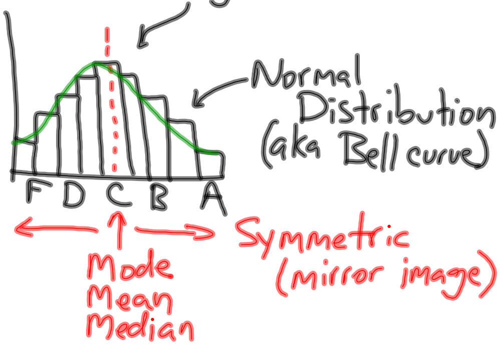
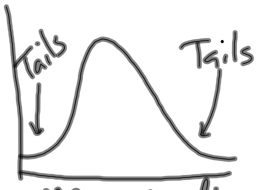
Normal Distribution

- Think Histograms

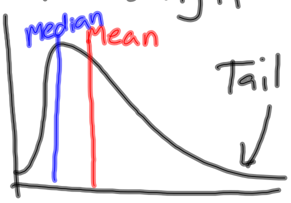


Normal



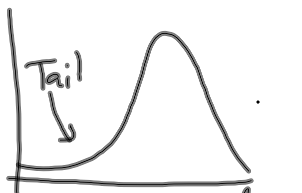
mean=median

Skewed right



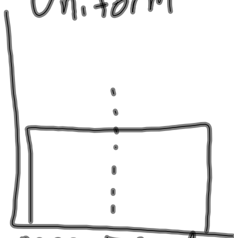
Mean≠median

Skewed Left



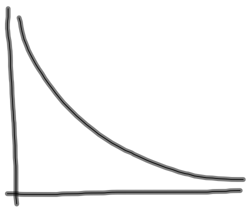
mean<median

Uniform



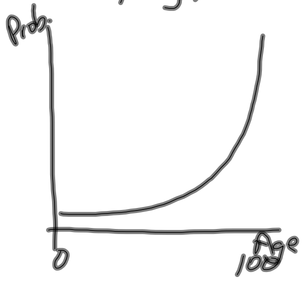
mean=median
ex: rolling dice

Power



Weibul

(probability of dying)



Typically in statistics, we rely on the normal distribution to conduct our analysis...

Sampling

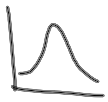
- Often we don't the resources (e.g. time, money) to collect data on everything.
- We rely on sampling to make a few observation to describe the population.

Sampling affects how we calculate some statistics (and symbols we use).

Ex: - Everyone here is the population for Statistics in Social Science.
- Sample of Grand view students.

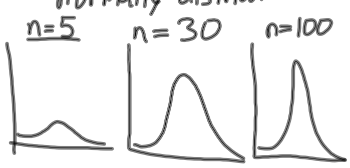
Statistic	Population	Sample
Sample Size (# of obs.)	N	n
Mean	$\mu=\frac{1}{N}\sum x_i$ (mu)	$\bar{x}=\frac{1}{n}\sum x_i$
Variance	$\sigma^2=\sum\frac{(x_i-\mu)^2}{N}$ =VARP( )	$s^2=\sum\frac{(x_i-\bar{x})^2}{n-1}$ =VAR( )
Std. Dev.	$\sigma=\sqrt{\sigma^2}$ =STDEVP()	$s=\sqrt{s^2}$ =STDEV()

However, even when we sample, we can often assume that the data set will be normally distributed.

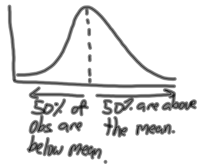


Central Limit Theorem

└ A sufficienty large sample, the mean & variance will be approx. normally distributed.

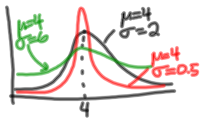


Normal Distribution



However, the normal distribution still depends on the mean and standard deviation.

Ex:



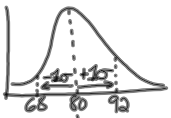
Standard Normal Distribution

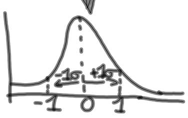
→ Translates any normal distribution with a mean and standard deviation, to a normal distribution w/ $\mu=0$ & $\sigma=1$

→ Z-scores

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

Ex: Suppose that the average SAT score was 80 w/ a $\sigma=12$.





Ex: In the test example, what percent of scores are below 80?

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

$$\Rightarrow \frac{(80)-(80)}{12}=0=Z$$

⇒ Half (50%) are below a score of 80.

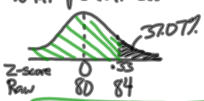
Ex: What percentage of students scored above 84?

$$Z=\frac{84-80}{12}=\frac{4}{12}=\frac{1}{3}$$

$$=0.333=Z$$

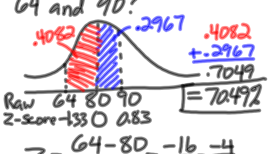
37.07% score higher than 84.

What percent scored below 84?



1 − .3707 = .6293
62.93% scored below an 84.

What percent of the population was between 64 and 90?



.4082
+ .2967
.7049
= 70.49%

$$Z=\frac{64-80}{12}=\frac{-16}{12}=\frac{-4}{3}$$

$$=-1.33$$

$$=\frac{90-80}{12}=\frac{10}{12}=\frac{5}{6}$$

$$=0.833$$