10. Weight in lift

Max weight of the lift is 800 kg.

10 people → each one 70kg (Avg).

Variance in 200g

Sample population = 10 people (adults).

Sampling distribution mean = population mean.

$\sigma_{SD} = \sigma_{pop} / \sqrt{N} = 0.20 / \sqrt{10}$

$= 0.06$ or 60grams.

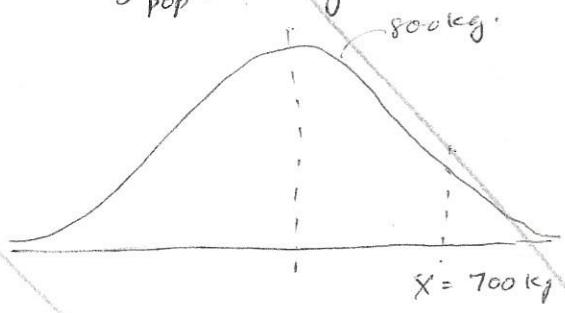
$X = 700$ kg $\Rightarrow Z_{score}$?

$P(X=700) =$ 700 -

Area under the curve can be considered to be 800 kg.

$\mu_{pop} = 70$ kg

$\sigma_{pop} = 200$ g.



Q3. An unbiased dice is tossed 700 times. Use normal approximation to binomial

$N = 700$

(i) more than 124 '6's'.

$P = \frac{1}{6}$ $q = \frac{5}{6}$

Normal distribution approximation to binomial can be done if:

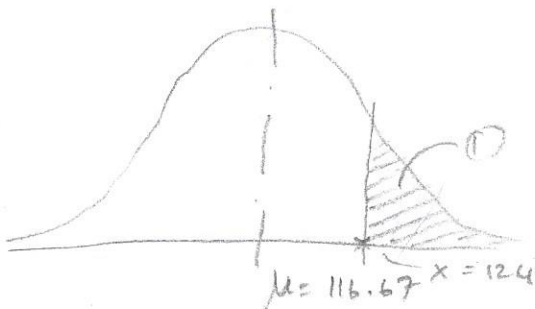
$n \times p > 5 \Rightarrow 700 \times \frac{1}{6} = 116.67$

$n \times q > 5 \Rightarrow 700 \times \frac{5}{6} = 583.33$

Mean $\mu = n \times p \Rightarrow 116.67$

Variance $= n \times p \times q \Rightarrow 116.67 \times \frac{5}{6} = 97.225$

$\sigma = \sqrt{97.225} = 9.86$



(i) $P(X > 124) = \frac{124.5 - 116.67}{9.86} = 0.794$

(Area under 0.794 $\Rightarrow$ 0.7852 $\Rightarrow 1 - 0.7852 = 0.2148$ or 21.5%

CONTINUITY CORRECTION

If $P(X=n)$ use $P(n-0.5 < X < n+0.5)$

$P(X > n)$ use $P(X > n+0.5)$

$P(X < n)$ use $P(X < n-0.5)$

$P(X \geq n)$ use $P(X > n-0.5)$

$P(X \leq n)$ use $P(X < n+0.5)$

(ii) $P(81 < X < 100)$

$P(81.5 < X < 99.5)$

$Z = \frac{99.5 - 116.67}{9.86} = -1.74$ (A $\Rightarrow$ 0.0409)

$Z = \frac{81.5 - 116.67}{9.86} = -3.56$ (A $\Rightarrow$ 0.0002)

A $\Rightarrow 0.0409 - 0.0002 \Rightarrow 0.0407$

or 4.07%

(iii) $P(X = 145)$

$= \frac{145 - 116.67}{9.86}$

$= 2.87$

(A $\Rightarrow$) $1 - 0.9979$

$= 0.0021$

or 0.21%

Q10. Average weight of each male = 70kg. Variance = 200 | Max Lift weight = 800 kg

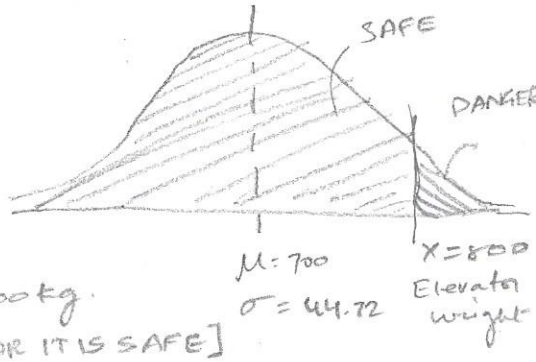
(a) The problem statement is about weight of 10 people and NOT the weight of one person.

So the average of 10 adult males = 700 kg

variance of 10 adult males = 2000

Std dev of 10 adult males = $\sqrt{2000}$

= 44.72 kg.



What is the probability that average may be < 800 kg. [OR IT IS SAFE]

$$P(X \leq 800) = \frac{X-M}{\sigma} = \frac{800-700}{44.72} = \frac{100}{44.72} = 2.236$$

Area under the curve for Z (2.236) = 0.9871 or 98.71%.

(b) Now the problem statement changes from n = 10 to n = 12 so

the average of 12 adult males = 12 × 70 = 840 kg. Variance = 12 × 200

= 2400

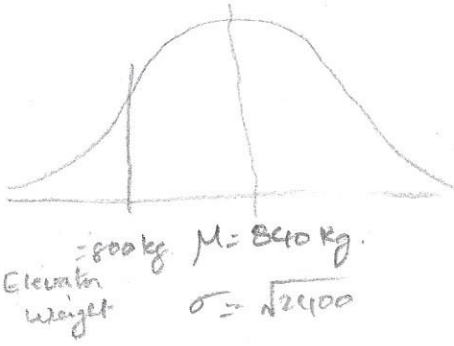
Stdev = $\sqrt{2400}$

$$P(X \leq 800) = \frac{800-840}{\sqrt{2400}} = \frac{-40}{48.98} = -0.816$$

Area under the curve Z score -0.816 ⇒ 0.2090

or 20.90%

(Safely reaching ground)



Q4. Random variable follows poisson distribution

with parameter = 25 [λ = 25]

Use normal approximation to Poisson distribution to find the probability that

$X \geq 30$.

[λ = M, λ = σ²] For large values of λ like λ > 1000 Normal distribution is Excellent approx

For λ > 10 Normal distribution is a good approximation

So Considering the BINOMIAL DISTRIBUTION TO NORMAL DISTRIBUTION

$$P(X \geq 30) = \frac{30-25}{5} = \frac{5}{5} = 1$$ (Area under the curve: 0.8413)

$$P(X \geq 30) = 1 - 0.8413 = 0.1587$$ or 15.87%