getting an item defective is 0.005. What is the probability that exactly 3 items in a sample of 200 are defective? (Given e^{-1} = 0.3679)** Here, p = 0.005 N = 200 M = 1 By Poisson's Distribution, P(3)= 0.06131

	P(3)= 0.06131
35.	Fit a Poisson distribution to set of observations

Xi	0	1	2	3	4
Fi	122	60	15	2	1

$$P(r) = \frac{e^{-m} m^r}{r!} = \frac{e^{-0.684} (0.684)^r}{r!}$$

36. If 5% of the electric bulbs manufacturing by a company aredefective, use Poisson distribution to find the probability that in a sample of 100 bulbs.

i) None is defective

ii) Five bulbs are defective ($e^{-5} = 0.007$)

Given $p = 5\% = 0.05$

$n = 100$

mean $m = np = 100 \times 0.05 \quad \therefore m = 5$

$$P(r) = \frac{e^{-m} m^r}{r!}$$

i) None is defective

$r = 0$

$$P(0) = \frac{e^{-5} (5)^0}{0!}$$

$P(0) = 0.007$

ii) Five bulbs are defective

$r = 5$

$$P(5) = \frac{e^{-5} (5)^5}{5!}$$

$P(5) = 0.1823$

37.	A problem is given to the three students Ram, Shyam andAmit, whose chances of solving it are ,1/2, 1/3 and 1/4 Respectively. If they attempt to solve a problem independently, Find the probability that the problem issolved by at least one of them. **(Not in Syllabus)**
38.	In 200 sets of tosses of 5 fair coins, in how many ways youcan expect. i) at least two heads ii) at the most two heads $p=\frac{1}{2}\ ,\ q=\frac{1}{2}$ $n=5$ $p(r)={}^{n}C_{r}p^{r}q^{n-r}$ $i)$ at least two heads $P(r)=1-[p(0)+p(1)]$ $=1-\left[{}^{5}C_{0}\left(\frac{1}{2}\right)^{0}\left(\frac{1}{2}\right)^{5-0}+{}^{5}C_{1}\left(\frac{1}{2}\right)^{1}\left(\frac{1}{2}\right)^{5-1}\right]=1-0.1875$ $=\frac{13}{16}$ or 0.8125 No. of ways $=200\times0.8125=162.5\approx163$ $ii)$ At the most two heads $P(r)=p(0)+p(1)+p(2)$ $P(r)=p(0)+p(1)+p(2)$ $=0.1875+{}^{5}C_{2}\left(\frac{1}{2}\right)^{2}\left(\frac{1}{2}\right)^{5-2}$ $=0.5$ No. of ways $=200\times0.5=100$
39.	The probability that a machine manufactured by a company will be defective 1/10. If 5 such machines are manufactured find probability that. i) Exactly two will be defective. ii) At least two will be defective.

Binomial distribution is , $P(x=r)={}^{n}C_r\,(p)^r\,(q)^{n-r}$

(i) Exactly two will be defective

$\therefore\ p(2)={}^{5}C_2\,(0.1)^2\,(0.9)^{5-2}$

$=0.0729$

(ii) At Least two will be defective

i.e $r=2$ or 3 or 4 or 5

$\therefore\ p(r=2 \text{ or } 3 \text{ or } 4 \text{ or } 5)=1-p(r=0 \text{ or } 1)$

$=1-\left(p(0)+p(1)\right)$

$=1-\left[{}^{5}C_0\,(0.1)^0\,(0.9)^{5-0}+{}^{5}C_1\,(0.1)^1\,(0.9)^4\right]$

$=0.08146$

40. Fit a Poisson's distribution for the following observations

xi	0	1	2	3	4
fi	21	18	7	3	1

$$\text{Mean} = m = \frac{\sum f_i x_i}{\sum f_i}$$

$$\therefore\ m=\frac{0(21)+1(18)+2(7)+3(3)+4(1)}{21+18+7+3+1}$$

$$\therefore\ m=\frac{45}{50}=\frac{9}{10}=0.9$$

Poisson distribution is ,

$$P(x=r)=\frac{e^{-m}m^r}{r!}$$

$$\therefore\ P(r)=\frac{e^{-0.9}(0.9)^r}{r!}$$

41. A room has 3 electrical lamps. From a collection of 15 electric bulbs of which only 10 are good, 3 are selected at random and put in the lamps. Find the probability that the room is lighted by at least one of the bulbs.

	$P = P(\text{room is lighted by atleast one of the bulbs})$ $P = 1 - P(\text{room is not lighted})$ $P = 1 - \frac{^5C_3}{^{15}C_3}$ $P = \frac{89}{91}$ or 0.9780 **<u>OR</u>** $P = P(\text{room is lighted by atleast one of the bulbs})$ $P = \frac{^{10}C_1 \times {}^5C_2 + {}^{10}C_2 \times {}^5C_1 + {}^{10}C_3}{^{15}C_3}$ $P = \frac{89}{91}$ or 0.9780