Probability Distributions Part 2

Data Science for Quality Management: Probability and Probability Distributions

with **Wendy Martin**

Learning objectives:

Discriminate between discrete and continuous probability distributions

Identify the probability distributions most commonly used in decision making

Types of Probability Distributions

- Discrete – A discrete probability distribution is one where there are a limited number of possible values

Types of Probability Distributions

- Continuous – A continuous probability distribution has relatively unlimited possibilities for variable values

Random Variables

A random variable is one which can take on different values as a result of the outcomes of a random experiment.

Random variables, further, can be either discrete or continuous.

Probability Distribution for Discrete Random Variable

- Assume that an automated process produces between 50 and 60 parts per day. During a two month production period, daily production levels (DP) were noted and the following data were generated:

Daily Production (DP)	# of Days	P(DP)
50	1	0.027
51	2	0.054
52	2	0.054
53	3	0.081
54	5	0.135
55	7	0.189
56	6	0.162
57	4	0.108
58	4	0.108
59	2	0.054
60	1	0.027
	$\sum f = 37$	1.000

Probability Distribution for Discrete Random Variable

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> frequency.dist.grouped( )

Expected Value of a Discrete Random Variable

- One of the most important factors related to any probability distribution is the ability to define the expected value of a random variable.

Expected Value of a Discrete Random Variable

- The expected value of a discrete random variable is the weighted average of the expected outcomes.

Daily Production (DP)	P	Weighted P Value (DP x P)
50	0.027	1.351
51	0.054	2.757
52	0.054	2.811
53	0.081	4.297
54	0.135	7.297
55	0.189	10.405
56	0.162	9.081
57	0.108	6.162
58	0.108	6.270
59	0.054	3.189
60	0.027	1.621
	Sum	55.243

Expected Value of a Discrete Random Variable

- Therefore, E(DP) = 55.243

Expected Value of a Discrete Random Variable

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> weighted.mean(x,y)

OR

> mean( )

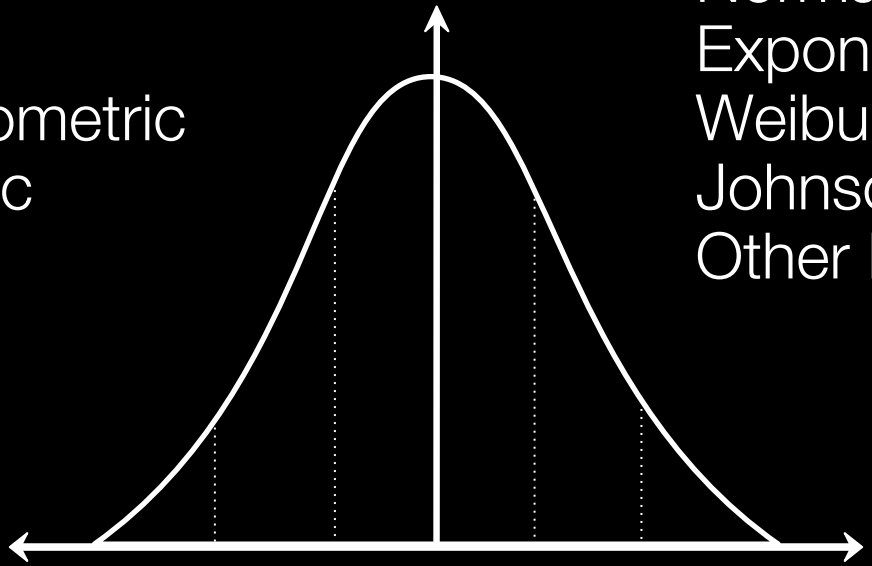
Some Commonly-Employed Probability Distributions

Discrete

- Binomial
- Poisson
- Hypergeometric
- Geometric

Continuous

- Normal
- Exponential
- Weibull Family
- Johnson Family
- Other Distributions



Sources

The material used in the PowerPoint presentations associated with this course was drawn from a number of sources. Specifically, much of the content included was adopted or adapted from the following previously-published material:

- Luftig, J. An Introduction to Statistical Process Control & Capability. Luftig & Associates, Inc. Farmington Hills, MI, 1982
- Luftig, J. Advanced Statistical Process Control & Capability. Luftig & Associates, Inc. Farmington Hills, MI, 1984.
- Luftig, J. A Quality Improvement Strategy for Critical Product and Process Characteristics. Luftig & Associates, Inc. Farmington Hills, MI, 1991
- Luftig, J. Guidelines for Reporting the Capability of Critical Product Characteristics. Anheuser-Busch Companies, St. Louis, MO. 1994
- Spooner-Jordan, V. Understanding Variation. Luftig & Warren International, Southfield, MI 1996
- Luftig, J. and Petrovich, M. Quality with Confidence in Manufacturing. SPSS, Inc. Chicago, IL 1997
- Littlejohn, R., Ouellette, S., & Petrovich, M. Black Belt Business Improvement Specialist Training, Luftig & Warren International, 2000
- Ouellette, S. Six Sigma Champion Training, ROI Alliance, LLC & Luftig & Warren, International, Southfield, MI 2005