PRACTICAL # 10

Q:1 If z is a random variable having standard normal distribution find $P_r(z < 1.33)$, $P_r(z \leq -0.79)$, $P_r(0.55 < z < 1.22)$, $P_r(-1.9 < z < 0.44)$.

Q:2 Find z if the standard normal curve area

(a) b/w 0 & z is 0.4726
(b) to the left of z is 0.9868
(c) to the right of z is 0.1314
(d) b/w $-z$ & z is 0.852

Q:3 If z is a r.v having st. normal distribution find z_1, z_2, z_3, z_4 such that

(a) $P_r(0 < z < z_1) = 0.4306$.
(b) $P_r(z \geq z_2) = 0.7704$.
(c) $P_r(z > z_3) = 0.2912$.
(d) $P_r(-z_4 < z < z_4) = 0.920$

Q:4 In a photographic process, the developing time of points may be a r.v. having normal distribution with $\mu = 15.4$ sec, $\sigma = 0.48$ sec. find the probabilities that the time it takes to develop is :-

(a) at least 16 sec
(b) at most 14.2 sec
(c) anywhere from 15 to 15.8 sec

SOLUTION:-

Q:1 (a) $Pr(z < 1.33) = Pr(-\infty < z < 1.33)$.

$= 0.9082$.

(b) $Pr(z \leq -0.79) = Pr(-\infty \leq z \leq -0.79)$.

$= 0.2148$.

(c) $Pr(0.55 < z < 1.22) = Pr(z < 1.22) - Pr(z < 0.55)$.

$= 0.8888 - 0.7088$.

$= 0.18$.

(d) $Pr(-1.9 < z < 0.44) = Pr(z < 0.44) - Pr(z < -1.9)$.

$= 0.6700 - 0.0287$.

$= 0.6413$.

Q:2 (a) b/w 0 & Z = 0.4726.

Consider the table from 0 to ∞. and add 0.5 to the value i.e 0.9726, & look in table ie 1.92.

$Pr(0 < z < 1.92) = 0.4726$.

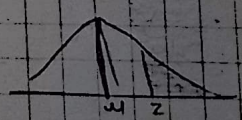
(b) to the left is 0.9868:-

Simply look in in the table $-\infty$ to $+\infty$

The value of z for which probability is 0.9868 is 2.22.

$Pr(z < 2.22) = 0.9868$.

(c) As the total area under the curve is equal to unity & we have cumulative z probability, so



$1 - 0.1314$

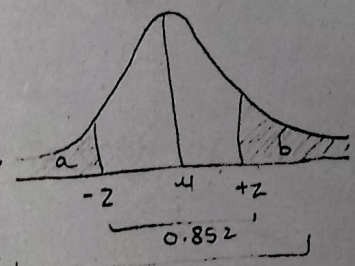
$= 0.8686$

$z = 1.12$

ie. $Pr(z > 1.12) = 0.1314$

(d) Let $-z$ & $+z$ be two points such that

$$P_r(-z < z' < z) = 0.852$$



1
sum
$1 - 0.85 = a + b$
$a = \frac{a+b}{2}$
$b = \frac{a+b}{2}$

so $P_r(-\alpha < z' < -z) = \frac{1 - 0.852}{2}$.

$P_r(-\alpha < z' < -z) = 0.074$.

so $-z = -1.45$

and $z = 1.45$

ie $P_r(-1.45 < z < 1.45) = 0.852$.

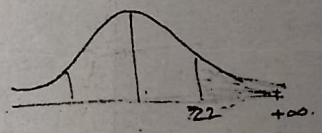
Q:3 (a) $P_r(0 < z < z_1) = 0.4306$ (add 0.5)
(0.9306)

from z-table:

$z_1 = 1.48$

ie $P_r(0 < z < 1.48) = 0.4306$.

(b) $P_r(z \geq z_2) = 0.7704$



$P_r(z_2 \leq z \leq +\infty) = 0.7704$.

$1 - P_r(z \geq z_2)$

$= 1 - 0.7704 = 0.2296$.

$z_2 = -0.74$.

$P_r(z \geq -0.74) = 0.2296$.

(c) $P_r(z \geq z_3) = 0.2912$.

$P_r(z_3 < z \leq +\infty) = 0.2912$.

$1 - P_r(z \leq z_3) = 1 - 0.2912$

$= 0.7088$

$z_3 = 0.55$

$P_r(z \geq 0.55) = 0.2912$.

$$Pr(-z_4 < z < z_4) = 0.920$$

$$Pr(-\infty < z < -z_4) = \frac{1-0.920}{2}$$

$$Pr(-\infty < z < -z_4) = 0.04$$

$$-z_4 = -1.75$$

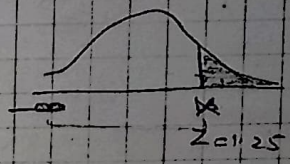
$$z_4 = 1.75$$

$$Pr(-1.75 < z < 1.75) = 0.920$$

Q:4

$$\mu = 15.4 \quad \delta = 0.48$$

(a) $Pr(X \geq 16)$



$$Pr\left[-z > \frac{16-15.4}{0.48}\right]$$

$$Pr[z \geq 1.25]$$

$$Pr(1.25 \leq z \leq +\infty] = 1 - 0.8944 = 0.1056$$

(b) $Pr(X \leq 14.2) =$

$$Pr\left[z \leq \frac{14.2-15.4}{0.48}\right]$$

$$Pr[z \leq -2.5]$$

$$Pr(X \leq 14.2) = 0.0062$$

(c) $Pr(15 \leq X \leq 15.8)$

$$= Pr\left[\frac{15-15.4}{0.48} \leq z \leq \frac{15.8-15.4}{0.48}\right]$$

$$= Pr[-0.83 \leq z \leq 0.83]$$

$$= 0.7967 - 0.2033$$

$$Pr(15 \leq X \leq 15.8) = 0.5934$$

PRACTICAL # 11

Q:1 Suppose the force acting on a column that helps to support a building is normally distributed with mean 15.0 kips and S.D 1.25 kips, what is the probability that, the force is

(a) at most 17 kips (b) b/w 12 & 17 kips

Q:2 Assume the development time for a particular type of photographic printing paper is normally distributed with mean 25sec and S.D 1.3 sec, what is the probability that

(a) a particular print will require more than 26.5 sec to develop
(b) development time is at least 23 seconds

Q:3 A particular type of tank is designed to hold 15 gallons. Suppose the actual capacity X is normally distributed with mean 15 gallons & S.D 0.2 gallons what is the probability that :-

(a) Selected tank will hold at most 14.8 gallons.
(b) Seleded tank will hold b/w 14.7 & 15.1 gallons.

Q:4 Suppose the pH taken from a region is normally distributed with mean 6 and S.D 0.10. If the pH selected soil is determined what is the probability that

(a) the resulting pH is b/w 5.9 & 6.15.
(b) the resulting pH exceed 6.10.

SOLUTION :-

Q:1 $\mu = 15$ $\sigma = 1.25$

(i) $Pr(x \leq 17) = ?$

$$Pr\left(z \leq \frac{17-15}{1.25}\right) = Pr(z \leq 1.6)$$

$$P(z \leq 1.6) = 0.9452.$$ ✓

(ii) $Pr(12 < x < 17) = ?$

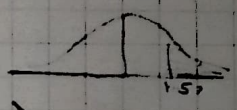
$$Pr\left(\frac{12-15}{1.25} < z < \frac{17-15}{1.25}\right)$$

$$Pr(-2.4 < z < 1.6)$$

$$(0.9452 - 0.0082) = 0.937$$

$$Pr(12 < x < 17) = 0.937$$ ✓

Q:2 $\mu = 25$ $\sigma = 1.3$



(i) $Pr(x > 26.5) = ?$

$$Pr\left(z > \frac{26.5-25}{1.3}\right) = Pr(z > 1.153)$$

$$1 - Pr(-\infty < z < 1.153)$$

$$1 - 0.8749$$

$$Pr(x > 26.5) = 0.1251$$ ✓

(ii) $Pr(x \geq 23) = ?$

$$Pr\left(z \geq \frac{23-25}{1.3}\right) = Pr(z \geq 1.538)$$

$$1 - Pr(z \geq 1.538)$$

$$1 - 0.0630$$

$$Pr(x \geq 23) = 0.937.$$ ✓

Q:3 $\mu = 15$ $\sigma = 0.2$

(i) $$Pr(x \leq 14.8) = Pr\left(z \leq \frac{14.8-15}{0.2}\right)$$

$$Pr(z \leq -1)$$

$$Pr(x \leq 14.8) = 0.1587$$ ✓

(ii) b/w 14.7 & 15.1

$$P_r(14.7 < x < 15.1) = P_r\left(\frac{14.7-15}{0.2} < z < \frac{15.1-15}{0.2}\right)$$

$$P_r(-1.5 < z < 0.5)$$

$$P_r(-\infty < z < 0.5) - P_r(-\infty < z < -1.5)$$

$$(0.6915 - 0.0668) = 0.6247.$$

$$P_r(14.7 < x < 15.1) = 0.6247. \checkmark$$

Q:4 $\mu = 6 \quad \sigma = 0.10.$

(i) $$P_r(5.9 < x < 6.15) = P_r\left(\frac{5.9-6}{0.1} < z < \frac{6.15-6}{0.1}\right)$$

$$P_r(-1 < z < 1.5)$$

$$P_r(-\infty < z < 1.5) - P_r(-\infty < z < -1)$$

$$= 0.9332 - 0.1587 = 0.7745$$

$$P_r(5.9 < x < 6.15) = 0.7745 \checkmark$$

(ii) $$P_r(x > 6.10)$$

$$P_r\left(-\infty < z < \frac{6.10-6}{0.1}\right)$$

$$P_r(-\infty < z < 1)$$

$$1 - 0.8413 = 0.1587$$

$$P_r(x > 6.10) = 0.1587 \checkmark$$

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28-5-22