MAS2903: Introduction to Bayesian Methods

Learning outcomes: Chapter 1

1. You should

- know the difference between the classical, frequentist and subjective interpretations of probability;
- be able to give examples of events whose probabilities can be found using the classical, frequentist and subjective interpretations of probability;
- be able to explain if the probabilities of events can be found using the classical, frequentist or subjective interpretations of probability;
- be able to explain the drawbacks of the classical, frequentist and subjective interpretations of probability.

2. You should be able to

- state the result for the *conditional probability* of event E given that event F has occurred;
- define a *partition* of the sample space;
- state, and prove, the *Law of Total Probability*;
- state, and prove, *Bayes' Theorem*;
- apply Bayes' Theorem to simple examples in probability;
- use Bayes' Theorem to formulate diagnostic rules given some observed states/symptoms.

3. You should

- know that the *likelihood function* for a parameter θ is simply the joint probability density function after observing data $\boldsymbol{x}$; assuming i.i.d. observations, this gives

$$f(\boldsymbol{x}|\theta) = \prod_{i=1}^{n} f_X(x_i|\theta);$$

- be able to determine the likelihood function for commonly–used statistical models, or indeed *any* given probability density function for data $\boldsymbol{x}$.

4. You should

- be able to state the *Factorisation Theorem*;
- be able to show that a given statistic $T(\boldsymbol{X})$ is *sufficient* for a parameter θ —
  (i) by showing that $f(\boldsymbol{x}|T(\boldsymbol{X}) = t)$ does not depend on θ;
  (ii) by using the Factorisation Theorem.
- be able to use the Factorisation Theorem to determine a sufficient statistic for θ.