Poisson is a discrete distribution

Weibull is a continuous distribution

The probably for each car to start is 60%

* Probability that at least one car starts (A or B) : P(A) + P(B) – P(A y B) = 0.6 + 0.6 - 0.6\*0.6 = 0.84
* Probability that both cars starts ( A and B ) : 0.6 \* 0.6 = 0.36
* Probability none starts: 0.4 \* 0.4 = 0.16
* Probability to get in a die the number 1 in the first throw and number 2 in the second? 1/6 + 1/6
* Probability to get “at least” one time number 1 in a die after 3 throws? 1/6 + 1/6 + 1/6 = 50%

Given 6 books, how many sets can be arranged in lots of 3

In different order? 

In different combinations? 

* Combinations, independence in the order of the combinations
* Not always greater than permutations

Team of 5 BB and 8 GB, how many unique meetings with 1 BB and 2 GB? 5 \* C82 = 5 \* 28 = 140

Probabilities

P ( A or B) = P(A) + P(B) if A and B are mutually exclusive ( A & B cannot occur simultaneously)

P( A and B) = P(A) x P(B) if A and B are independent

P(A) = 0.7 P(B) = 0.8 P(A) and P (B) = 0.56 what is the probability of P(A) or P(B)

P ( A U B) = P(A) + P(B) - P ( A ∩ B) = 0.7 + 0.8 - 0.56 = 0.94

The probability of a train arriving on time and leaving on time is 0.8 P (A and B )

Probability of the same train arriving on time is 0.84

Probability of the same train leaving on time is 0.86.

Given the train arrived on time what is the probability it will leave on time?

 0.8 / 0.84 = 0.9524

The mean is 1.00 the proportion less than 0.9 is

* Less than 50 %
* Less than the proportion greater than 0.9
* Equal to the proportion greater than 1.10
* Less than the proportion greater than 1

Probability of 1 or more defects 69%

Probability of 2 or more defects 34%

Probability of 3 or more defect 12%

Probability of 2 or less defects = 100% - Probability of 3 or more defect 12% = 88%

E ( c ) = c V( c ) = 0

E ( x ) =  V( x ) = 2 = E ( x – ) 2

E ( c x ) = c  V( c x ) = c2 2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Scale** | **Description** | **Central Location** | **Dispersion** | **Sample** | **Significant Test** |
| **Nominal** | No ordering | Mode | Information Only | Category: colors | Chi square |
| **Ordinal**  **(ranking order)** | Some **order or rank** | Median | Percentages | High, med, low | Sign or Run test |
| **Interval**  **(ranking in order)**  **Ordinal + same range** | No inherent starting point, ratios are meaningless | Mean | Standard or average deviation | Temp after 1 hour  200, 400, 600, | T test, F test correlation analysis |
| **Ratio** | Ratios are meaningful | Geometric or Harmonic Mean | Percent variation | Length in cms |  |
| **Location** |  |  |  |  |  |

**Nominal**

* Mathematically, the LEAST informative
* Area codes, geografic states (TX, MN, FL )
* Nominal scale is only the presence /absence of an attribute. Nominal data can only be counted values.

**Ordinal**

* HOQ Interaction roof uses a numeric scale (instead of alphabetic)
* Likert scale (1-5, 1-7, etc): Liker scale is a ranking scale. Ordinal scale is also a ranking scale
* Uses numbers (or letters) to order objects with respect to some characteristics A, B, C ..... 1, 2, 3......
* Numbers or letters associated to items with an order or sequence
* Survey rating Bad, Good, Satisfy, Excelent

**Interval**

* Rank things in order and differences between scale values are equal
* A measurement scale that ranks things in order so that differences between scale values are equal
* An experiment measures the temperature of a chemical reaction in Fahrenheit.

**Ratio**

* Recording length in centimeters
* Inherent zero starting point (no negative) and the proportions of 2 numbers can be compared
* Monthly ROI metric (%) trends were up 5%, down 1%, up 7%, up 3%, and 0%.

**Locational:** Data type most useful information in eliminating the causes of paint blemishes on automobiles being produced

3 common measures of central tendency: mean, median, mode (other weight average )

**Mode:** The measure of the central location for the nominal scale

Most frequent value, it is possible for groups of data to have more than one mode

**Range:** measure of variability that doesn’t depend on the exact value of every measurement

**Median** : For a skewed distribution, it is a better indicator of the central tendency

Is the meddle value when the data is arranged in ascending or descending order

For an even set of data, the median is the averae of the middle 2 values

For the normal probability distribution Mean = Median = Mode

Percentile is not a measure of central tendency, but is a curve to assist in identifying central tendencies

**Binomial:** Does NOT require the use of the natural logarithmic base for calculation

**Binomial:** Determining the lower limit on success at a desired confidence level for n tests with f failures

**Binomial:** The sum of the exponents of each term after expansion is equal to the sample size

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | When to use | Media | Deviation | To Describe |
| Bi nomial | N>50  n< 0.1 N  p>= 0.1  np > 5 (Normal) | np |  | Data with replacement |
| Poisson | p<= 0.1  n>=16  np = 4 or 5 | np | Variance = Media | Data with replacement with low probability mean |
| Hypergeometric | N: total r : x  d: success  n: sample (small) |  |  | sampling from a finite population without replacement |
| Exponential | Describe time between independent failures in constant rate |  | The mean =    |  |

Distributions with domain of x greater than zero: Lognormal, Weibull, Exponential

Which table to use

* Table **Z** (normal) make inferences **population mean** if you know sigma for population
* Table **t** (student) make inferences **population mean** if you don’t know sigma and sample size less than 30
* Geometric & hypergeometic: To model discrete data when population size is small compare to the sample size

For the Weibull distribution

Scale parameter (tetha) characteristic life, to define a failure-free zone

If increases, the probability density function stretches to the right, the shape is flat.

If decreases, the probability density function compressed to the left

Variation in the shape parameter for the Weibull distribution: Exponential Beta=1 / Rayleigh Beta=2 / Normal Beta=3 or 4

Scale parameter, characteristic of time to failure, fixed percentile of distribution regardless of its value, percentile is: **63.2**% (falls below)

Location parameter (delta) starts the function in the X, increases in the X

Weibull: The distribution plot of fatigue life using median ranks

Exponential: Includes average time between failures, but not median ranks

We receive a lot of 200 parts, the lot can be accepted if it has fewer than 10 non-conforming parts. A random sample of 20 parts from the lot has 2 defective units.

We are using Hypergeometric. Use Poisson when the number of non-confimities are tabulated, rather than the percentage of non-conforming units