

Course Name: INFERENCEAL STATISTICS

Course Code: STAT 2001

Level: 2

Semester: 2

Number of Credits: 3

Pre-requisites: STAT1001 or MATH2104

RATIONALE:

Inferential Statistics (or Statistical Inference) is used to describe a system of procedures that can be used to draw conclusions from datasets arising from systems affected by random variation. Such system of procedures should produce reasonable answers when applied to well-defined situations and be general enough to be applied to various situations.

COURSE DESCRIPTION:

In this course, we take amore fundamental approach to estimation and quantifying the accuracy of estimates. There will also be some graphical interpretation with some examplesand exercises making use of the statistical computer package R.

In statistical inference, we use a sample of data to draw inferences about some aspect of the population (real or hypothetical) from which the data were taken. Often the inference concerns the value of one or more unknown parameters, which describe some attribute of the population such as its location or spread. There are three main types of inference, namely, point estimation, interval estimation and hypothesis testing.

LEARNING OUTCOMES:

At the end of the course, students will be able to:

- Identify and apply appropriate statistical methods to real-world scenario
- Explain and categorise what makes a good estimator
- Construct appropriate hypotheses and confidence intervals
- Assess different statistical procedures

CONTENT:

- **Sampling Distributions:**

- Distribution of the sample mean and proportion(large sample size):-Sum and differences of sample mean, Sum and difference of sample proportion,

Hypothesis testing and confidence intervals; Distribution of the sample mean and variance (small sample size):- One and two sample t-test, paired test, Test concerning variances, Hypothesis testing and confidence intervals

- **Parameter Estimation:**

- Unbiasedness, bias, mean square error, consistency, efficiency, sufficiency, Minimum unbiased variance, Cramer-Rao lower bound, Likelihood and log-likelihood functions, maximum likelihood estimator, method of moments, properties of maximum likelihood, Rao-Blackwell theorem, Fisher-Neyman criterion, factorisation theorem

- **Interval Estimation:**

- Random intervals and sets, use of pivotal quantities, use of asymptotic results; Relationship between hypothesis tests and confidence intervals; graphical confidence interval

- **Hypothesis Testing:**

- Simple and Composite hypotheses, Types of Error, Power of test, p-value; Neyman-Pearson method, Generalised Likelihood Ratio Test; Use of asymptotic results to construct tests: - Central Limit theorem, asymptotic distributions of maximum likelihood estimator and generalised likelihood ratio test statistic

- **Goodness-of-fit Test:**

- Goodness-of-fit test of standard distributions:- binomial, geometric, Poisson, negative binomial, truncated Poisson, uniform, normal, exponential and gamma to observed data

TEACHING METHODOLOGY:

The delivery of the course will be a mixture of lectures, tutorials and computer labs. The 39 contact hours consists of: 27 hours of lectures and 12 hours of tutorials/labs. The tutorial will be interspersed with the lectures by having students discuss exercises, revise material as needed, and cover new content each day. Course materials such as exercises, assignments, solutions, etc., will be posted on the webpage: <http://ourvle.mona.uwi.edu/>

ASSESSMENT:

The course assessment has four components:

i)	One one-hour mid-semester examination	15%
ii)	Two take-home assignments (5% each)	10%
iii)	One lab assignment	5%
iv)	One two-hour final examination	70%

REFERENCE MATERIAL:

Books:

Prescribed

1. ROUSSAS, George G: *An Introduction to Probability and Statistical Inference*, 1st Edition, 2003, ISBN-13 #:978-0125990202

Recommend

2. DEGROOT, Morris, & Schervish, Mark J. *Probability and Statistics*, 4th Edition, 2011; ISBN-10#: 020111366X

Highly Recommend

3. MENDENHALL William, SCHEAFFER Richard, WACKERLY Dennis: *Mathematical Statistics with Application*, 7th Edition, 2007; ISBN-13#:978-0495110811

Internet resource:

1. <http://onlinestatbook.com/rvls.html>

This is useful in the demonstration of statistical concepts, link to other statistics resources on the web and case studies of real data and analyses and interpretation.