

Unit 6 *Normal Distribution*

Introduction

Learning objectives

Whilst most people have a certain understanding of what is meant by the normal distribution, here we consider both its mathematical background and how it can be applied in a range of contexts. After studying this unit, you should

- understand the derivation and meaning of the standardised and normal distributions (mean 0 and standard deviation 1)
- be able to transform any normal distribution into the standardised normal distribution
- use normal distribution tables to find probabilities and, inversely, given z values, to find probabilities
- be able to use and apply the normal distribution in a range of contexts.

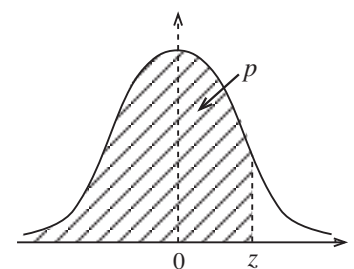
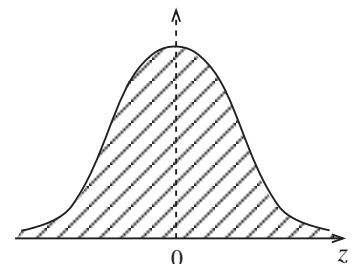
Notes

Whilst the standardised Normal Distribution has a mathematical formula, derived by the German mathematician Carl Gauss in the early 19th century, in practical contexts this formula is not used as tables give sufficiently comprehensive values. Indeed these are now stored on some recently developed calculators (for example, the Casio $fx-991EX$).

Key points

- The standardised normal distribution, denoted by $N(0, 1)$ has mean 0 and standard deviation 1
- The area under this curve has value 1
- Tables are provided to give the probability up to a certain value, z , as shown in the second diagram
- A normal distribution of mean μ and standard deviation σ , (i.e. $N(\mu, \sigma)$) can be transformed to the standardised normal distribution using the transformation

$$z = \frac{x - \mu}{\sigma}$$

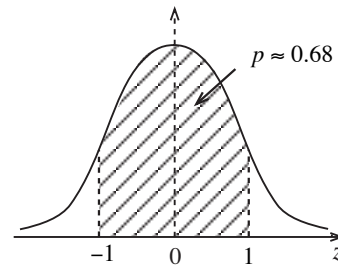
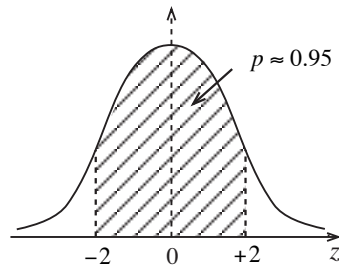


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Facts to remember

- The standardised normal distribution $N(0, 1)$ is bell-shaped with mean 0 and standard deviation 1
- For a standardised normal distribution, about 95% lies ± 2 standard deviations and about 68% between ± 1 standard deviations of the mean



- Use the transformation $z = \frac{x - \mu}{\sigma}$ to transform any normal distribution $N(\mu, \sigma)$ to the standardised normal distribution, $N(0, 1)$.