



Curtin University, Semester 2, 2026

ECOM5005

Tutorial 4

Elementary Probability

Preparation expectation. You are expected to prepare for the tutorial prior to your tutorial. If you cannot obtain an answer, demonstrate that you attempted the problem and bring specific questions to class.

Learning Outcomes

1. Recognise and understand basic probability concepts.
2. Calculate probabilities of simple, marginal and joint events.
3. Understand and calculate conditional probabilities and determine whether events are independent or not.
4. To be able to use Bayes' Theorem to revise probabilities.
5. Use counting rules to calculate the number of possible outcomes.

PART 1 - Short answer questions

Question 1.

Let's look at a famous probability problem, called the two-child problem. Many versions of this problem have been discussed in the literature. I suggest that you try to guess the answers before solving the problem using probability formulas.

Consider a family that has two children. We are interested in the children's genders. Our sample space is $S = \{(G, G), (G, B), (B, G), (B, B)\}$. Also assume that all four possible outcomes are equally likely.

- (a) What is the probability that both children are girls given that the first child is a girl?
- (b) We ask the father: "Do you have at least one daughter?" He responds "Yes!" Given this extra information, what is the probability that both children are girls? In other words, what is the probability that both children are girls given that we know at least one of them is a girl?

Question 2.

A box contains three coins: two regular coins and one fake two-headed coin ($P(H) = 1$). You pick a coin at random and toss it. What is the probability that it lands heads up?

Question 3.

Assume that the word 'offer' occurs in 80% of the spam messages in my account. Also, let's assume 'offer' occurs in 10% of my desired emails. If 30% of the received emails are considered as a scam, and I will receive a new message which contains 'offer', what is the probability that it is spam?

Question 4. E-commerce fraud screening

An online retailer uses an automated fraud-screening system. Historical data show that 3% of transactions are fraudulent. The system flags 90% of fraudulent transactions, but it also flags 5% of legitimate transactions.

Let F denote “fraudulent” and A denote “flagged by the screening system”. Answer the following:

- For a hypothetical batch of 10,000 transactions, construct an expected-frequency table showing Fraud/Legitimate by Flagged/Not Flagged.
- Calculate $P(A)$, the probability that a randomly selected transaction is flagged.
- Calculate $P(F | A)$, the probability that a transaction is fraudulent given that it has been flagged.
- Calculate $P(F | A')$, the probability that a transaction is fraudulent given that it has not been flagged.
- Explain, in one or two sentences, why “the system detects 90% of fraud” does not mean that “90% of flagged transactions are fraud”.

Question 5. Retail campaign design and counting rules

A retailer has 8 candidate products for a digital campaign. Three of the products are premium products and five are standard products. The retailer is planning both a homepage display and a three-product promotional bundle.

- The homepage has three distinct ordered positions: Hero, Secondary and Tertiary. How many different ordered displays can be formed if the three products must be distinct?
- How many different three-product bundles can be formed if the order of products in the bundle does not matter?
- If one of the three-product bundles is selected at random, what is the probability that it contains exactly two premium products?
- What is the probability that the randomly selected bundle contains at least one premium product?
- Briefly explain why part (a) uses a permutation whereas part (b) uses a combination.

PART 2 - Data exercise

Question 6. Australian labour-force probability analysis in Excel

The data file titled “UE_Australia.xlsx” contains labour force status of the Australian civilian population aged 15 years and over in May 2017. The values are reported in thousands. You must complete the analysis in Microsoft Excel.

Excel preparation requirements

Open UE_Australia.xlsx and keep the original UE worksheet unchanged.

Insert a new worksheet and rename it Analysis.

Copy the source table into the Analysis worksheet and create clearly labelled working tables. Use Excel formulas for every derived value and probability; do not type calculated answers manually.

Format probabilities and rates as percentages to two decimal places.

Using the data in the file, complete the following tasks:

- What is the probability that a randomly selected person is female?
- What is the probability that a randomly selected male is not employed? For this exercise, “not employed” includes both unemployed categories and “not in labour force”.
- Suppose you know that a person is employed full time. What is the probability that they are female?
- Are the two events “employed full-time” and “female” statistically independent? Demonstrate your conclusion numerically using conditional probability and, as a cross-check, the joint-probability product rule.

- (e) What is the probability that a randomly selected person is a male in full-time employment?
- (f) The unemployment rate is defined here as the percentage of the labour force that is unemployed. Calculate the unemployment rate for males, females and overall.
- (g) The participation rate is defined as the percentage of the civilian population in the labour force, either employed or unemployed. Calculate the participation rate for males, females and overall.
- (h) Create a clustered column chart comparing Male and Female values across the five labour-force-status categories (exclude the total row). Give the chart an informative title and label it clearly.
- (i) Create a second clustered column chart comparing the unemployment rate and participation rate for Male, Female and Overall. Format the vertical axis as a percentage.
- (j) Write three concise observations based on your probabilities, rates and charts. At least one observation must discuss the relationship between sex and full-time employment.

Required Excel outputs

1. A cleaned labour-force table.
2. A derived-measures table containing population, employed, unemployed, labour force, not employed, unemployment rate and participation rate.
3. A probability-results table for parts (a)-(e), including the independence cross-check.
4. Two charts for parts (h) and (i).
5. Three written interpretation points for part (j).

PART 3 - Pearson MyLab

Please logon to MyLab and complete the following tasks.

1. Complete Quiz 2 which has been released on this Tuesday (25-Aug-2026) and will be due on next Tuesday (1-Sep-2026) at 5:00pm AWST.

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, contact the teaching team explaining the issue. It is important that MyLab tasks are completed on a weekly basis.