

STAT/MATH 270 - Introduction to Probability and Statistics

“You can, for example, never foretell what any one man will do, but you can say with precision what an average number will be up to. Individuals vary, but percentages remain constant. So says the statistician.”

— Sherlock Holmes, The Sign of Four

Luck. Coincidence. Randomness. Uncertainty. Risk. Doubt. Fortune. Chance. You’ve probably heard these words countless times, but chances are they were used in a casual, everyday way. In 270, we dig deeper into the logic of uncertainty turning vague notions of “chance” into precise, powerful mathematical tools. If you’ve completed Calculus II (or have an equivalent background) and are curious about how to quantify and reason about randomness, this course is for you!

This course is perfect for those looking to apply statistics and probability in their fields or anyone curious about modeling real-life phenomena from genetics and quantum physics to finance, gambling, polling, and meteorology. It also provides a solid foundation for advanced studies in statistics, data science, or machine learning. We will get plenty of hands-on practice working with data using statistical software such as R/Minitab in the lab.

Examples of What We’ll Explore:

- *Statistics in Action:* How do we analyze and make sense of patterns and trends in real-world data? Learn to separate “noise” from meaningful signals and to measure just how confident we are about our findings.
- *Physics:* Modern quantum theory hinges on inherently probabilistic events at the subatomic level. We’ll see how probability provides insight into phenomena that even Einstein once called “spooky.”
- *Biology:* Genetic mutations and inherited traits are full of randomness. Learn how probability theory helps biologists untangle the messy complexities of heredity and evolution.
- *Computer Science:* Randomized algorithms make random choices while running and can be surprisingly efficient compared to deterministic ones. Probability also plays an essential role in machine learning and artificial intelligence.
- *Survey Polls:* Pollsters love to say a candidate “leads by 5% with $\pm 2\%$ margin of error.” Where do these numbers come from? You’ll learn to assess whether such poll results are truly reliable or if they might just be statistical noise.
- *Life:* Life is uncertain, and while we can’t perform formal calculations for every decision, thoughtful consideration of probability can help us avoid common fallacies, recognize coincidences, and make better predictions.

Prerequisites: One of the following: MATH 112, MATH 118, B or better in MATH 141

Transferability: This course transfers to the following institutions: Athabasca University (AU), Camosun College (CAMO), College of the Rockies (COTR), Douglas College (DOUG), Kwantlen Polytechnic University (KPU), Okanagan College (OC), Simon Fraser University (SFU), Thompson Rivers University (TRU), University of British Columbia (UBC), University Canada West (UCW), University of Northern British Columbia (UNBC), University of Victoria (UVIC), Vancouver Community College (VCC), Vancouver Island University (VIU).

Content: An introduction to the theory and practice of statistics for engineering and science students who have experience with calculus. Topics include: descriptive statistics, probability, random variables and their probability distributions, sampling distributions, confidence intervals and hypothesis tests for means and proportions, Pearson’s Chi-squared tests, correlation, and linear regression.