

Probability

Bernoulli Distribution

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| Probability Density Function (PDF)

- **Statistical inference** involves **drawing a sample from a population** and **analyzing** the sample data to learn about the population.
- In many situations, **one has an approximate knowledge** of the probability mass function or probability density function of the **population**.
 - **Approximated by one of several standard families**
 - **Describe some of these standard functions,**
 - **Describe some conditions under which it is appropriate**

| Bernoulli Distribution

- Imagine an experiment that can **result in one of two outcomes**. One outcome is labeled **success**, and the other outcome is labeled **failure**.
 - Toss of a coin
 - accept / reject component

| Bernoulli Distribution

- For any Bernoulli trial, we define a **random variable X** as follows: If the experiment results in **success**, then **$X = 1$** . Otherwise, **$X = 0$** .

| Bernoulli Distribution

- The random variable X is said to have the **Bernoulli distribution with parameter p** .
- The notation is **$X \sim \text{Bernoulli}(p)$**

| Bernoulli Distribution

- Consider whether the next person buying a computer at a university bookstore **buys a laptop or a desktop model**. Let
$$X = \begin{cases} 1 & \text{if the customer purchases a laptop computer} \\ 0 & \text{if the customer purchases a desktop computer} \end{cases}$$
- If **20%** of all purchasers during that week select a laptop,

| Bernoulli Distribution

- Consider whether the next person buying a computer at a university bookstore buys a laptop or a desktop model.

| Example - 01

- A **coin** has **probability 0.5 of landing heads when tossed**. Let $X = 1$ if the coin comes up heads, and $X = 0$ if the coin comes up tails. What is the distribution of X ?

| Example - 02

- A **die** has probability **$1/6$ of coming up 6 when rolled**. Let $X = 1$ if the die comes up 6, and $X = 0$ otherwise. What is the distribution of X ?

| Example - 03

- **Ten percent** of the components manufactured by a certain process are **defective**. A component is chosen at random. Let **$X = 1$** if the component is **defective**, and $X = 0$ otherwise. What is the distribution of X ?

| Mean and Variance

- It is easy to compute the mean and variance of a Bernoulli random variable. If $X \sim \text{Bernoulli}(p)$, then

| References

- Statistics for Engineers and Scientists, Fourth Edition, William Navidi
Colorado School of Mines
- Agresti, A., Franklin, C. and Klingenberg, B., 2017. Statistics: The art and science of learning from data (Fourth Edi).
- Khan Academy