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DPP-9 Maths-4 Unit-4

Topic- Normal Distribution

Q-1- In a test on 2000 electric bulbs, it was found that the life of a particular make, was normally distributed with an average life of 2040 hours and S.D. of 60 hours, estimate the number of bulbs likely to burn for

i) more than 2150 hours
ii) less than 1950 hours
iii) more than 1920 but less than 2160 hours.

Sol- i) $P(X > 2150)$

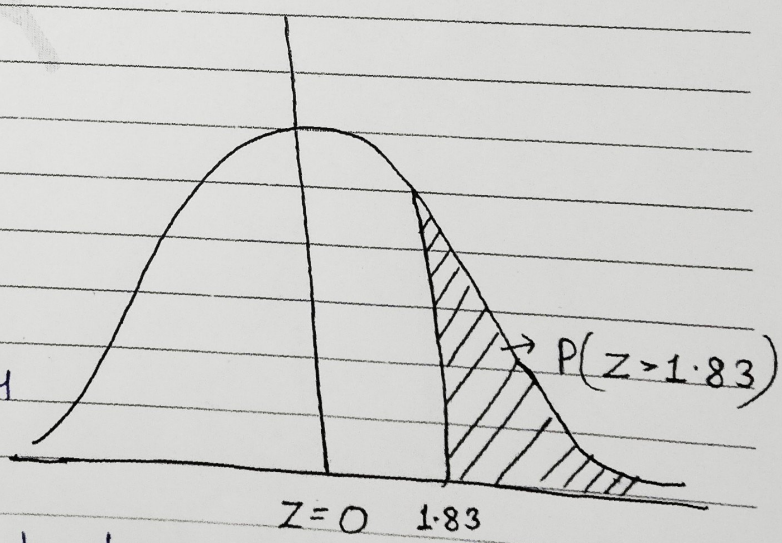
$\mu = 2040$, $\sigma = 60$

$$Z = \frac{X - \mu}{\sigma}$$

$$Z = \frac{2150 - 2040}{60}$$

$$Z = 1.833$$

$P(Z > 1.83) = 0.5 - 0.4664$
$= 0.0336$



The number of bulbs likely to burn more than 2150 hours
$= 0.0336 \times 2000$
$= 67.2$
$\simeq 67$

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ii) $P(X < 1950)$

$$Z = \frac{1950 - 2040}{60}$$

$$Z = -1.5$$

$$P(Z < -1.5) = P(Z > 1.5)$$
$$= P(0 < Z < \infty) - P(0 < Z < 1.5)$$
$$= 0.5 - 0.4332$$
$$= 0.0668$$

No. of bulbs likely to burn for less than 1950 hours =
$= 2000 \times 0.0668$
$= 133.6$
≈ 134

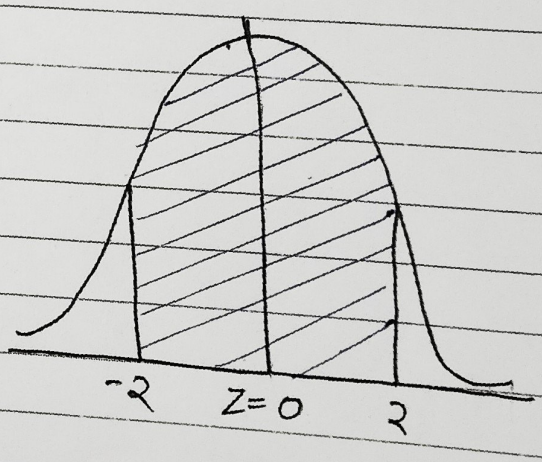
iii) $P(1920 < X < 2160)$

$$Z_1 = \frac{1920 - 2040}{60}$$

$$Z_1 = -2$$

$$Z_2 = \frac{2160 - 2040}{60}$$

$$Z_2 = 2$$



$$P(-2 < Z < 2) = P(-2 < Z < 0) + P(0 < Z < 2)$$
$$= P(0 < Z < 2) + P(0 < Z < 2)$$
$$= 0.4772 + 0.4772$$
$$= 0.9544$$

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No. of bulbs likely to burn between 1920 and 2160
$= 0.9544 \times 2000$
$= 1909$ bulbs

Q-2 - The marks X obtained in maths by 1000 students are normally distributed with mean 78% and S.D. 11%. Determine
i) how many students got marks above 90%?
ii) What was highest marks obtained by lowest 10% students?
iii) Within what limit did the middle 90% of student lie?

Sol - i) $P(X > 90)$

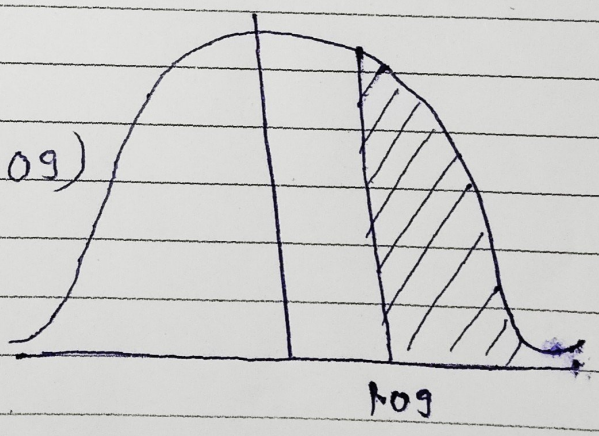
$$Z = \frac{x - \mu}{\sigma}$$
$$= \frac{90 - 78}{11}$$
$$Z = 1.09$$

$P(Z > 1.09)$

$= P(0 < Z < \infty) - P(0 < Z < 1.09)$

$= 0.5 - 0.3621$

$= 0.1379$



No. of student got above 90% $= 0.1379 \times 1000$
$= 137.9$
≈ 138

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ii) What was the highest marks obtained by lowest 10% of student?

$Z = -1.28$

$-1.28 = \frac{Value - 78}{11}$

$Value = 63.92 \approx 64$

Highest mark obtained by the lowest 10% of student = 64%.

iii) Within what limits did the middle of 90% student lie?

Sol- 5% to 95% students

$\Rightarrow Z = -1.645$ and $Z = 1.645$

$-1.645 = \frac{value - 78}{11}$

$Value = 59.9 \approx 60$

$1.645 = \frac{Value - 78}{11}$

$value = 96.1 \approx 96$

middle of 90% of the students lie b/w 60% to 96%.

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Q-3- In a normal distribution, 7% of the items are under 35 and 89% are under 63. Determine the mean and variance of the distribution.

Sol- Let μ be the mean and σ be standard deviation

$P(X<35) = 7\%$

$P(X<35) = 0.07$

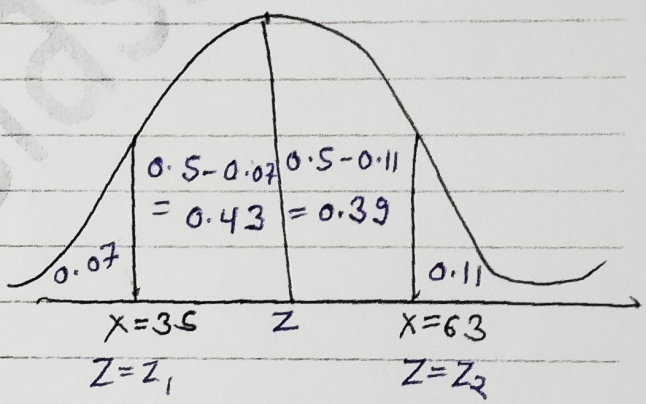
$P(X<63) = 89\%$.

$P(X>63) = 1 - P(X<63)$

$= 1 - 0.89$

$P(X>63) = 0.11$

$$Z = \frac{x-\mu}{\sigma}$$



$Z_1 = -35$

$P(-35<x<0) = 0.43$

$Z_1 = -1.48$

when $x_2 = 63$

$P(0<x<63) = 0.39$

$Z_2 = 1.23$

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

$$-1.48 = \frac{35-\mu}{\sigma}$$

$-1.48\sigma + \mu = 35$ — (1)

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$$Z_2 = \frac{x_2 - \mu}{\sigma}$$

$$1.23 = \frac{63 - \mu}{\sigma}$$

$$1.23\sigma = 63 - \mu$$

$$1.23\sigma + \mu = 63 \quad - (2)$$

On solving eq (1) and (2)

$$1.23\sigma + \mu = 63$$
$$-1.48\sigma + \mu = 35$$
$$+ \quad - \quad -$$

$$2.71\sigma = 28$$

$$\sigma = \frac{28}{2.71}$$

$$\boxed{\sigma = 10.33}$$

Similiarly

$$\boxed{\mu = 50.3}$$

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