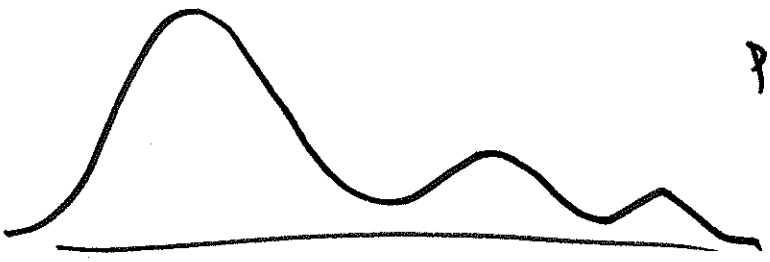
Discussion Section 9.

extra notes:

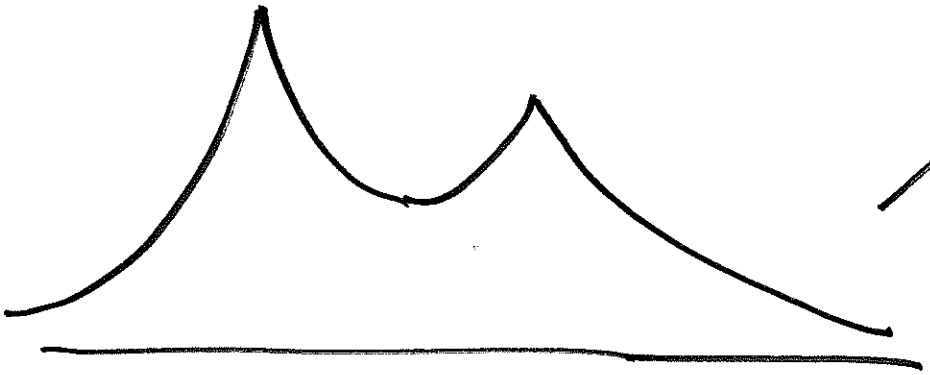
AMS 131
24 Jan 18

① pp. (3.4) → 



PDF of $\bar{X}_1$ → 

PDF of $\bar{X}_n$, (n) large



n in CLT: how large?

① if $X_i \sim N(\mu, \sigma^2)$ then you get ~~[illegible]~~ $N(\mu, \frac{\sigma^2}{n})$ exactly for PDF of $\bar{X}_n$ for all $n = 1, 2, \ldots$

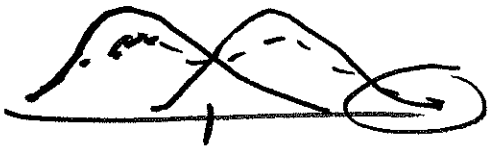
② the closer the PDF of X_i is to Normality to begin with the smaller n needs to be

X_i = weight of person i on elevator on a typical fully-loaded trip,

$i = 1, \ldots, n = 192$

SD = 33 lb.

PDF of X_i



$\mu = 158$ lb.

PDF of women's weight

75 lb.

PDF of men's weight

$S_n = \sum_{i=1}^{n} X_i$ $\quad \bar{X}_n = \frac{S_n}{n}$ $\quad S_n = n\bar{X}_n$

$P(\text{overload}) = P(S_n > 31{,}400 \text{ lb.})$

$X_i \overset{IID}{\sim}$ PDF ⊛

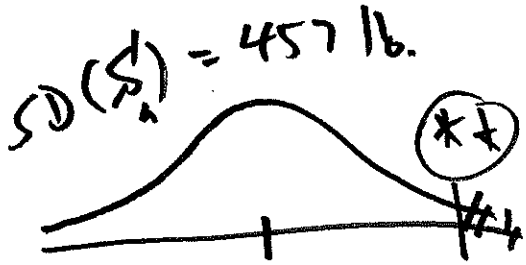
$E(X_i) = \mu = 158$ lb.

$SD(X_i) = \sigma = 33$ lb.

CLT says if n is large, PDF of $\bar{X}_n$ will be close to Normal

since $S_n = n\bar{X}_n$,

the same is true about S



$$E(S_n) = E\left(\sum_{i=1}^{n} X_i\right)$$

$$= \sum_{i=1}^{n} E(X_i) = \sum_{i=1}^{n} \mu$$

$$= n\mu = (192)(158 \text{ lb.})$$

$$= 30,336 \text{ lb.}$$

$$SD(S_n) = \sqrt{V(S_n)}$$

$$V(S_n) = V\left(\sum_{i=1}^{n} X_i\right)$$

① IID

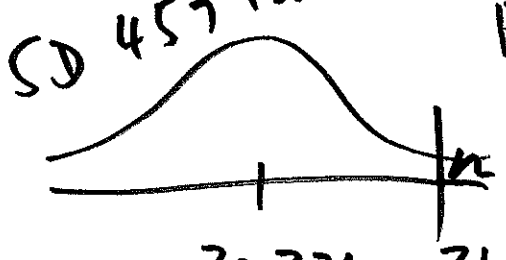
$$= \sum_{i=1}^{n} V(X_i) = \sum_{i=1}^{n} \sigma^2 = n\sigma^2$$

$$SD(S_n) = \sqrt{n\sigma^2}$$

$$= \sigma\sqrt{n}$$

$$= (33 \text{ lb.})\sqrt{192}$$

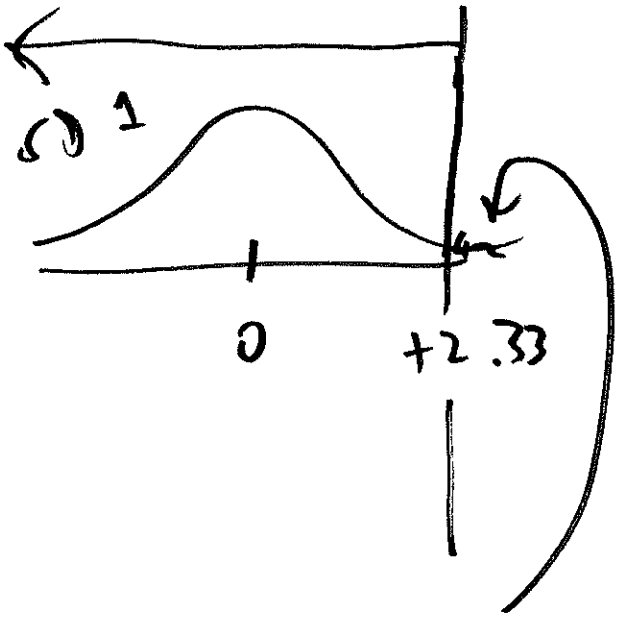
$$\approx 457 \text{ lb.}$$



$$z = \frac{s - E(S)}{SD(S)}$$

$$\Phi(z)$$

$$\frac{31,400 \text{ lb.} - 30,336 \text{ lb.}}{457 \text{ lb.}} = +2.33$$



$$\Phi(x) = P(Z \le x)$$

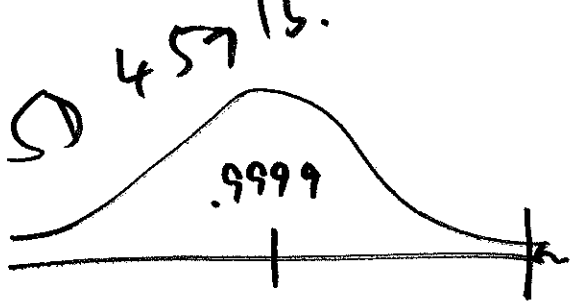
$N(0,1)$

$= \text{phorm}(x)$

$1 - \text{phorm}(+2.33) \doteq 0.01 = 1\%$

---

escalator breaks about every 100 fully-loaded trips



PDF of S_n

$\frac{1}{10000} = .0001$

32,036 lb.
−31,400 lb.
= 636 lb
158 lb
÷ 4 people

54

$\frac{x - 30336}{457} = 3.719$