August 5, 2021

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ST2334 MODULE INFORMATION

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(1) **About this module**

- PRE-REQUISITES: MA1102R or MA1312 or MA1505 or MA1507 or MA1521
- PRECLUSION: ST1131, ST1131A, ST1232, ST2131, MA2216, CE2407, EC2231, EC2303, PR2103, DSC2008. ME students taking or having taken ME4273. All ISE students.
- 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**

TOPICS

- BASIC CONCEPTS OF PROBABILITY

  Sample space and events. Permutation and combination. Definition of probability. Basic properties of probability. Conditional probability. Multiplicative rule. Total probability theorem. Independent events.

- BASIC CONCEPTS OF 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.

References

- Walpole, R. E., Myers, R. H., Myers, S. L. and Ye, K. Probability and Statistics for Engineers and Scientists, 9th edition (2012), Pearson/Prentice Hall.
- Devore, J. L, Probability and Statistics for Engineering and the Sciences, 9th edition (2016), Cengage Learning.

(3) **Modes of Assessment**

Final Exam

- Count 70% towards the final grade.
- The format depends on the Covid situation and NUS policy. To be announced in due course.

Quizzes

- There will be 4 quizzes given during the semester. The four quizzes together make up 30% of the final grade.
- The Quizzes are scheduled on Weeks 4, 7, 10, and 13 respectively.
- Each quiz lasts for 30 minutes. Only one attempt is allowed.
- All quizzes are conducted online via LumiNUS.
- The window for taking each quiz will be from Friday 14:00 to Sunday 23:00 of the week.
  For example, for quiz 1, you can take the quiz anytime between Sep 3, 14:00 and Sep 5, 22:30 (since the quiz lasts for 30 minutes).
- It is advisable that you don't take your quiz too last minute (say, Sunday 22:30).
  If you get disconnected due to unforeseeable circumstances, don't panic. The timer will pause, resume your quiz after you are connected again.
- There are different types of questions in the quizzes: True-or-false, Multiple-choice, Multiple-response, Fill-in-the-blank, and Matching.
- Quizzes are open-book in the sense that you are allowed to access all written and text resources. Dynamic internet resources are discouraged, but there will not be any active proctoring for the quizzes.
- Warning: You should work on the quizzes alone, and are NOT to collaborate with any other person. You are NOT to receive or provide help with one another.
- Students with special needs should reach out to Prof. Choi Kwok Pui (stackp@nus.edu.sg) and cc your lecture group professor for special arrangements.

(4) **Modes of Learning**

Online Blended Learning is adopted: a mix of pre-recorded videos and live Zoom lessons.

Lectures/Lecture notes

- Pre-recorded lecture videos will be released weekly.
- They are labeled by the week in the in LumiNUS "Multimedia" tool. You can also access them via Learning Flow.
- Lecture notes will be posted under LumiNUS "Files" tool.

Lecture Discussions

- Each week, we conduct live discussions via Zoom during the second lecture time slots of your lecture group. That is,
  L1 Lecture group: Fri 10-12;
  L2 Lecture group: Thu 8-10;
  L3 Lecture group: Thu 4-6.

- These discussions meant to reinforce the recorded lectures by going through selected topics/points.

  Therefore, you are expected to have watched the lecture videos prior to attending the Lecture Discussion.

- You are expected to attend all the discussion sessions and are encouraged to actively participate in the discussion sessions. Discussion sessions may be recorded, and if some are recorded they will NOT be published (kept only for quality check).

- The Zoom meetings will open at the scheduled time. You can access them via LumiNUS under the "Conferencing" tool. It is also linked under Learning Flow.

TUTORIALS

Tutorials will be conducted live via Zoom.

- You are expected to attend all your tutorial sessions as the recorded tutorials will <u>NOT</u> be published (they are meant for quality check).

  Please attend your tutorials at the tutorial time.

- You are expected to try all the tutorial questions before coming to the (zoom) tutorial class.

- Solutions to the tutorials will be posted after the tutorial session.

(5) **Feedback and Contact Information**

You are encouraged to send feedback on anything about the course to your lecture group professors.

L1 lecture group: Choi Kwok Pui (stackp@nus.edu.sg)

L2 lecture group: Li Jialiang (jialiang@nus.edu.sg)

L3 lecture group: Chan Yiu Man (chan.yiu.man@nus.edu.sg)