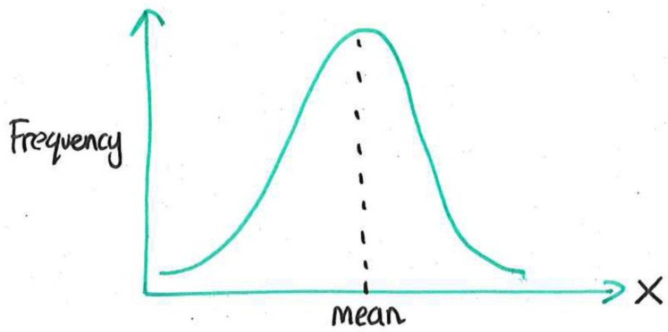
Year 2 Applied Chp 3 - Normal Distribution

Normal Distribution

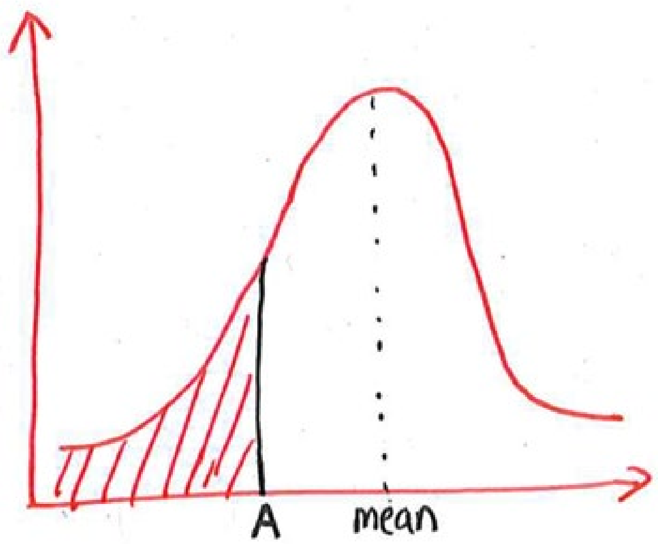
$X \sim N(\mu, \sigma^2)$



Normal CD

(Find the Area)

Find $P(X < A)$

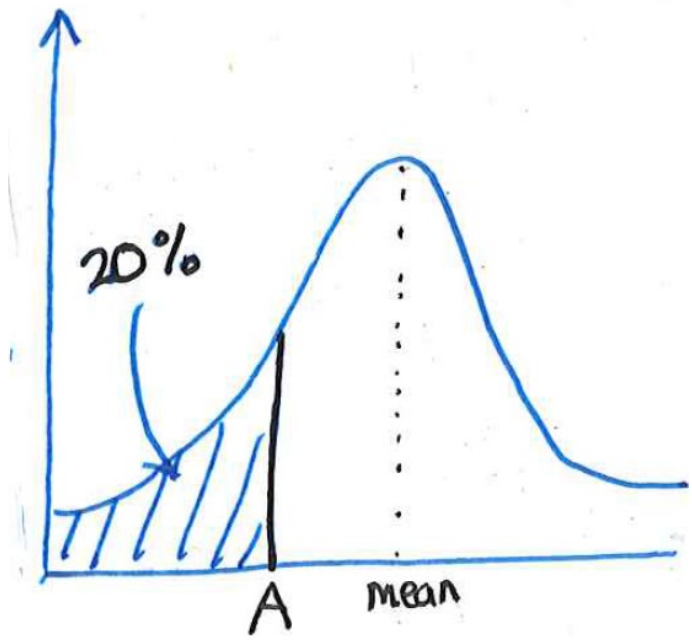


Normal CD
Lower: -10000000000
Upper: A
μ: mean
σ: standard deviation

Inverse Normal

(Find the Boarderline)

$P(X < A) = 0{\cdot}2$



Inverse Normal
Area: 0.2
μ: mean
σ: standard deviation

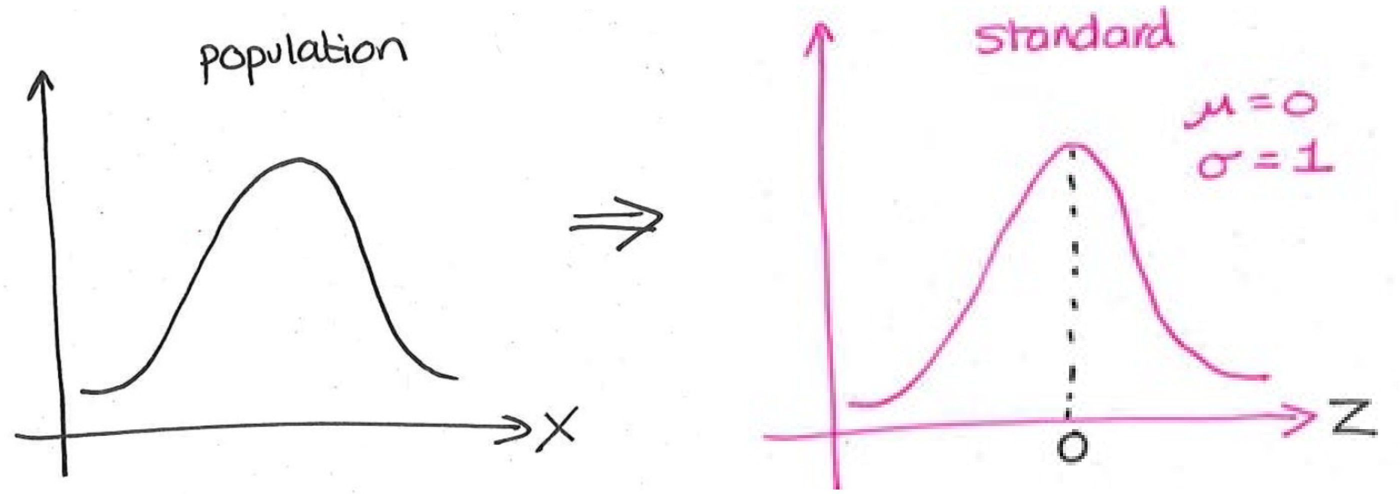
$P(X > A) = 0{\cdot}3$

has the same as boarder as

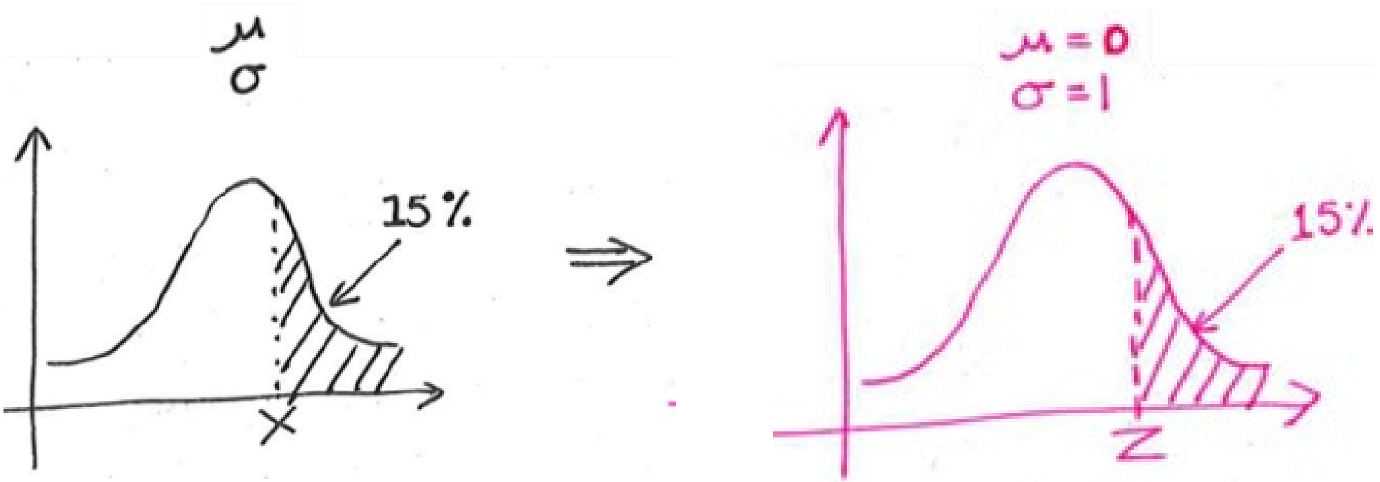
$P(X < A) = 0{\cdot}7$

Standard Normal

Missing mean or standard devaiton then convert the Population Distribution to a Standard Distribution



Convert



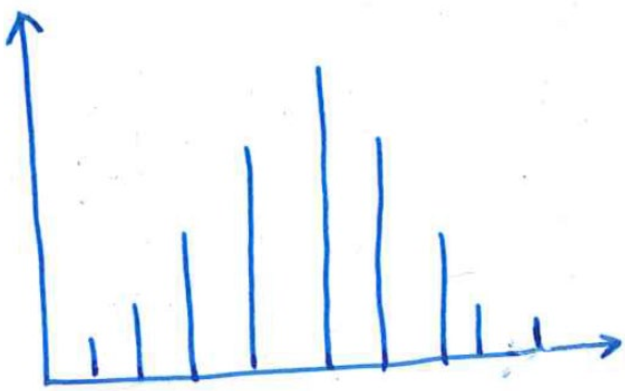
then use

$$Z = \frac{X - \mu}{\sigma}$$

Approximating Binomial Distribution

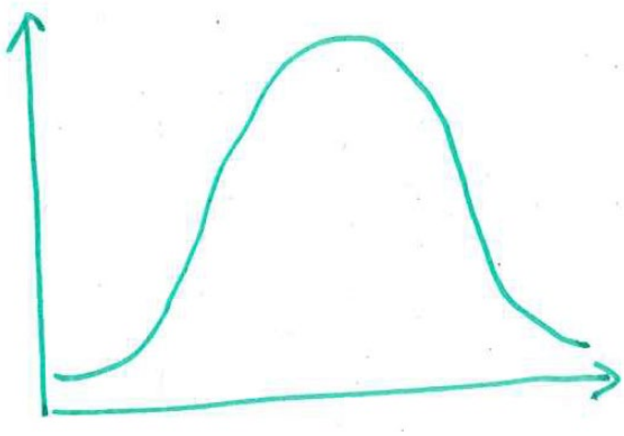
Binomial Distribution

$X \sim B(n, p)$

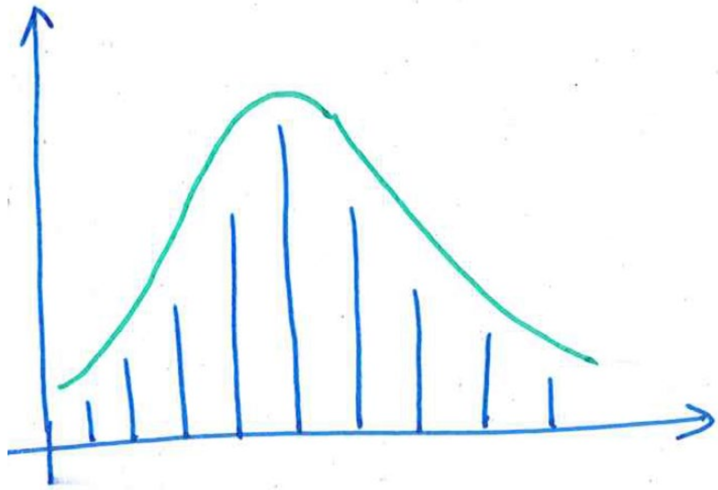


Normal Distribution

$X \sim N(\mu, \sigma^2)$



n is large
p is close to 0.5
then a
binomial distribution
can be approximated by a
normal distribution



Approximating

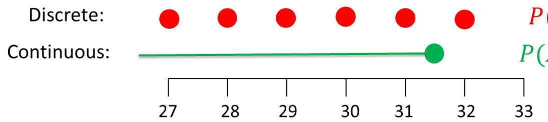
$Y \sim N(np, np(1-p))$

$Mean =$
np

Standard Deviation $=$
$\sqrt{np(1-p)}$

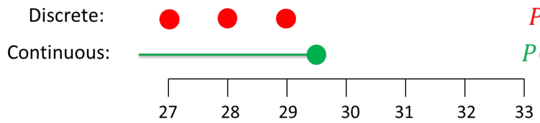
Contitinuty Correction

(Discrete to Continuous)



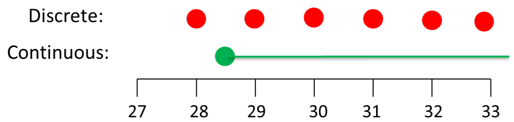
$P(X < 32)$

$P(X < 31.5)$



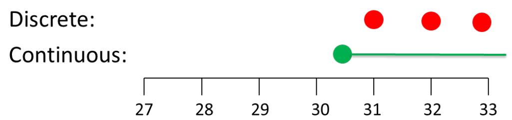
$P(X \leq 29)$

$P(X < 29.5)$



$P(X > 28)$

$P(X \geq 28.5)$



$P(X \geq 31)$

$P(X \geq 30.5)$

Hypothesis Testing on a Sample Mean

Population Distribution

$$X \sim N(\mu, \sigma^2)$$

Sample Distribution

$$X \sim N\left(\mu, \frac{\sigma^2}{n}\right)$$

Sample size $= n$

Standard deviation $= \sqrt{\frac{\sigma^2}{n}}$

Hypothesis Testing Steps:

Step 1. State you hypotheses

Step 2. State you distribution for the sample

Step 3. Calculate the probability
(from the normal distribution)
of your sample result happening

Step 4. Compare this probability
with the significant level

Step 5. Accept or reject your hypotheses H_o

Example:

A certain company sells fruit juice in cartons. The amount of juice in a carton has a normal distribution with a standard deviation of 3ml. The company claims that the mean amount of juice per carton, μ, is 60ml. A trading inspector has received complaints that the company is overstating the mean amount of juice per carton and wishes to investigate this complaint. The trading inspector takes a random sample of 16 cartons and finds that the mean amount of juice per carton is 59.1ml.

Using a 5% level of significance, and stating your hypotheses clearly, test whether or not there is evidence to uphold this complaint.

Step 1: State your hypotheses

$$H_0: \mu = 60$$
$$H_1: \mu < 60$$

Step 2: State your distribution for the sample

Population

$$X \sim N(60, 3^2)$$

$$\sigma = \sqrt{\frac{3^2}{16}} = 0.75$$

Sample (Size 16)

$$\bar{X} \sim N\left(60, 0.75^2\right)$$

Step 3: Calculate the probability of your sample result happening

Use NORMAL CD

$\text{Lower} = 0$

$\text{Upper} = 59.1$

$\mu = 60$

$\sigma = 0.75$

$$P(\bar{X} \leq 59.1) = 0.1151$$

Step 4. Compare this probability with the significant level

$$0.1151 > 0.05$$

Step 5. Accept or reject your hypotheses H_o

Insufficient evidence to reject H_0
You cannot conclude that the mean of the whole population is less than 60 ml.