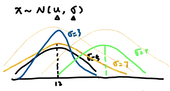
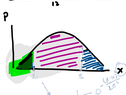
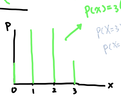
Tuesday, December 19, 2023 8:15 AM

$X \sim N(u, \sigma)$







Mass Fn:

$P(x) = 3C_x(\frac{1}{3})^x(1-\frac{1}{3})^{3-x}$

$P(X=3) = \frac{1}{3}$

$P(X=1) = \frac{1}{3}$

$P(X=x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-u)^2}{2\sigma^2}}$

$P(X=x_1) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-u)^2}{2\sigma^2}} = 0.00000$

$P(X<x_1) = P(X \le x_1) = \int_{-\infty}^{x_1} \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-u)^2}{2\sigma^2}} dx$

$P(X > x_1)$

$P(x_1 \le X \le x_2) = P(X \le x_2) - P(X \le x_1)$

cumulative

$P(X \ge x_1) = 1 - P(X \le x_1)$

$= 1 - P(X < x_1)$

$P(-\infty < X < +\infty) = 1$

$u = 12 \quad \sigma = 3.2$

$P(X > ?) = 10\%$

?

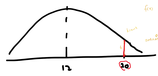
X: daily consumption

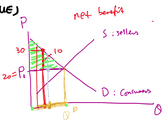
$X \sim N(12, 3.2)$

$P(X=20) = \frac{1}{3.2\sqrt{2\pi}} e^{-\frac{(20-12)^2}{2 \cdot 3.2^2}}$ = norm.dist(20, 12, 3.2, False)

$P(X<20)$ = norm.dist(20, 12, 3.2, TRUE)

$P(X>20) = 1 - P(X<20) = 1 -$ norm.dist(20, 12, 3.2, TRUE)

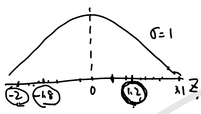




$P(a < X < b) = P(X < b) - P(X < a)$ $\quad \int_a^b f(\alpha)\,d\alpha$

Standard Normal Distribution

$X \sim Z(0,1)$; $Z \sim Z(0,1)$



$X \sim N(80, 5)$	$Z \sim Z(0,1)$
80	0
95	3
75	-1
78	$\frac{78-80}{5} = \frac{-2}{5} = -0.4$
96	
⋮	

$Z_x = \frac{X - u_x}{\sigma_x}$

X_i

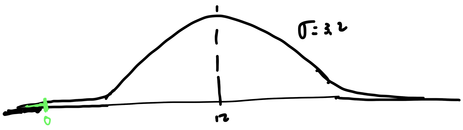
16

14

10

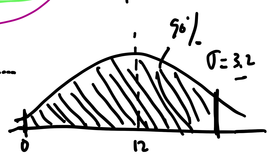
0

⋮



$P(X < 16) = P(0 < X < 16)$

$P(X<0) = 0.000\ldots\ldots$

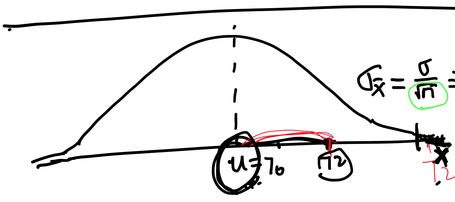


Pass Rate

σ is large

σ=10

σ=12



$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} \doteq \frac{s}{\sqrt{n}} = \frac{s}{\sqrt{30}} = \frac{s}{5.5}$

S

$\frac{S_2}{5.5}$

σ

$E(\bar{x}) = u$



$\frac{\sigma_x}{5.5}$ $\quad \frac{S}{\sqrt{n}}$



X

$H_0: u = 70$ ✓

$H_1: u \ne 70$

72

20.00000

$P(X=20)$

$P_r(\bar{X} > \frac{0}{S/\sqrt{n}}) < 10\%$

10%



$P(\quad < X \le$

$P(X \ne)$ $\quad P(X=10)$

have work $\quad P(X>10)$

$P(X<a) \doteq P(X \le a)$

$P(X \le 60) = P(X=60) + \cdots + P(X=0)$

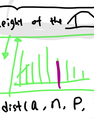
X: continuous variable

$P(X=a) \approx 0 = \underbrace{\text{norm.dist}(a, u, \sigma, \text{False})}_{\text{height of the}}$ * ΔX

Mass Function

$P(X=20) = 0.005 \cdot \Delta X$

$P(19.9999 < X < 20.00001) = 0.005 \times \Delta X^{0.0001}$



X ~ Binomial

$P(X=a) = \text{binom.dist}(a, n, P, \text{False})$