Course Syllabus

Course Description
In today's world, there is no shortage of data. But the quantity of information means nothing without the ability to understand it.

This course covers basic statistical concepts and methods that are essential for learning from data and communicating insights. By the end of the course, you will be able to perform exploratory data analysis, understand the key principles of sampling, and select appropriate tests of significance for multiple contexts. You will gain the foundational skills that prepare you to pursue more advanced topics in statistical thinking, statistical programming, machine learning and more.

This course will be delivered using the Coursera platform.

Instructors

Guenther Walther, PhD

Professor of Statistics, Stanford

University

Guest Presenters

Andrew Radin

CEO and Co-Founder, twoXAR

Course Topics

> **Module 1 – Introduction and Descriptive Statistics for Exploring Data**
> This module provides an overview of the course and a review of the main tools used in descriptive statistics to visualize information.
>
> Approximate video length: 28 minutes
> Module Exercises:
> '   Quiz (Estimated time to complete: 26 minutes)

➤ **Module 2 – Producing Data and Sampling**
In this module, you will look at the main concepts for sampling and designing experiments. You will learn about curious pitfalls and how to evaluate the effectiveness of such experiments.

   Approximate video length: 14 minutes
   Module Exercises:
         '   Quiz (Estimated time to complete: 2 minutes)

➤ **Module 3 – Probability**
In this module, you will learn about the definition of probability and the essential rules of probability that you will need for solving both simple and complex challenges. You will also learn about examples of how simple rules of probability are used to create solutions for real-life, complex situations.

   Approximate video length: 27 minutes
   Module Exercises:
         '   Quiz (Estimated time to complete: 12 minutes)

➤ **Module 4 – Normal Approximation and Binomial Distribution**
This module covers the empirical rule and normal approximation for data, a technique that is used in many statistical procedures. You will also learn about the binomial distribution and the basics of random variables.

   Approximate video length: 27 minutes
   Module Exercises:
         '   Quiz (Estimated time to complete: 12 minutes)

➤ **Module 5 – Sampling Distributions and the Central Limit Theorem**
In this module, you will learn about the Law of Large Numbers and the Central Limit Theorem. You will also learn how to differentiate between the different types of histograms present in statistical analysis.

   Approximate video length: 23 minutes
   Module Exercises:
         '   Quiz (Estimated time to complete: 18 minutes)

➤ **Module 6 – Regression**
This module covers regression, arguably the most important statistical technique based on its versatility to solve different types of statistical problems. You will learn about inference, regression, and how to do regression diagnostics.

  Approximate video length: 44 minutes
  Module Exercises:
         '   Quiz (Estimated time to complete: 22 minutes)

➤ **Module 7 – Confidence Intervals**
In this module, you will learn how to construct and interpret confidence intervals in standard situations.

  Approximate video length: 15 minutes
  Module Exercises:
         '   Quiz (Estimated time to complete: 12 minutes)

➤ **Module 8 – Tests of Significance**
In this module, you will look at the logic behind testing and learn how to perform the appropriate statistical tests for different samples and situations. You will also learn about common misunderstandings and pitfalls in testing.
  Approximate video length: 34 minutes
  Module Exercises:
         '   Quiz (Estimated time to complete: 14 minutes)

➤ **Module 9 – Resampling**
This module focuses on the two main methods used in computer-intensive statistical inference: The Monte Carlo method, and the Bootstrap method. You will learn about the theoretic principles behind these methods and how they are applied in different contexts, such as regression and constructing confidence intervals.

  Approximate video length in module: 17 minutes
  Module Exercises:
         '   Quiz (Estimated time to complete: 8 minutes)

➤ **Module 10 – Analysis of Categorical Data**
This module focuses on the three important statistical analysis for categorical data: Chi-Square Goodness of Fit test, Chi-Square test of Homogeneity, and Chi-Square test of Independence.

Approximate video length: 18 minutes
Module Exercises:
       ' Quiz (Estimated time to complete: 14 minutes)

➤ **Module 11 – One-Way Analysis of Variance (ANOVA)**
This module covers the basics of ANOVA and how F-tests work on one-way ANOVA examples.

Approximate video length: 16 minutes
Module Exercises:
       ' Quiz (Estimated time to complete: 10 minutes)

➤ **Module 12 – Multiple Comparisons**
In this module, you will learn about very important issues that have surfaced in the era of big data: data snooping and the multiple testing fallacy. You will also explore the reasons behind challenges in data reproducibility and replicability, and how to prevent such issues in your own work.
Approximate video length: 12 minutes
Module Exercises:
       ' Quiz (Estimated time to complete: 8 minutes)

Course Requirements

Please watch all course videos and complete all course exercises that can be found throughout the course in each module. In order to get a certificate, you will need to successfuly complete and pass 80 % of the quizzes. Each quiz question counts equally towards your completion.

Exercises

Each exercise will be submitted via the course assignment submission area within the course learning platform. To successfully complete each exercise, you will need to follow all instructions.

Please note that some assignments may contain Macromedia Flash movies or Java applets and may not be able to be completed on all mobile platforms. Notes about these requirements will be included in the assignment instructions and noted where applicable on this syllabus.

Course Materials

All course materials are provided within the course learning platform. These include the course videos, course handouts and all assignment instructions.

Participant Integrity Policy

The Stanford Center for Professional Development, as part of Stanford University, takes academic integrity very seriously. All forms of academic misconduct, including but not limited to, cheating, fabrication, plagiarism, or facilitating academic dishonesty are grounds for participant discipline. Assignments must be individual efforts. It is not acceptable to copy (verbatim or even with minor changes) sections of a book, article or Internet resource, and submit them as one's own work. Regardless of the source, all references must be properly cited and include full bibliographic information. Direct quotes must be indicated as such.