Assignment - 4

5. $\mu = 140$, $\sigma = 10$

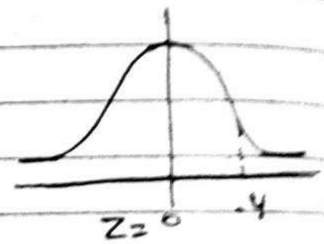
X : denotes the daily wages of workers.

(i) $P(140 < x < 144) = P(0 < z < 0.4)$

$$z_1 = \frac{x_1 - \mu}{\sigma} = \frac{140 - 140}{10} = 0$$

$$z_2 = \frac{x_2 - \mu}{\sigma} = \frac{144 - 140}{10} = \frac{4}{10} = 0.4$$

$P(0 < z < 0.4) = .1554$



No. of workers whose daily wages will be b/w Rs 140 and 144 $= N \times .1554$

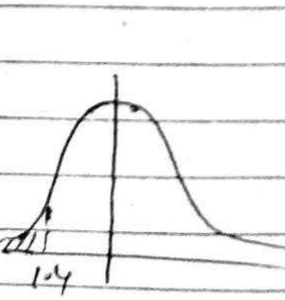
$= 1000 \times .1554$

$= 155.4 \approx 155$ (app)

(ii) less than Rs 126

$P(x < 126) =$

$$z = \frac{126 - 140}{10} = -1.4$$



$P(x < 126) = P(z < -1.4)$

$= P(z > 1.4)$

$= P(0 < z < \infty) - P(0 < z < 1.4)$

$= \frac{1}{2} - .4192 = 0.0808$

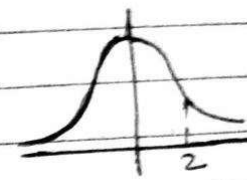
No. of worker whose wages less than 126 $= 1000 \times \cdot 8808$

$\Rightarrow 880 \cdot 8 \approx 881$ (app)

(iii) more than Rs 160.

$P(x > 160) =$

$$z = \frac{x - \mu}{\sigma} = \frac{160 - 140}{10} = 2$$



$$P(x > 160) = P(z > 2)$$

$$= P(0 < z < \infty) - P(0 < z < 2)$$

$$= \frac{1}{2} - \cdot 4772$$

$$= \cdot 5 - \cdot 4772$$

$$= \cdot 0228$$

No. of workers whose wages more than Rs 160 $= 1000 \times \cdot 0228$

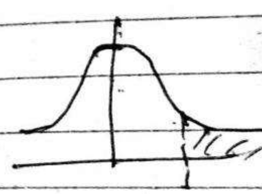
$= 22 \cdot 8 \approx 23$ (app)

10. $N = 100$, $\mu = 12$, $\sigma = 3hr$

x : denotes the length of life

(i) $P(x > 15 hr) =$

$$z_1 = \frac{15 - 12}{3} = 1$$



$$P(x > 15hr) = P(z > 1)$$

$$= P(0 < z < \infty) - P(0 < z < 1)$$

$$= 0 \cdot 5 - \cdot 3413 = \cdot 1587$$

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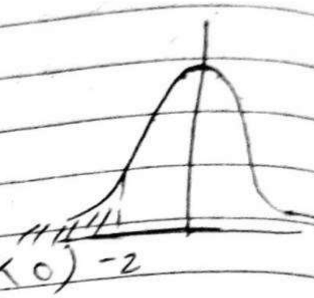
No of Battery cell life > 15 hr $= .1587 \times 100$
$= 15.87$
$= 15.87\%$

ii) $P(x < 6\,hr) =$

$$z = \frac{6-12}{3} = \frac{-6}{3} = -2$$

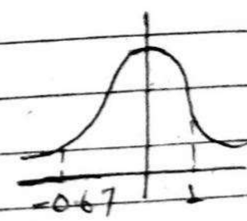


$$P(x < 6\,hr) = P(z < -2)$$
$$= P(0 < z < \infty) - P(-2 < z < 0)$$
$$= 0.5 - P(0 < z < 2)$$
$$= 0.5 - .4772$$
$$= 0.0228$$

No. of battery cell life < 6 hr $= .0228 \times 100$
$= 2.28\%$

(iii) $P(10 < x < 15)$.

$$z_1 = \frac{10-12}{3} = \frac{-2}{3} = -0.67$$



$$z_2 = \frac{15-12}{3} = 1$$

$$P(10 < x < 15) = P(-0.67 < z < 1)$$
$$= P(-0.67 < z < 0) - P(0 < z < 1)$$
$$= P(0 < z < \infty) - P(-.67 < z < 0) - [0.5 - P(0 < z < 1)]$$
$$= 0.5 - P(0 < z < .67) - [.5 - P(0 < z < 1)]$$
$$= 0.5 - .2485 - [0.5 - .3413]$$
$$= .2515 - 0.1587$$
$$= 0.0928$$

~~No. of battery cell life b/w $10 < x < 15 = 100 \times .0928$~~
~~$= 9.28 \approx 9$(app)~~

$P(10 < x < 15) = P(-0.67 < z < 1)$
$= P(-0.67 < z < 0) + P(0 < z < 1)$
$= P(0 < z < 0.67) + P(0 < z < 1)$
$= .2485 + .3413$

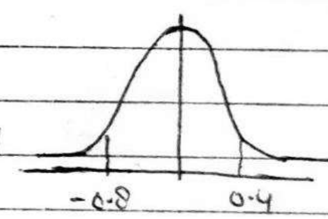
No. of battery $= .5898$
cell life b/w $= .5898 \times 100$
$(10 < x < 15) = 58.98\%$ Ans

15. $N = 1000$ cases , $\mu = 14$, $\sigma = 2.5$

(i) x : student score b/w 12 and 15
$P(12 < x < 15) =$

$z_1 = \frac{12-14}{2.5} = \frac{-2}{2.5} = -0.8$

$z_2 = \frac{15-14}{2.5} = \frac{1}{2.5} = 0.4$



$P(12 < x < 15) = P(-0.8 < z < 0.4)$
$= P(-0.8 < z < 0) + P(0 < z < 0.4)$
$= P(0 < z < 0.8) + P(0 < z < 0.4)$
$= .2881 + .1554$
$= .4435$

No. of student score b/w 12 & 15 $= 1000 \times .4435$
$= 443.5 \approx$
$= 444$ (app)

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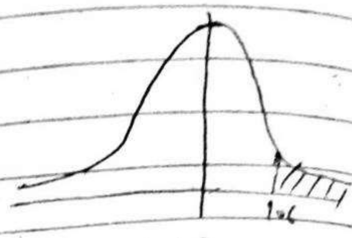
(ii) x : denots student score > 18

$$z = \frac{18-14}{2.5} = \frac{4}{2.5} = 1.6$$

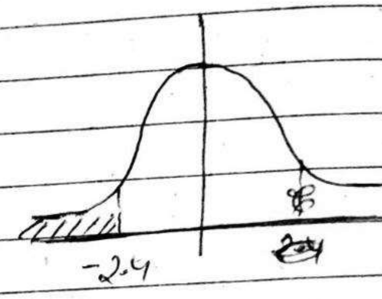


$$P(x>18) = P(z>1.6)$$
$$= P(0<z<\infty) - P(0<z<1.6)$$
$$= 0.5 - .4452$$
$$= .0548$$

No. of student score > 18 $= 1000 \times .0548$
$= 54.8 \simeq 55$ (app)

(iii) x : denotes below 8

$$z = \frac{8-14}{2.5} = -2.4$$



$$P(x<8) = P(z<-2.4)$$
$$= P(z>2.4)$$
$$= 0.5 - P(0<z<2.4)$$
$$= 0.5 - .4918$$
$$= .0082$$

No. of student score below 8 $= 1000 \times .0082$
$= 8.2 \simeq 8$ (app)

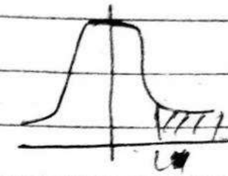
Variance

17. x : denotes weight of envelop.

$\mu = 1.9$ gm , $\sigma^2 = 0.01 \Rightarrow \boxed{\sigma = 0.1}$

(i) $P(x \geq 2)$

$$z = \frac{2-1.9}{0.1} = 1$$



$P(x \geq 2) = P(z \geq 1)$

$= P(0 < z < \infty) - P(0 < z < 1)$

$= 0.5 - .3413$

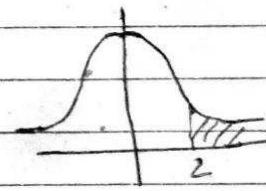
$= .1587$

No. of envelops weighing 2gm or more $= 1000 \times .1587$

$= 158.7 \approx 159$ (app)

(ii) $P(x \geq 2.1)$

$$z = \frac{2.1-1.9}{0.1} = \frac{0.2}{0.1} = 2$$



$P(x \geq 2.1) = P(z \geq 2)$

$= 0.5 - P(0 < z < 2)$

$= 0.5 - .4772$

$= 0.0228$

No. of envelops weighing 2.1 gm or more $= 1000 \times .0228$

$= 22.8 \approx 23$ (app)

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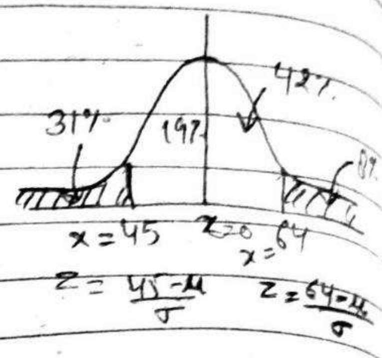
18. 31% of the items are under 45

Let μ and σ are mean and S.D respectively.



$$z_1 = \frac{45-\mu}{\sigma}$$

$$\int_{z_1}^{0} \phi(z)dz = .19$$

$$\boxed{z_1 = -0.5}$$

$$-0.5 = \frac{45-\mu}{\sigma}$$

$$-0.5\sigma = 45 - \mu$$

$$\mu = 45 + 0.5\sigma$$

$$\mu = 0.5\sigma + 45 \quad \text{——} (1)$$

8% of the items are over 64.

$$z_2 = \frac{64-\mu}{\sigma}$$

$$\int_{0}^{z_2} \phi(z)dz = .42$$

$$\boxed{z_2 = 1.41}$$

$$1.41\sigma = 64 - \mu$$

$$\cancel{\mu = 1.41\sigma - 6'}$$

$$\mu = 64 - 1.41\sigma$$

$$\mu = -1.41\sigma + 64 \quad \text{——} (2)$$

Now, solving eq^n (1) and (2) we get

~~Eq 8.8~~

~~$\boxed{\mu = 15.08}$~~ $\mu = 49.9 \approx 50$

~~$\boxed{\sigma = 10.18}$~~ $\sigma = -9.9$

Put $\mu = 49.9$ in eq^{n} (1), we get

$49.9 = 0.5\sigma + 45$

$4.9 = 0.5\sigma$

$9.8 = \sigma$

$\boxed{\sigma = 9.8 \approx 10}$

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