Final Assessment

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20241068

1. AMD = 40% = 0.4

so, Intel = 1 − 0.4
= 0.6

people = 18

(a) ~~Mean~~

$n = 18$

$p = 0.4$

so, Mean = np
$= 18 \times 0.4$
$= 7.2$
≈ 7

Standard deviation (SD) $\Rightarrow \sqrt{np(1-p)}$ [$q = 1-p$]

$= \sqrt{7.2(1-.4)}$

$= \sqrt{7.2 \times .6}$

$= \sqrt{4.32}$

$= 2.07846$

$= \cancel{2.0785}$

SD $\Rightarrow$ 2.0785 [Ans]

(b)

Mean $-$ ($2 \times$ SD)

$\Rightarrow 7.2 - (2 \times 2.0785)$

$\Rightarrow 7.2 - 4.157$

$\Rightarrow 3.04$

Again,

Mean $+$ $\cancel{2}$($2 \times$ SD)

$\Rightarrow 7.2 + \cancel{2}(2 \times 2.0785)$

$\Rightarrow 7.2 + 4.157$

$\Rightarrow 11.357$

$\Rightarrow 11.36$

~~So, $\Rightarrow P(X \leq 3) + P(X \geq 12)$~~

So, $P(X > n+2\sigma) = P(X \leq 3) + P(X \geq 12)$

$= P(X \leq 3) + 1 - P(X \leq 11)$

$= 0.03278 + 1 - 0.9797183$

$= 0.03278 + 0.0202817$

$= 0.0530617$

$= 0.0531$ [Ans]

(c) Given:

AMD = 10 Laptops
Intel = 12 laptops.
population = 18

Total laptops = 22
If demand of AMD is more than 10, it will not be enough.

Again
If demand of Intel PC is more than 12, it means demand of AMD laptop is less than 6. [as population = 18]. Then there would be a shortage of laptops.

So probablity can be written as $\Rightarrow P(6 \le x \le 10)$

$$\Rightarrow P(x \le 10) - P(x \le 5)$$

$$\Rightarrow 0.9423526 - 0.20875837212$$

$$\Rightarrow 0.7335942895$$

$$\Rightarrow 0.7336$$

$\therefore$ So probablity of 18 people getting what they want is 0.7336

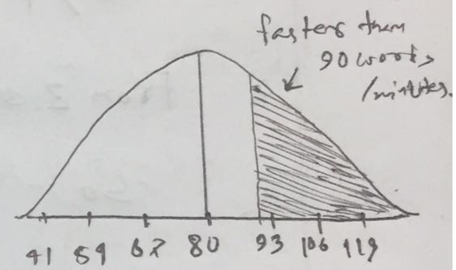
[Ans]

3. Given,

Mean, $\mu = 80$ words/minute.

Standard deviation $\sigma = 13$ words/minute.

(a). Probablity of a randomly selected applicant types at a speed faster than 90 words/minute is $P(x>90)$.



So, $P(x>90)$

$$\Rightarrow P\left(\frac{x-\mu}{\sigma} > \frac{90-\mu}{\sigma}\right)$$

$$\Rightarrow P\left(Z > \frac{90-80}{13}\right) \left[\because Z = \frac{x-\mu}{\sigma} \text{ (z-score)}\right]$$

$$\Rightarrow P\left(Z > \frac{10}{13}\right)$$

$$\Rightarrow P(Z > 0.76923)$$

$$\therefore \Rightarrow P(Z > 0.77)$$

$$\Rightarrow 0.2206 \quad \text{[From Z-score table]}$$

[Ans]

(b) 95th percentile value for typing speed

$\Rightarrow P(x<c)=0.95$

~~Ans~~ Now,

$$P(x<c)=0.95$$

$$\Rightarrow P\left(\frac{x-\mu}{\sigma}<\frac{c-\mu}{\sigma}\right)=0.95$$

$$\Rightarrow P\left(Z<\frac{c-80}{13}\right)=0.95$$

From Z-score table $P(Z<1.65)\cong 0.95$

So,

$$\frac{c-80}{13}=1.65$$

$$\Rightarrow c-80=1.65\times13$$

$$\Rightarrow c=\cancel{0.65}\ 21.45+80$$

$$\therefore c\simeq 101.45$$

$$\Rightarrow c\approx 101$$

Therefore the 95th percentile value for typing speed is ~~101/minute~~ ~~[Ans]~~ 101/minutes.

[Ans]

(c) Probablity that a random selected applicant will not meet the typing requirement of the company is

$$P(x<70)+P(x>120)$$

$$\Rightarrow P\left(\frac{x-\mu}{\sigma}<\frac{70-\mu}{\sigma}\right)+P\left(\frac{x-\mu}{\sigma}>\frac{120-\mu}{\sigma}\right)$$

$$\Rightarrow P\left(Z<\frac{70-80}{13}\right)+P\left(Z>\frac{120-80}{13}\right)$$

$$\left[\because Z=\frac{x-\mu}{\sigma}\right]$$

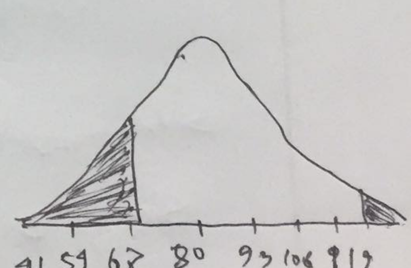
$$\Rightarrow P(Z<-0.77)+P(Z>3.07)$$

[From Z-score table]

$$\Rightarrow 0.2206+0.011$$

$$\Rightarrow 0.2217$$

[Ans]



$\Rightarrow$ Not meeting the typing requirement of the company.

(d) Minimum typing speed an applicant should ~~achieve~~ achieve if they wish to increase their chances of being hired as a typesetters:

Let c = Minimum typing speed required.

$7\% = 0.07$

So,

$$P(X > c) = 0.07$$

$$\Rightarrow P\left(\frac{X-\mu}{\sigma} > \frac{c-\mu}{\sigma}\right) = 0.07$$

$$\Rightarrow P\left(Z > \frac{c-80}{13}\right) = 0.07$$

From z-score table $P(Z > 1.47) = 0.07$

So,

$$\frac{c-80}{13} = 1.47$$

$$\Rightarrow c - 80 = 1.47 \times 13$$

$$\Rightarrow c = 19.11 + 80$$

$$\therefore c \Rightarrow 99.11$$

So $c \simeq 99$

$\therefore$ Required minimum typing speed is: ~~99/99%~~ 99 words/minutes.

[Ans]

3. Given,

$\mu = 45$

$\sigma = 8$

So,

population variance $(8)^2 = 64$

$\bar{x} = 48$

$n = 25$

(a) Null Hypothesis (H_0) ⇒ Mean duration of the fishermen holding their breath is equal to an adult human. So,

$\mu = 45$

(b) Alternate Hypothesis (H_1) ⇒ Mean duration of the fishermen holding their breath is not equal to an adult human.

$\mu \neq 45.$

(b) → Type I Error ⇒

Error that we are doing by rejecting the true null hypothesis. Its probablity is denoted by α.

so, Type I (Rejecting H_0 when it is true)

This means the mean duration of the fishermen holding their breath is equal to an adult human or $\mu = 45$. However we are rejecting this statement. In reality mean duration for the fishermen holding their breath is the same as of an adult.

→ Type II Error ⇒

Error that we are doing by failing to reject null hypothesis, H_0 when it is actually false. Its probablity is ~~detone~~ denoted by β.

so, Type II (Fail to reject H_0 when it is false)

This means the mean duration of the ~~fishermen~~ fishermen holding their breath is ~~not~~

~~equal to an adult human. So $\mu \neq 45$. However,~~

not equal to an adult human. So $\mu \neq 45$. However, We are rejecting H_1 and accepting H_0 $(\mu = 45)$.

(c) Hypothesis ~~tes~~ testing:

~~test statistics:~~

Level of significance = 1%.

We know,

$$Z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$$

$$= \frac{48 - 45}{\frac{8}{\sqrt{75}}}$$

[test - statistics]

$$= \frac{3}{0.92376}$$

$$= 3.247565$$

$$= 3.25$$

Z_{table} (for 1%) = 2.576

So, $Z_{cal} > Z_{table}$

20241068

Since, test statistics value is greater than Z_{table}. we reject null hypothesis H_0, at 1% level of significance. It means that the mean duration for the fishermen to hold their breath is not the same as adult humans. So $\mu \neq 45$.

comment:
Since H_0 / null hypothesis is rejected we can say that there is not enough evidence to claim that mean distribution of the fishermen holding their breath is equal to an adult humans

20241068

4 Given:

Average lifetime for a particular model / $\mu = 15$

Sample size / $n = 13$

Sample date $\Rightarrow \{15, 18, 17, 20, 16, 16.5, 15.5, 17.5, 19, 19, 21, 18.5, 16.5, 15, 19\}$

~~Ans~~ As sample size $n < 30$, and sd is unkwon we will use t-test.

(a) Null Hypothesis (H_0): There is no difference between the average model μ and the samele mean.

so, $\mu = 15$

Alternate Hypothesis (H_1): Average lifetime of a model is greater than the sample mean.

so, $\mu > 15$

(b) Given $n = 15$

$$\therefore \bar{x} = \frac{\Sigma \text{ sample data}}{n}$$

$$\Rightarrow \bar{x} = \frac{15+18+17+20+16+16.5+15.5+17.5+19+14+21+18.5+16.5+15+14}{15}$$

$$= \frac{253.5}{15}$$

$$= 16.9$$

Now,

x	$x-\bar{x}$	$(x-\bar{x})^2$
15	-1.9	3.61
18	1.1	1.21
17	0.1	0.01
20	3.1	9.61
16	-0.9	0.81
16.5	-0.4	0.16
15.5	-1.4	0.96
17.5	0.6	0.36
19	2.1	4.41
14	-2.9	8.41
21	4.1	16.81
18.5	1.6	2.56
16.5	-0.4	0.16
15	-1.9	3.61
14	-2.9	8.41

$\Sigma \Rightarrow 62.1$

So,

Sample Standard deviation $\Rightarrow \sqrt{\frac{\Sigma(x_i-\bar{x})^2}{n-1}}$

$$\Rightarrow \sqrt{\frac{62.1}{14}}$$

$\therefore S \Rightarrow 2.1061$

(c) ~~We know~~

Hyphothesis testing:

~~test-statistic→~~

We know,

Level of significance ⇒ 5%.

$$t = \frac{\bar{x} - u}{s/\sqrt{n}}$$

[test-statistics]

$$\Rightarrow \frac{16.9 - 15}{\frac{2.1061}{\sqrt{15}}}$$

$$\Rightarrow \frac{1.9}{0.543\cancel{7}9}$$

$$\therefore t_{cal} \Rightarrow 3.493995$$

Z_{table} / Critical value ⇒ t-value from t table with (15−1) ~~df~~ degree of freedom and 0.05 level of significances

⇒ 1.~~7~~61

So, t_{cal} > critical value / ~~Z table~~ Z_{table}.

Since,
test-statistic value is greater than critical value, we reject the null hypothesis(H_0).
So, we accept the alternate hypothesis which states that average lifetime of a model is greater than the sample mean. [Level of significane = 5%]

Comment: Since null hypothesis is rejected we can say that there is not enough evidence to claim that there is no difference between the average model mean and the sample mean.