

2022/2023 Sem 1: ST2334 Syllabus and Policies

Last updated on
November 8, 2022

1 Course Catalog

1.1 Pre-requisites

- MA1102R or MA1312 or MA1505 or MA1507 or MA1511 or MA1521 or MA2002

1.2 Preclusion

- ST1232, ST2131, MA2116, MA2216, MA2301, CE2407, EC2303, PR2103, DSC2008

1.3 Description

- Basic concepts of probability, conditional probability, independence, random variables, joint and marginal distributions, mean and variance, some common probability distributions, sampling distributions, estimation and hypothesis testing based on a normal population. This module is targeted at students who are interested in Statistics and are able to meet the pre-requisites.

2 Detailed Syllabus

2.1 Topics

- Basic Concepts of Probability
Sample space and events. Counting Methods. Definition of probability. Basic properties of probability. Conditional probability. Multiplicative rule. Independent events. Total probability theorem. Bayes' theorem.
- Random Variables
Concept of a random variable. Discrete and continuous probability distributions. Cumulative distribution function. Two-dimensional random variables. Joint probability

density functions. Joint cumulative distributions. Marginal and conditional probability distribution functions. Independent random variables. Definitions and properties of mean and variance.

- Some Common Probability Distributions
Discrete uniform distribution. Poisson distribution. Binomial distribution. Geometric distribution. Negative binomial distribution. Continuous uniform distribution. Exponential distribution. Normal distribution.
- Sampling and Sampling Distributions
Random sampling with and without replacement. Sampling distributions of the mean and variance. Central Limit Theorem and its applications. Sampling distribution of the difference of two means. The χ^2 , t - and F -distributions.
- Estimation Based on Normal Distribution
Point estimation of mean and variance. Confidence intervals for mean with (i) known variance and (ii) unknown variance. Confidence intervals for the difference between two means (i) for paired data, (ii) with known variance and (ii) unknown but equal variances. Confidence intervals for variance and ratio of two variances with unknown mean.
- Hypotheses Testing Based on Normal Distribution
Null and alternative hypotheses. Type I and Type II errors. Level of significance. Two-sided and one-sided tests. Critical region. Relationship between two-sided test and confidence interval. Testing concerning mean with (i) known variance and (ii) unknown variance. Tests concerning the difference between two means (i) for paired data, (ii) with known variance and (iii) unknown but equal variances. Tests concerning variance and ratio of two variances with unknown mean.

2.2 References

- Agresti, A. and Kateri, M. (2022). *Foundations of Statistics for Data Scientists, With R and Python*, Chapman and Hall/CRC.
- Speegle, D. and Clair, B. (2022). *Probability, Statistics, and Data; A Fresh Approach Using R*, Chapman and Hall/CRC.

3 Assessment

3.1 Final Exam

- Count 70% towards the final grade.
- Date and time: November 19, 2022: 9:00–11:00am. [Please be on location before 8:45am.](#)

- Location: MULTI-PURPOSE SPORTS HALL 2A, 2B. Special need students will be invigilated by RO nurse in a separate venue.
- The exam is **OPEN BOOK**; hard copies or/and soft copies of materials physically stored on the laptop for the exam are allows.

Calculators and/or software physically installed on your computer of any kind are allowed. Also, I will allow calculators integrated in exemplify for all questions. So, looking for a good calculator/software is not likely useful.

If you need script papers, please bring along some on your own.

- Format: similar to the midterm, the exam is conducted onsite through exam software: Exemplify. A laptop with the software installed and solid battery that can last for at least 2 hours and 15 minutes is needed.
- Coverage: all the chapters covered in the semester, including
 - ★ Chapter 1: Basic Concepts of Probability
 - ★ Chapter 2: Random Variables
 - ★ Chapter 3: Joint Distributions
 - ★ Chapter 4: Special Probability Distributions
 - ★ Chapter 5: Sampling and Sampling Distributions
 - ★ Chapter 6: Estimation
 - ★ Chapter 7: Hypothesis Tests
- Question types: only four types are possible, including
 - ★ **TRUE/FALSE**;
 - ★ **Fill in the blank**;
 - ★ **Multiple choice question: choose the unique correct answer**;
 - ★ **Multiple responses question: choose all that apply**.

The type is indicated at the top of each question; please pay attention especially for the “Multiple choice question” and “Multiple responses question”; for the former, you need to choose out the only correct answer; for the latter, however, you need to pick up all the correct answers to get the mark, i.e., choose wrong, less or more will not get a mark. For “fill in the blank” questions, if the question asks to fill in the form x.xx, but the answer is 3, you can fill in either ”3” or ”3.00” to get the mark.

Similar to the example exam paper, the exam is composed of 35 questions. Questions are shuffled so that different exam participants have different question orders. Forward and backward navigation are allowed.

- Paper download: **the exam paper will be available for downloading from 9.00am Friday, November 18, 2022 onwards** (exactly 24 hours before the exam starts); please download the question paper **at least 30 minutes or even earlier** before the exam starts to avoid unforeseen problems. After submitting the exam, please make sure that you see the "green screen" before shutting down your computer.
- Here are some consultation hours by the lecturers:
 - ★ Tuesday, November 15, 12:00–13:30pm;
 - ★ Friday, November 18, 14:00–16:00pm.

Join through zoom link available in Canvas. Other consultation hours can be available and held by our teaching assistants; please check in the zoom session in canvas for details.

3.2 Midterm

- Count 20% towards the final grade.
- Date and time: the lecture time of the 7th academic week. The exam time is 8.30 – 9.30am, Tuesday, 27 September, 2022. **Please be on location before 8.10am.**
- Location: MULTI-PURPOSE SPORTS HALL 2A, 2B, and 6A.
- The format is open book (hard copies or/and soft copies physically stored on the laptop for exam are allowed), onsite through **exam software: Exemplify**. A laptop with the software installed and solid battery that can last for at least 1.5 hours is needed.
- Coverage:
 - Chapter 1: Basic Probability Concepts and Definitions;
 - Chapter 2: Random Variables.

3.3 Course Attendance

- Count 10% towards the final grade.
- There will be in-class exercises for **every Tuesday's lecture from 9.15am to 10.00am**; usually, it can be finished within 10 minutes, and can be done using a mobile phone.
- Questions will be based on that week's lecture video and lecture meeting. The purpose of the exercises is to encourage students to view the weekly videos timely and attend the live lectures diligently.

- **Format: Quiz through Canvas.** The password will be announced in class before 9.15am.
- Discussion among peers is allowed; but you need to answer the questions in Canvas on your own.
- There will be about 11 exercises; participating all the exercises is strongly encouraged, but only the **6 best performed exercises will be picked and counted to form the 10% of your final grades.**

4 Teaching Mode

- We will be doing Blended Learning: a mix of pre-recorded videos and E-hybrid teaching will be used.
- Lecture notes for the pre-recorded videos and lectures will be published through Canvas: **notes for videos are printed in black**; while **those for lecture meetings are printed in blue.**

4.1 Lecture Videos

- There will be a **pre-recorded video released in Canvas** every week.
- Make sure you view the week's video carefully before the lecture meeting. The covered contents by the lecture videos are very important but won't be repeated in the lecture meeting.

4.2 Lecture Meetings

- There will be a **E-hybrid lecture meeting every Tuesday morning from 8.00 to 9.30am.**
- Students can join the meeting onsite (LT27) or online (zoom).
- Attending the lecture meeting is compulsory. Again, please study the week's lecture video on your own first before the lecture meeting. The contents of the lecture videos will not be repeated in the lecture meeting.

5 Tutorials

- We will have onsite tutorials **starting from week 3.**
- You are expected to attend all your tutorial sessions.

- You are expected to have attempted all questions. Write down your attempt, thoughts and ideas even if you know you don't have the right answer.
- Solutions to the tutorials will be posted after the tutorial session.

6 Canvas Discussion Forum and Shared Resources

- The Canvas discussion forum is a useful tool for students to have meaningful dialogues about the course material.
- The lecturer and helpers may view, answer questions, post interesting points raised from students from elsewhere; so **please view and look for answers from the historical posts in the forum before asking new ones.**
- Students are encouraged to ask and answer questions.
- I believe that crowdsourcing is powerful, but in the event that misinformation is posted, we will address it in Lecture/Tutorial time.

7 Feedback and Contact Info

- You are highly encouraged to send feedback on anything and everything about the course.
- Lecturer: Yu Tao, yu.tao@nus.edu.sg
- If you are to ask an academic question, **please view the discussion forum and if needed, send your questions to tutors and teaching assistants first.** tutors and teaching assistants will forward your questions to the lecturer whenever needed.
- Tutors:

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| – T1: Liu Tianyu (e0134148@u.nus.edu) | – T11: Yu Tao (yu.tao@nus.edu.sg) |
| – T2: Yu Yuetao (e0546149@u.nus.edu) | – T12: Li Shang (e0384121@u.nus.edu) |
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| – T7: Li Han (e0708169@u.nus.edu) | – T17: Chen Yucheng (e0444122@u.nus.edu) |
| – T8: Xu Haowen (e0729954@u.nus.edu) | – T18: Chen Yucheng (e0444122@u.nus.edu) |
| – T9: Xu Haowen (e0729954@u.nus.edu) | – T19: Zhan Haoran (e0384151@u.nus.edu) |
| – T10: Zheng Haoliang (e0983506@u.nus.edu) | – T20: Xu Zineng (e0572857@u.nus.edu) |

- Teaching Assistants:
 - Brandon R. Han (e0540875@u.nus.edu)
 - Wen Feiyang (feiyang@u.nus.edu)