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DPP-8 Maths-4 Unit-4

Topic- Normal Distribution

Q-1- Define

i) Binomial Distribution- Let a random variable X denote the number of successes in n independent trials in an experiment.
Let p be the probability of success and q be the probability of failure in a single trial so that

$$p+q=1$$

r successes can be obtained in n trials in ${}^nC_r$ ways.

Probability of r successes in n trials

$$\boxed{P(X=r) = {}^nC_r p^r q^{n-r}}$$

ii) Poisson Distribution- If the parameters n is very large and p is very small, application of binomial distribution is very labourious. If we assume $n \to \infty$ and $p \to 0$ such that np always remain finite, say λ, we get poisson approximation to the binomial distribution.

$$\boxed{P(X=r) = \frac{e^{-\lambda}\lambda^r}{r!} \quad (r=0,1,2,3\ldots)}$$

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Normal Distribution - The normal distribution is a continuous distribution based on continuous random variable. A continuous random variable X is said to have a normal distribution with parameters μ (Mean) and σ^2 (Variance) if the probability density function is given by

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$$

i) $f(x) \geq 0$

ii) $\int_{-\infty}^{\infty} f(x)\,dx = 1$

Q-2 - If X is a normal variable with mean 30 and S.D. 5. find the probabilities that

i) $26 \leq X \leq 40$

$X_1 = 26$, $X_2 = 40$

$$Z_1 = \frac{x_1 - \mu}{\sigma}$$

$$Z_1 = \frac{26-30}{5} = -0.8$$

$$Z_2 = \frac{40-30}{5} = 2$$

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$P(26 \le X \le 40) = P(-0.8 \le Z \le 2)$

$= P(-0.8 \le Z \le 0) + P(0 \le Z \le 2)$

$= P(0 \le Z \le 0.8) + P(0 \le Z \le 2)$

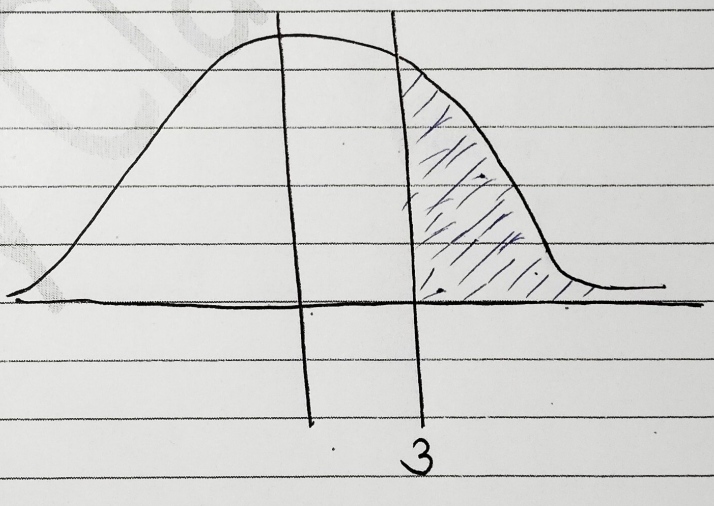
$= 0.2881 + 0.4772$

$= 0.7653$

ii) $X \ge 45$

$Z = \frac{x-\mu}{\sigma} = \frac{45-30}{5} = 3$

$P(X \ge 45) = P(Z \ge 3)$



$= 0.5 - 0.4987$

$= 0.0013$

iii) $|X-30| > 5$

$-5 > X-30 > 5$

$25 > X > 35$

$x_1 \quad x_2$

$Z_1 = \frac{25-30}{5} = -1$

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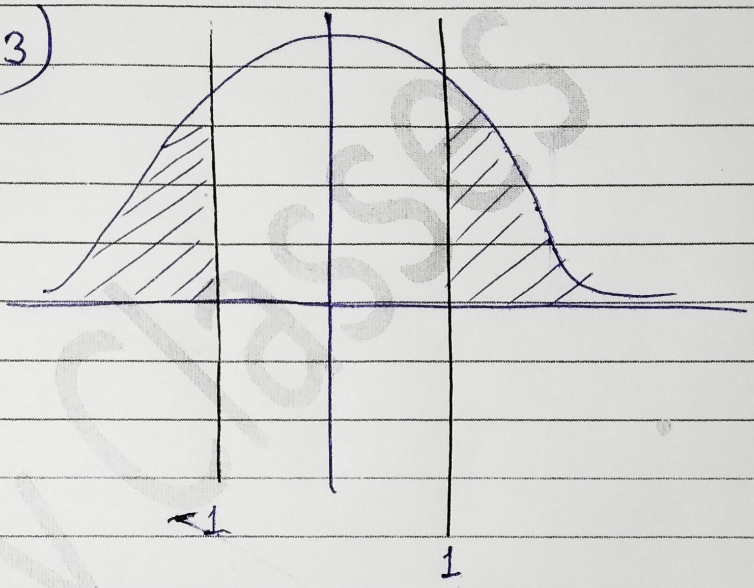
$$Z_2 = \frac{35-30}{5} = 1$$

$$P(-1 > Z > 1)$$

$$P(-1 > z) + P(z > 1)$$

$$= (0.5 - 0.3413) + (0.5 - 0.3413)$$

$$= 0.3174$$



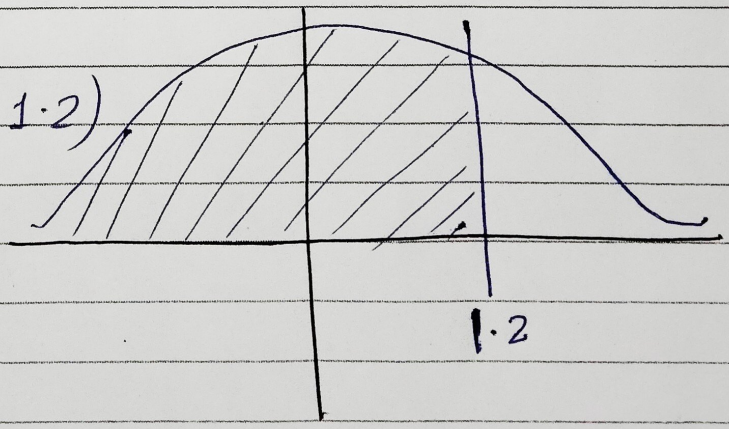
Q-3. If Z is a standard normal variable. Find the following probabilities.

i) $P(Z < 1.2)$

$$= P(-\infty < Z < 0) + P(0 < Z < 1.2)$$

$$= 0.5 + 0.3849$$

$$= 0.8849$$



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ii) $P(Z > -1.2)$

$P(Z < 1.2)$

$= P(-\infty < Z < 0) + P(0 < Z < 1.2)$

$= 0.5 + 0.3849$

$= 0.8849.$

iii) $P(-1.2 < Z < 1.3)$

$P(-1.2 < Z < 0) + P(0 < Z < 1.3)$

$P(0 < Z < 1.2) + P(0 < Z < 1.3)$

$= 0.3849 + 0.4032$

$= 0.7881$

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