Lecturer info: https://seanvdm.co.za/

The purpose of this guide is to explain the structure of the course in detail so that everybody knows what to expect when. Items marked with a “❗” are of particular importance.

General course information

0. Queries

Queries regarding the course, material, outcomes, assessments, or any matter affecting the class as a whole must be posted on the online discussion forum (immediately - do not wait until the next class, use your phone and post while it’s hot). General queries raised personally with the lecturer will be redirected to the forum. You are welcome to post anonymously.

Queries of a personal nature (something affecting only you) should be emailed to the lecturer and will usually be responded to within 12 hours. Include a detailed subject line and your student number in all correspondence. If you do not receive a timely response then please follow up.

Only matters that cannot be resolved via discussion with the lecturer should be taken to the programme director or head of department (details are on the department page: https://www.ufs.ac.za/mathstats/ ).

1. Notes:

The notes of this course is the set of slides available online. For additional learning material please see the extensive list of references on the slides. Alternatively, ❗search the internet for resources that are relevant. It is your responsibility to meet the outcomes.

2. Class Times:

Tuesday nights 17:00 to 19:20 in the computer labs. Note that all announcements made in class are binding. Class attendance is compulsory for this course. Attendance will be taken in every class. An excuse must be produced for every class missed, but regardless of excuses, an attendance of less than 80% will result in an incomplete. ❗Full attendance will be rewarded. Students unable to attend in person must attend the class electronically via Blackboard whenever this option is available (may depend on faculty policy). Merely signing in is not enough - online students must ask and answer questions using the chat.

There will be a practical session on Thursday afternoons from 13:10 to 17:00 in the computer labs, where the lecturer will be present most of the time to assist students with assigned work. This will be the only time students will have guaranteed access to resources and assistance. Normally a practical session will have an assistant, but in this course the lecturer takes that role, so ❗the practical session will also take on the role of consultation time. Tests will be written in this time slot in some weeks. The practical sessions are also compulsory and attendance will be taken. Attendance credit will only be given if at least 2 hours of the session are spent on doing or reading work relevant to the course in some way.

3. Tests:

Each test will be done on PC and will be open book. Remember to bring calculators and your own scratch pads to tests (and stationery). There will be **two** compulsory tests. Should a test be missed then justifying evidence must be provided at the next class, and a sick test written at the end of the semester. Missing 2 tests is an automatic incomplete.

Note that negative marking is used in this course where doing so is in favour of fairness and accuracy in the view of the marker. Further, gross statistical errors forfeit all marks for the question. Language and neatness may count for or against a student where it is deemed exceptionally good or bad respectively (applies to all work in the course).

4. Assignments:

Completely on computer - no paper. All assignments are compulsory: each assignment will have two deadlines, the first is for full credit and the second is for partial credit (making up some lost marks); note that even a single assignment not handed in by the second deadline will result in an incomplete. Students must work continuously.

You may assist each other with advice or suggestions, but ‘working together’ is not allowed (unless a piece of work is clearly marked as group work). If two or more assignments have even a single interpretation with identical wording then those assignments will be void.

❗Assignments may be re-attempted as many times as you wish prior to the second deadline, but only half of the marks gained will be awarded on attempts after the first (assignment marks will be the average of the best mark before the first deadline and the best mark before the second deadline). Generally, a maximum of one attempt will be marked per week per student.

❗Occasionally, minimum marks will be attached to specific formative assessments that must be achieved to allow progress in the course.

5. Mark:

The final mark will be a weighted average of the marks obtained through the semester. The weights are to be determined by the lecturer and may change. Weighting may be viewed on PeopleSoft GradeBook.

Detailed test and assignment feedback will be given during the practical sessions only.

6. Lack of Examinations:

There is no exam of any kind! The semester mark is your final mark. There is no second opportunity either - you pass or fail based on the semester marks alone.

7. Prerequisites:

The prerequisites for this course are some previous knowledge of Bayes and parameter estimation as well as experience with R. If you do not have this knowledge and experience then it is your responsibility to gain this in the first week. Resources for doing so are provided in the notes.

8. Course Overview:

Univariate Simulation, Basics of Bayes, Conjugate Priors, Discrete Bayes, Parameter Estimates, Posterior Intervals, Objective Priors, Bayesian inference using AI sampling (using STAN), Subjective priors, Specifying models, Hierarchical Models, Showing that one model is better than another model

9. Course Information Test

❗You must sign the course information by doing the digital test or face an incomplete.

Course Outcomes

Students will be able to:

explain standard Bayesian concepts and apply them to problems

derive, and simulate samples from, prior, posterior and predictive densities, for both simple and complex Bayesian hierarchical models

calculate probabilities, parameter estimates and credibility intervals, for both simple and complex Bayesian hierarchical models

test their results for internal consistency and perform appropriate inference based on those results

approach statistical analysis as would be done in the workplace

Long description:

This course equips the student to be able to implement the Bayesian paradigm. First, the Bayesian paradigm is introduced and all the standard terms and concepts are studied, both in general and via basic examples. These concepts include subjective priors and their derivation, objective priors and their derivation, posterior derivation and predictive posterior derivation. Related concepts that are studied include parameter estimation and interval construction. Second, the student will learn and practice simulation techniques that are useful in Bayesian analysis. Third, students will use both R and STAN to implement a variety of Bayesian models, including hierarchical models. They will learn to program the input and interpret the output. They will learn about answering statistical research questions and about doing diagnostic checking to add credibility to their answers.

Note on assessment types

We will use a lot of types of assessments in this course. I'm going to describe some of them here for clarity:

Practice assignments are meant to be entirely formative. They are designed in such a way that all students can get full marks just by putting in a little effort and following the instructions (essentially free marks). They cover basic topics and skills.

Major assignments will cover the main course outcomes, these carry assessment weight but are also formative. Do not expect to get full marks for these on first attempt, but do try to learn from your mistakes and improve your marks partially over time.

Major tests will cover the main course outcomes. This will be the bulk of the final mark of the course. These are individual assessments under time pressure. Students generally struggle with these due to poor self-reflection (don't tell yourself lies like, 'I'll be fine - it's open book/internet', rather practice and make sure you've mastered the outcomes.) All students must sit for all of these in person on the arranged dates.

Other minor assessments of various types include quizzes, class activities, presentations, interviews, and discussions. These are also meant to be formative but these marks are easily lost by not attending or not participating in classes and on Blackboard. For example, taking part on all the discussion boards is compulsory and will be graded on effort for the general ones (you don't need to do top quality posts, only genuine posts) - the boards marked as graded are the exception and are graded according to their own mark allocations indicated.