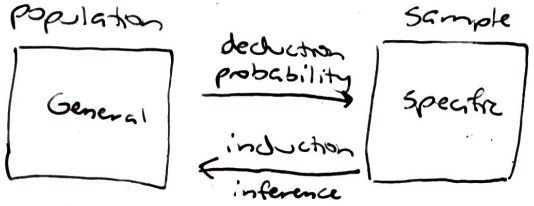
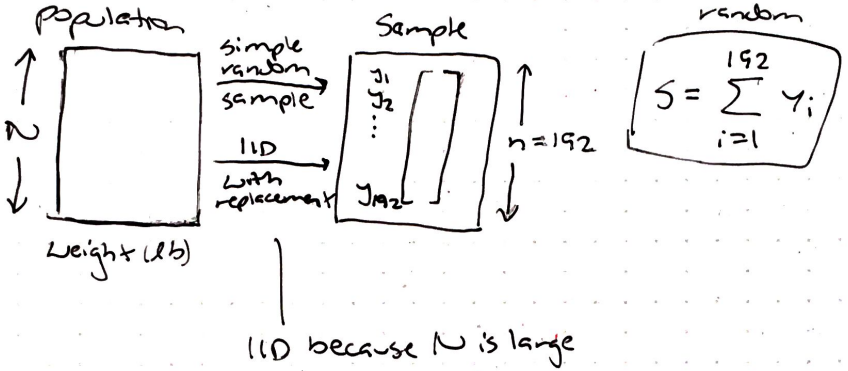
5/29/19 Section 9 TA: LB

London Underground Case Study





IID because N is large

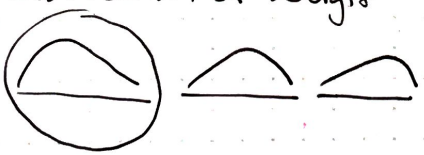
Y_i : weight of ind i

Capacity : 31400 pounds → fixed

$P(\text{"overload"}) = P(S > 31400)$

X r.v. $P(X > a) = \int_a^\infty f_X(x)\,dx$: PDF

Distribution of weight



Distribution of S:

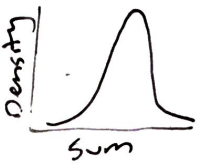
sum of random samples from X

$S \longrightarrow$ Normal

$n \to \infty$

↓

N is large!



PDF of S

$P(S > 31400)$

Need to calculate the expected value and standard deviation or variance.

$$E(S) = E\left(\sum_{i=1}^{n} y_i\right) = \sum_{i=1}^{n} E(y_i) = \sum_{i=1}^{n} \mu = n\mu$$

$E(y_i) = 158.15 = \mu$

$SD(y_i) = 33.15 = \sigma$

$$Var(S) = V\left(\sum_{i=1}^{n} y_i\right) \overset{\text{i.i.d}}{=} \sum_{i=1}^{n} V(y_i) = \sum_{i=1}^{n} \sigma^2 = n\sigma^2$$

(i.i.d: independent)

$SD(S) = \sqrt{n} \cdot \sigma$

$$P(S > 31400) = P\left(Z > \frac{31400 - (192)(158)}{\sqrt{192} \cdot 33}\right)$$

(normal approx. from CLT)

standard normal: $Z = \frac{S - E(S)}{SD(S)}$

$= P(Z > 2.3268)$ or $P(Z < -2.3268)$

* Now we can use the tables for a normal distribution or R

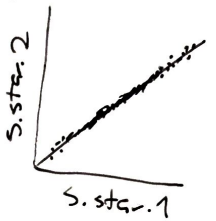
$pnorm(-2.3268) = 0.00998374$

Probability of overload is close to 1%

Bimodal, not Normal →

sub-population PDF

qq plot



Probability of overload

$P(S > 31400)$

R code:

mean(S.star.1 > 31400)

= 0.010715

1% like what we got from when we did a theoretical value