

MODULE: PROBABILITY AND STATISTICS (course code BSCH-PS)

Griffith College Dublin – Computing Science

Fall semester

This module is intended for at least sophomore level students who are majoring in this field (not intended for first-year students).

Aims

This module shows you how to calculate probabilities and statistical values. You are shown the importance of statistics in the computing world and the module includes many applications of these mathematical techniques. The module will also show you how to conduct a sample survey that will lead to valid conclusions about a population.

In addition to the basics of probability and statistics you will learn counting techniques. These techniques such as combinations and permutations are vital in many aspects of computing. Finally, you will study random numbers. These numbers are important in areas such as cryptography. However, there is an inherent problem with using a deterministic device such as a computer to generate a non-deterministic random quantity. Hence you will discover how to test a sequence of pseudo-random numbers for true randomness and also learn of means of generating truly random numbers.

Learning Outcomes

Upon successful completion of this module, you should be able to:

1. use the theory of probability to estimate the likelihood of both discrete and continuous random variables
2. calculate probability related parameters from raw data
3. calculate summary statistics for a sample
4. test statistical hypotheses
5. critically evaluate sampling methodologies
6. apply combinations and permutations to counting problems
7. differentiate truly random and pseudo random numbers and test a sequence of numbers for randomness

Indicative Content

Topic	Description
The language of probability	Events and probability: Axioms of probability, rules of probability. Dependence: Dependent events and conditional probability.

	Independent events. Baye's Theorem.
Random variables	Random variables and probability distributions. Bernoulli trial. Binomial random variable and the binomial distribution. Bernoulli process. The geometric distribution
The normal distribution	Moments, measures of location, measure of dispersion. The shape of a distribution. The normal distribution. The standard normal distribution. Properties of the normal distribution.
Expectation	The mode, mean, median and variance. Expectation of a function of a random variable. Calculating means and variances.
Confidence	Constructing a confidence interval. Confidence intervals for parameters. Confidence intervals for proportions.
Sampling	Finite and infinite population. Taking samples. The sample mean and sample variance. Calculation of sample mean and variance. Sampling from a normal distribution. Confidence intervals for sample mean. Introduction to central limit theorem
Counting	Product and sum rules Pigeonhole principle Permutations and combinations
Random number generation	Properties of random numbers; Generation of pseudo-random numbers; Congruential methods; Testing for randomness; Repeatability

Assessment Methods

Continuous assessment will be based on a combination of some of the following:

- Selected homeworks
- Class tests
- Quizzes
- Oral examination
- Take-home exams.

Both the written examination at the end and the continuous assessment components addresses all of the learning outcomes.