

Assignment 2

Normal distribution

$$\begin{aligned} \text{Q1} \quad \mu &= 45 \\ \sigma &= 8 \end{aligned}$$

given that manager takes 10 minutes
to start working

\therefore time left = 50 minutes.

\therefore let x be the number of mins
required to finish the job

$$\therefore x = 50$$

Probability the customer service won't be
able to meet commitment =

$$P(x > 50) \text{ or } 1 - P(x < 50)$$

Solving using normal distribution

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

$$\frac{1}{6}$$

$$\therefore Z = \frac{50 - 45}{8}$$

$$Z = \frac{5}{8} = 0.625$$

$\therefore P(u < 50) = Z = 73.4\%$
probability that the customer will receive the car in time = 73.4%

$$\therefore P(u > 50) = 100 - 73.4 \\ = 26.6\% \\ \text{or } 0.267$$

\therefore Answer is B option

$$27 \quad \mu = 38 \\ \sigma = 6$$

a)

probability of employees greater

$$\text{than } 44 = P(u > 44) = 1 - P(u \leq 44)$$

$$Z = \frac{u - \mu}{\sigma} = \left(\frac{44 - 38}{6} \right)$$

$$P(u \leq 44) = 1 / (44 - 38) = 2 / 1 = 0.841$$

$\therefore P(n > 44) = 1 - 0.841$
= 0.1586
or 15.86%

$$\therefore P(n > 44) = 1 - 0.841 \\ = 0.1586$$

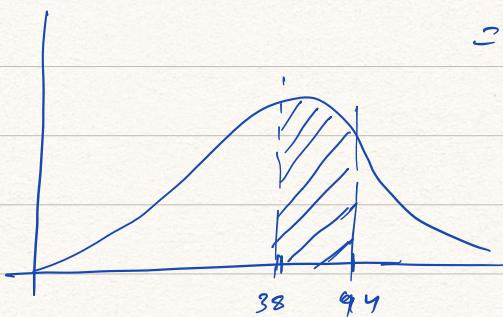
or 15.86%

Probability of $38 < n < 44$

$$P(38 < n < 44) = \frac{z(44 - 38)}{6} = z(0)$$

$$= 0.5$$

$$\therefore P(38 < n < 44) = P(n < 44) - P(n < 38)$$



$$= 0.841 - 0.5$$

$$= 0.341$$

= 34.1%

\therefore we can say that employees in the range of $38 \rightarrow 44$ are greater than employees with age > 44 .

So the answer is **false**

$$b) P(n < 30) = z\left(\frac{30 - 38}{6}\right)$$

$$= z(-8)$$

$\sim \bar{6}/$

$$= 0.0901$$

$$= 9.1\%$$

\therefore number of employees to turn out
= 9.1% of 400

$$\therefore \frac{9.1}{100} \times 400 = 9.1 \times 4 = 36 \text{ emp.}$$

\therefore ans is True

$$3) X_1 \sim N(\mu, \sigma^2)$$

$$X_2 \sim N(\mu, \sigma^2)$$

$$\text{first case} \Rightarrow 2 \cdot X_1 \sim 2 \cdot [N(\mu, \sigma^2)]$$

$$v(cx) = c^2 v(x)$$

$$\therefore 2 \cdot X_1 \sim N(2\mu, 2^2 \sigma^2)$$

$$\sim N(2\mu, 4\sigma^2)$$

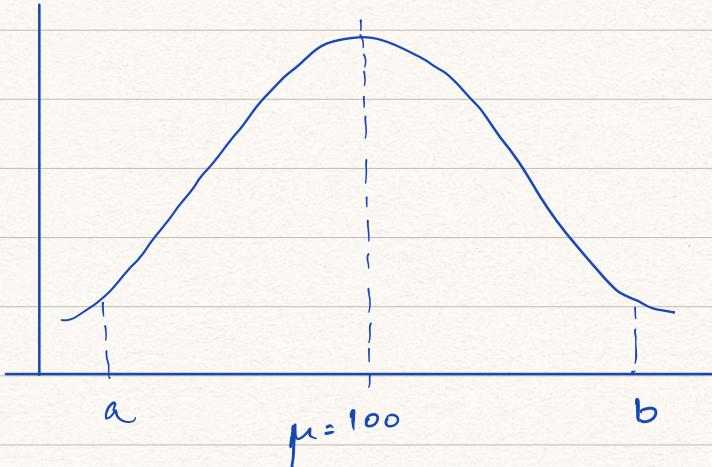
2nd Case \rightarrow $X_1 + X_2 =$

$$N(\mu, \sigma^2) + N(\mu, \sigma^2)$$

$$= N(2\mu, 2\sigma^2)$$

we can conclude that variance of 1st case
is greater than variance of 2nd case ..

4)



given that the probability of a point falling
between a and b has a probability of 0.99
or 99%

\therefore we can say that the area beyond
 a and b will have probability of 0.01
or 1%

\therefore

$$P(u < a) + P(u > b) = 0.01$$

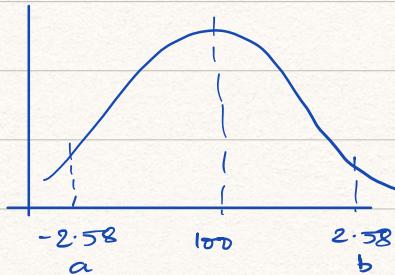
as both a and b are symmetric we can say that

$$P(n < a) = 0.005, Z_a = -2.58$$

$$\text{and } P(n > b) = 0.005, Z_b = 2.58$$

$$P(a < n < b) = 0.99$$

$$Z_a = \frac{n - \mu}{\sigma}$$



$$-2.58 = \frac{x_a - 100}{20}$$

$$\begin{aligned} x_a &= (-2.58 \times 20) + 100 \\ &= 48.4 \end{aligned}$$

Similarly.

$$Z_b = \frac{x_b - \mu}{\sigma}$$

$$2.58 = \frac{x_b - 100}{20}$$

$$\begin{aligned} x_b &= (2.58 \times 20) + 100 \\ &= 51.60 + 100 \\ &= 151.60 \end{aligned}$$

\therefore The answer is D. , 48.5, 151.5

5) Profit. $\sim N(\mu, \sigma^2)$

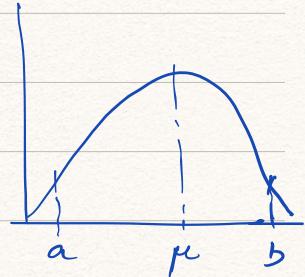
$$\text{Profit}_2 \sim N(7, 4^2)$$

\therefore annual profit of the company

$$= \text{Profit}_1 + \text{Profit}_2$$

$$= N(5, 3^2) + N(7, 4^2)$$

$$= N(12, 25) \text{ or } N(12, 5^2)$$



$$P(x < a) = \frac{0.05}{2} = 0.025$$

$$\therefore Z = -1.96$$

range where 95% of profit lie =
based on total annual profits we can

Say that $\mu = 12$ and $\sigma = 5$

$$Z_a = -1.96, Z_b = 1.96$$

$$Z_a = \frac{x_a - \mu}{\sigma}$$

$$\text{or } x_a = \frac{\sigma}{6} (-1.96 \times 5) + 12 \\ = 2.2$$

$$Z_b = \frac{x_b - \mu}{\sigma} = \frac{(1.96 \times 5) + 12}{6}$$

$$\therefore x_b = 21.8$$

\therefore range of the profit in dollars

$$= 2.2 \text{ to } 21.8$$

range in rupees = (2.2×45) and

$$(21.8 \times 45)$$

$$= 99 \text{ and } 981 \text{ (in millions)}$$

b) To find 5th percentile, we have to find the point where 5% of data lies below it.

or to find the probability which is close to 0.05

z score close to the probability of 0.5

$$= -1.64$$

finding 5th percentile

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

$$-1.64 = \frac{x - 12}{5}$$

$$x = (-1.64 \times 5) + 12$$

$$= 3.8$$

$$\therefore 3.8 \times 45 = 171$$

\therefore 5th percentile of total profit of the company is 171 million rupees.

c) for division 1 :

to calculate loss prob.

$$P(u_1 < 0)$$

$$Z_1 = \frac{0 - 5}{3} = \frac{-5}{3} = -1.6$$

$$P(u_1 < 0) = 0.0548 = 5.48\%$$

now to calculate loss prob. of 2nd division

$$P(u_2 < 0)$$

$$Z_2 = \frac{0 - 7}{4} = \frac{-7}{4} = -1.75$$

$$P(u_2 < 0) = 0.040 = 4\%$$

\therefore we can say the division 1 has higher probability of getting loss.
or $P \sim N(5, 3^2)$ is more probable to be at loss.