Revision Tutorial Topic 5

Continuous Distributions and Sampling Distributions

Introduction

In the last topic we looked at discrete distributions, that is, distributions which involved whole numbers such as, one two three four et cetera. In this topic we will look at continuous distributions. A continuous number, in reality, has no steps or discrete values therefore we can immediately say that all decimal values are continuous. There are occasions when a whole number may also be classified as effectively continuous. We would do this when we're talking about large numbers such as salaries and house prices.

Therefore, the aims of this tutorial are to:

- calculate probabilities from the normal distribution
- determine whether a set of data is approximately normally distributed
- calculate probabilities from the uniform distribution
- calculate probabilities from the exponential distribution
- interpret the concept of the sampling distribution
- calculate probabilities related to the sample mean
- recognise the importance of the Central Limit Theorem
- calculate probabilities related to the sample proportion

Textbook Questions

6.10 A set of final examination marks in an introductory statistics unit is normally distributed with a mean of 73 and a standard deviation of 8.

a. What is the probability of getting a mark of 91 or less?

b. What is the probability that a student obtains a mark between 65 and 89?

c. If the lecturer gives Distinction and High Distinction grades to the top 15% of students, what mark does a student need to get a distinction?

d. If the lecturer gives a High Distinction to the top 5% of students, are you better off with a mark of 80 on this exam or a mark of 68 on a different exam where the mean is 62 and the standard deviation is 3? Show your answer statistically and explain.

6.28 Vehicles arrive, randomly and independently, at a toll booth located at the entrance to a bridge at the rate of 240 per hour between 1 am and 2 am. Suppose a vehicle has just arrived.

a. What is the probability that the next customer will arrive within 1 minute?

b. What is the probability that the next customer will arrive within 5 minutes?

c. During the dinner time period, the average arrival rate is one per minute. What are your answers to (a) and (b) for this period?

7.8 It is often important to monitor traffic on a website as organisations need to make online interactions with their clients faster and easier. For example, businesses applying for an Australian Business Number (ABN) online at <www.abr.gov.au> are asked to have a variety of information about their entity ready before they begin the online process. Assume that ABN online-application times are normally distributed with a mean time of 40 minutes and a standard deviation of 5 minutes. If a random sample of 50 applications is taken:

a. What is the probability that the sample mean application time is less than 38 minutes?

b. What is the probability that the sample mean is between 39 and 41 minutes?

c. The probability is 80% that the sample mean is between what two values symmetrically distributed around the population mean?

d. The probability is 90% that the sample mean is less than what value?

7.18 According to an Australian Government report, retail trade is the second largest employing industry in Australia with more than 1.267 million workers, or 11% of working Australians (Department of Employment, Australian Jobs 2016 <https://docs.employment.gov.au/system/files/doc/other/australianjobs2016_0.pdf> accessed 28 April 2017). This report shows that the percentage of those employed in retail trade in November 2015 who were working part-time was 49%. Assuming this percentage is still current:

a. If you select a random sample of 400 Australian retail trade workers, what is the probability that the sample has between 45% and 50% who are employed part-time?

b. If a current sample of 400 Australian retail trade workers has 50.2% who are employed part-time, what can you infer about the population estimate of 49%? Explain.

c. If a current sample of 100 Australian retail trade workers has 50.2% who are employed part-time, what can you infer about the population estimate of 49%? Explain.

d. Explain the difference between the results in (b) and (c).

TEXTBOOK REFERENCE:

Basic Business Statistics: Concepts and Applications. *Berenson, M.L. Levine, D.M. Szabat, K.A. O'Brien, M. Jayne, N. Watson, J.* 5th edition. 2019. Pearson Australia Group Pty Ltd. ISBN 9781488617249. Chapter 6, sections 6 to 6.5 and Chapter 7, sections 7 to 7.3