



Curtin University, Semester 2, 2026

ECOM5005

Tutorial 5

Probability Distributions

Preparation expectation. Remember that you are expected to prepare for the tutorial prior to your tutorial. In particular, if you cannot obtain answers then you should demonstrate that you have attempted them by providing your own questions concerning these problems, the relevant section(s) of the lecture slides, etc.

Learning Outcomes

1. Recognise and apply the properties of a probability distribution.
2. Calculate the expected value and variance of a probability distribution.
3. Calculate average return, and measure risk associated with various investment proposals.
4. Calculate probabilities from binomial, and Poisson distributions.
5. Use the binomial, and Poisson distributions to solve business problems.

PART 1 - Short answer questions

Question 1.

An agent sells life insurance policies to five equally aged, healthy people. According to recent data, the probability of a person living in these conditions for 30 years or more is $2/3$. Calculate the probability that after 30 years:

- (a) All five people are still living.
- (b) At least three people are still living.

Question 2.

A player throw a die. If a prime number is obtained, he gains to win an amount equal to the number rolled times 100 dollars, but if a prime number is not obtained, he losses an amount equal to the number rolled times 100 dollars. Calculate the probability distribution and the expected value of the described game.

Question 3.

Telephone calls enter the support desk of a company on the average of two every three minutes. If one assumes an appropriate Poisson process, what is the probability of 4 or less calls during a 9-minute period?

Question 4.

If we know that the length of time it takes a university student to find a parking space in the university car park follows a normal distribution with a mean of 3.5 minutes and a standard deviation of 1 minute, find the probability that a randomly selected university student will find a parking space in the car park in less than 3 minutes.

Extension problems - real-life applications

Extension Problem A - EV battery quality-control audit

A distribution centre has 30 EV battery packs ready for dispatch. Quality-control records show that 5 of the 30 packs are defective. An auditor randomly selects 6 packs without replacement.

- Explain why a hypergeometric model is appropriate rather than a binomial model.
- Find the probability that exactly one defective pack is selected.
- Find the probability that at least one defective pack is selected.
- Find the expected number and standard deviation of defective packs in the sample, and interpret the results.

Extension Problem B - Same-day grocery delivery service level

A grocery delivery platform models delivery time X as normally distributed with mean 32 minutes and standard deviation 6 minutes.

- What proportion of deliveries take more than 45 minutes and therefore trigger a customer voucher?
- What is the probability that a delivery takes between 28 and 38 minutes?
- The operations team wants a promised delivery time that 95% of orders will meet. Find this time threshold.
- State the Excel functions you would use for parts (a)-(c).

Extension Problem C - Cybersecurity alert surge

A security operations centre receives an average of 3.2 high-priority alerts per hour. Assume alerts follow a Poisson process.

- During a 90-minute monitoring window, find the probability of receiving at least 7 high-priority alerts.
- Find the probability of receiving between 3 and 6 alerts inclusive during the same 90-minute window.
- Find the expected number and standard deviation of alerts in 90 minutes.
- Explain how the result in part (a) could be used for staffing or escalation planning.

PART 2 - Data exercise

Question 5.

Download the file titled "stock_price_2017.xlsx" from the data section in topic 5. Open the file in Excel and complete the following questions:

- Compute the descriptive statistics for each return.
- Compute the covariance of the returns.
- What is expected value (mean) of the portfolio which contains equally weighting ($w = 0.5$) for each return?
- What is the risk (standard deviation) of the portfolio which contains equal weighting ($w = 0.5$) for each return?
- Create a time-series line chart showing AAPL and MSFT prices across 2017. Give the chart a clear title and label the vertical axis.
- Create a scatter plot with AAPL daily returns on the horizontal axis and MSFT daily returns on the vertical axis. Add a linear trendline and interpret the direction of the relationship.
- Create a new equal-weight portfolio-return column using $0.5 \times \text{AAPL return} + 0.5 \times \text{MSFT return}$. Verify the portfolio mean and risk from parts (c) and (d), then create a histogram of the portfolio daily returns.

(h) In 3-5 sentences, compare AAPL, MSFT and the equal-weight portfolio in terms of average daily return, risk and diversification.

PART 3 - Pearson MyLab

Please logon to MyLab and complete the following tasks.

1. Complete the Homework #3 questions.

Note: If you are having issues with obtaining access to MyLab, please re-read the instructions (available in the welcome topic). If you are still unsuccessful, please send an email to the teaching team explaining the issue. It is important that you complete MyLab tasks on a weekly basis since the final e-test in this unit will be completed using MyLab.