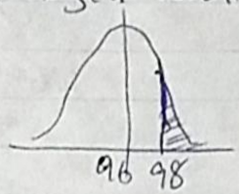
Central Limit Theorem

(1) Officer needs => 35.
Avg IQ of 35 must be >98. Avg IQ of Soldier = 96 (μ)
with std dev of 16 pts (σ_{pop}).
If given random 35 what is prob that he gets what he wants.

$$\sigma_{SD} = \frac{\sigma_{pop}}{\sqrt{N}} = \frac{16}{\sqrt{35}} = 2.70.$$



$$z = \frac{x - \mu_{SD}}{\sigma_{SD}} = \frac{98-96}{2.7} = \frac{2}{2.7} = 0.74 \Rightarrow$$

~~= 23% prob that officer gets 35 men, IQ over 98~~

1 - zscore => 1 - 0.74 = 0.26 = 60.26% chance that officer gets 35 men with IQ >98.

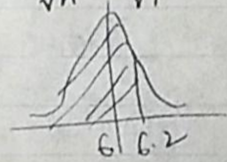
(2) Head Breadth of Men $\mu = 6.0$ & $\sigma = 1$

(a) If a male is randomly selected what is P() that his head breadth is < 6.2 in.

$$\sigma_{SD} = \frac{\sigma_p}{\sqrt{n}} = \frac{1}{\sqrt{1}} = 1$$

$$z = \frac{x - \mu}{\sigma_{SD}} = \frac{6.2 - 6}{1} = 0.2 = 57.93 = 58\%$$

& 58% prob that the breadth is < 6.2 in



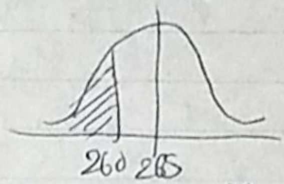
(b) Find P() that 100 random have a mean breadth is < 6.2 in

$$\sigma_{SD} = \frac{\sigma_{pop}}{\sqrt{n}} = \frac{1}{\sqrt{100}} = \frac{1}{10} = 0.1$$

$$z = \frac{x - \mu}{\sigma_{SD}} = \frac{6.2 - 6}{0.1} = \frac{0.2}{0.1} = 2 \Rightarrow 0.9772 \text{ or } 97.72\%$$

(c) Sampling of 100 is not a correct population to decide that the breadth of Men will be < 6.2 in. Test needs to be run for much larger population.

(8) Length of pregnancy $\mu = 268$ days SD = 15 days
(a) 25 random with length < 260 days.

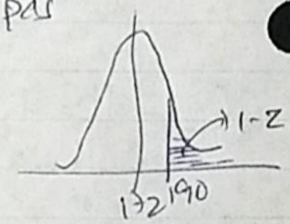


$$\sigma_{SD} = \frac{\sigma_{pop}}{\sqrt{n}} = \frac{15}{\sqrt{25}} = \frac{15}{5} = 3$$

$$Z = \frac{268-260}{3} = \frac{8}{3} = \cancel{2.67}\ \bar{2}.67 = 0.0038 = 0.38\%$$

(b) If on a special diet for 25 before preg and $\mu < 260$ days.
does it appear diet has effect on preg.
P( ) of happening normally is ~~0.038~~ 0.038 < 0.05
Mean is very low, so can be stated that diet has effect on preg.

(4) Wt. of Adults $\mu = 172$ and $\sigma = 29$
a) P( ) of one randomly select weighs > 190 pds

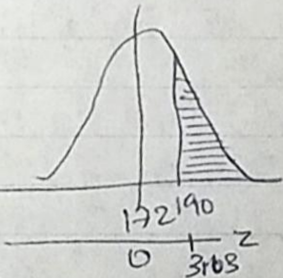


$$Z = \frac{x - \mu}{\sigma_{SD}} \qquad \sigma_{SD} = \frac{\sigma_{pop}}{\sqrt{N}} = \frac{29}{\sqrt{1}} = 29$$

$$= \frac{190-172}{29} = \frac{18}{29} = 0.621 \Rightarrow 0.7324$$

Right of it) $1 - Z = 1 - 0.7324 = 0.2676 \Rightarrow 26.8\%$

(b) $n = 25$ with $\mu > 190$ pds



$$\sigma_{SD} = \frac{\sigma_{pop}}{\sqrt{n}} = \frac{29}{\sqrt{25}} = \frac{29}{5} = 5.8$$

$$Z = \frac{x - \mu}{\sigma_{SD}} = \frac{190-172}{5.8} = \frac{18}{5.8} = 3.103 \Rightarrow$$

$\Rightarrow$ 0.0010 P( ).

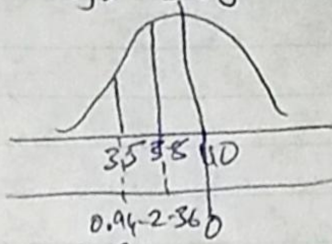
(c) Max allowable wt of elev = 4750 random selection is 25 ppl

$\mu = \frac{4750}{25} = 190.$ what is P( ) that its max. allowable wt.

$P(\bar{x} > 190) = 0.0010$ ← same as in (b)

(5) Amt of impurity in chemical prod $\mu = 4.0$ $\sigma = 1.5$
50 independent samples with μ between 3.5 & 3.88

$$\sigma_{SD} = \frac{\sigma_{pop}}{\sqrt{n}} = \frac{1.5}{\sqrt{50}} = \frac{1.5}{5\sqrt{2}} = 0.2121$$



$$P(3.5) \Rightarrow \frac{3.5-4}{.2121} = \frac{0.5}{.2121} = -2.357 = -2.36$$

$\Rightarrow (z(2.36) = 0.0091$

$$P(3.8) = \frac{3.8-4}{0.2121} = -\frac{0.2}{0.2121} = -0.942$$

$z(0.942) = 0.1736)$

$\Rightarrow z_1 - z_2 = 0.1736 - 0091 = \boxed{0.1645}$

(6) random size $n = 64$. $\mu = 50$ $\sigma = 16$.

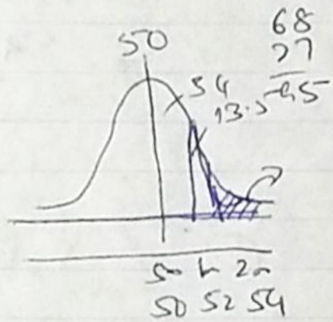
$x^- = \frac{50 \times 8}{16} \; 25$

(a) Expectation & Std dev of x^-

$\mu = 50$. $\sigma_x = \frac{16}{\sqrt{64}} = \frac{16}{8} = 2$

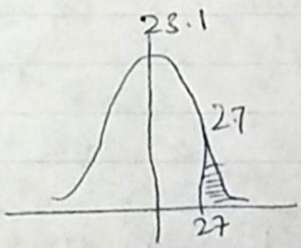
(b) What is P( ) that sample mean is >54.

Approximately $\boxed{2.5\%}$ of chance that $\mu > 54$.



(c) No additional assumption needed as sample size is above the expected range.

(7) age $\mu = 23.1$ $\sigma = 3.1$, $N = 6$

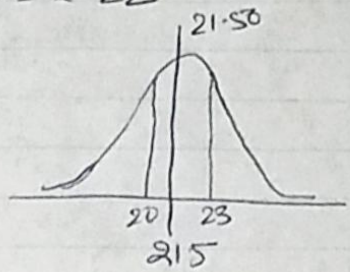


$$\sigma_{SD} = \frac{\sigma_{pop}}{\sqrt{n}} = \frac{3.1}{\sqrt{6}} = 1.265$$

$$z = \frac{27-23.1}{1.265} = 3.08 = 0.9990$$

$1 - z = 0.9990 = 0.001 = \underline{0.1\%}$.

(8) Avg amt spent on food = $\mu = 21.50$ $\sigma = 2.22$



$$\sigma_{SD} = \frac{\sigma_{POP}}{\sqrt{N}} = \frac{2.22}{\sqrt{8}} = \frac{2.22}{2\sqrt{2}} = 0.78$$

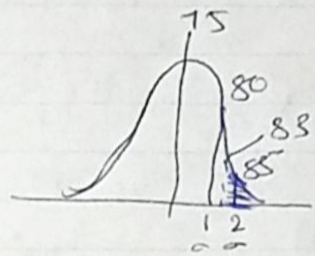
$$Z_1 = \frac{20-21.5}{0.78} = -1.91 = 0.0281$$

$$Z_2 = \frac{23-21.5}{0.78} = 1.91 = 0.9791$$

$\Rightarrow 0.9719 - 0.0281$

$\Rightarrow \underline{0.0438}$

(9) Suppose grades of $\mu = 75$ $\sigma = 5$



(a) $n = 1$ $\mu > 83$

$$\sigma_{SD} = \frac{\sigma_P}{\sqrt{N}} = \frac{5}{\sqrt{1}} = 1$$

$$\cancel{Z} = \frac{83-75}{5} = \frac{8}{5} = 1.6 = 0.9452$$

$\Rightarrow 1 - Z = 1 - 0.9452 = 0,0548 = 5\%$.

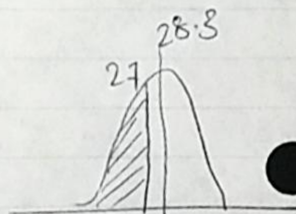
(b) $n = 5$ is atleast 83.

$$\sigma_{SD} = \frac{\sigma_P}{\sqrt{N}} = \frac{5}{\sqrt{5}} = \sqrt{5} = 2.23$$

$$Z = \frac{83-75}{\sqrt{5}} = \frac{8}{2.23} = 3.58 \Rightarrow 0.999$$

$>83 \Rightarrow 1 - 0.999 = 0.0001$

(10). Age $\mu = 28.3$ $\sigma = 2.3$



$N = 10$ $\mu < 27$ yrs

$$\sigma_{SD} = \frac{2.3}{\sqrt{10}} = 0.727$$

$$Z = \frac{27-28.3}{0.727} = -1.79$$

$= 0.0367$