

## Hypothesis Testing:

Null hypothesis: Current scenario or status Quo

Say most of time, the gender of the new born pup is male will be 50%.

$H_0$ : Null hypothesis :  $\mu_m = 50\%$

lets say we observe the new born pup is female 2 out of 2 times.

so alternate hypothesis :  $H_a : \mu_m < 50\%$

what is the probability that 2 out of 2 times the gender turns out to be female, provided that null hypothesis is true.

Null hypothesis :  $\mu_m = 50\%$

Binomial problem:

$$2^C_2 (0.5)^2 (0.5)^0 = \frac{1}{4} = 0.25 = 25\%$$

The alternate hypothesis is 25% probable to happen, its nothing surprising.

But wait !!

What if it happens 15 out of 15 times?

$P(15 \text{ out of } 15 \text{ new born puppies are female} \mid \text{prob of a new born being male} = 0.5)$

Binomial problem

$${}^{15}C_{15} (0.5)^{15} (0.5)^0 = 0.003\%$$

It's looking like it's a moon shot. not easy.  
pretty rare.

Rule of thumb: If the probability of the scenario in alternate hypothesis happening is less than a value (p-value), say 5%, then this event is rare and we reject the null hypothesis.

$\swarrow$  p. value = conditional probability  
=  $P(\text{scenario of alternate hypothesis happening} \mid \text{provided Null hypothesis is true})$

also called significance value.

The same check can be done, when we know the population mean and S.D. and sample mean representing alternate hypothesis.