Random variables that can assume a countable number, even if the number is infinite, of values are called discrete variables. Discrete probability distribution includes Binomial distribution, Poisson distribution, and Hypergeometric distribution. The real-life example that I am going to use is a cocaine sting case to be solved by Binomial distribution. In this case, there are 496 foil packets of white powdery substance with 4 tested positive for cocaine. Then the police used 2 of the remaining 492 foil packets in a reverse sting operation. We assume that 331 out of 496 original packets contained cocaine. The statistician used Binomial model to calculate the probability that the first 4 packets selected contain cocaine is:

The probability that the 2 packets do not contain cocaine is:

So the probability of first 4 packets test positive for cocaine and random selected 2 will tested negative is:

Only 2%, such a small probability is unlikely to occur. Therefore, the defendant in the reverse cocaine sting was guilty of drug trafficking.

The probability distribution has a smooth curve graphical form, is called continuous random variables. Continuous Random Variables includes Normal Distribution, Uniform distribution and Exponential distribution. The example that I am going to use is a print manufacturing application. A paint manufacturer wants to find out the level of production that should management pay the incentive bonus who has exceeds the 90th percentile of the distribution. The daily production is 100,000 gallons with a standard deviation of 10,000 gallons. First of all, we convert x to a standard normal random variable, as below:

We also know the corresponding z-score is 1.28, which solve the equation:

Therefore, management team should pay an incentive bonus when the daily production exceeds 112,800 gallons.

Reference:

Shuster, J. (1991). The Statistician in a Reverse Cocaine Sting. *The American Statistician*, Vol. 45, No. 2 (May, 1991), 123-124