New Jersey Institute of Technology

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Spring 2024

# MATH 341-002: Stats Methods I

K. Carfora

## Recommended Citation

# MATH 341: Statistical Methods I
## *Spring 2024 Course Syllabus*

**NJIT Academic Integrity Code**: All Students should be aware that the Department of Mathematical Sciences takes the University Code on Academic Integrity at NJIT very seriously and enforces it strictly. This means that there must not be any forms of plagiarism, i.e., copying of homework, class projects, or lab assignments, or any form of cheating in quizzes and exams. Under the University Code on Academic Integrity, students are obligated to report any such activities to the Instructor.

## COURSE INFORMATION

**Course Description**: Covers applications of classical statistical inference. Topics include transformation of variables, moment generating technique for distribution of variables, introduction to sampling distributions, point and interval estimation, maximum likelihood estimators, basic statistical hypotheses and tests of parametric hypotheses about means of normal populations, chi-square tests of homogeneity, independence, goodness-of-fit. Effective From: Spring 2009.

**Number of Credits**: 3

**Prerequisites**: Math 244 with a grade of C or better or Math 333 with a grade of C or better.

**Course-Section and Instructors:**

| Course-Section | Instructor |
|---|---|
| Math 341-002 | Professor K. Carfora |

**Office Hours for All Math Instructors:** Spring 2024 Office Hours and Emails

**Required Textbook**:

| | |
|---|---|
| **Title** | *Mathematical Statistics with Applications* |
| **Author** | Wackerly, Mendenhall, and Scheaffer |
| **Edition** | 7th |
| **Publisher** | Thomson Brooks/Cole |
| **ISBN #** | 978-0495110811 |

**University-wide Withdrawal Date**: The last day to withdraw with a **W** is **Monday, April 1, 2024**. It will be strictly enforced.

# COURSE GOALS

**Course Objectives**

Covers applications of classical statistical inference. Topics include transformation of variables, moment generating technique for distribution of variables, introduction to sampling distributions, point and interval estimation, maximum likelihood estimators, basic statistical hypotheses and tests, classical tests of parametric hypotheses about means of normal populations, chi-square tests of homogeneity, independence, goodness- of-fit.

**Course Outcomes**

- Develop skills in the methods of mathematical statistics.
- Recall and apply different estimation techniques (method of moments, maximum likelihood).
- Develop the skills to compute uniformly minimum variance unbiased estimators.
- Recall and apply the likelihood ratio test.
- Recall and apply confidence intervals.
- Recall and apply hypothesis tests including Chi-squared tests of homogeneity of populations, independence of categorical variables and goodness-of-fit.
- Recall and compute the power of tests

**Course Assessment:** Will be based on regular homework, quizzes, a midterm exam, and a final exam.

# POLICIES

**DMS Course Policies**: All DMS students must familiarize themselves with, and adhere to, the Department of Mathematical Sciences Course Policies, in addition to official university-wide policies. DMS takes these policies very seriously and enforces them strictly.

**Grading Policy**: The final grade in this course will be determined as follows:

| Homework | 15% |
|---|---|
| Quizzes | 25% |
| Midterm Exam | 30% |
| Final Exam | 30% |

Your final letter grade will be based on the following tentative curve.

| A | 90 - 100 | C | 65 – 74 |
|---|---|---|---|
| B+ | 85 - 89 | D | 55 – 64 |
| B | 80 - 84 | F | 0 – 54 |
| C+ | 75 – 79 | | |

**Attendance Policy**: Attendance at all classes will be recorded and is **mandatory**. Please make sure you read and fully understand the Math Department's Attendance Policy.

**Homework and Worksheet Policy:** Homework problems assigned are listed at the end of each Chapter lecture. Assignments are on canvas and homework will be submitted via a **single PDF upload** to the appropriate canvas assignment.

**Calculator:** You need a scientific calculator for this course. **Graphing calculators are not allowed.**

| | |
|---|---|
| Midterm Exam | Thur Feb 27th (Tentative) |
| Final Exam Period | May 3 - May 9, 2024 |

Make sure you read and fully understand the Math Department's Examination Policy. This policy will be strictly enforced.

**Makeup Exam Policy**: There will be **NO MAKE-UP QUIZZES OR EXAMS** during the semester. In the event an exam is not taken under rare circumstances where the student has a legitimate reason for missing the exam, the student should contact the Dean of Students office and present written verifiable proof of the reason for missing the exam, e.g., a doctor's note, police report, court notice, etc. clearly stating the date AND time of the mitigating problem. The student must also notify the Math Department Office/Instructor that the exam will be missed. In this case, the final exam score will take the place of the missed exam.

**Cellular Phones**: All cellular phones and other electronic devices must be switched off during all class times.

## ADDITIONAL RESOURCES

**Math Tutoring Center**: Located in the Central King Building, Lower Level, Rm. G11 (See: Spring 2024 Hours)

**Further Assistance**: For further questions, students should contact their instructor. All instructors have regular office hours during the week. These office hours are listed on the Math Department's webpage for Instructor Office Hours and Emails.

**Accommodation of Disabilities**: The Office of Accessibility Resources and Services (OARS) offers long term and temporary accommodations for undergraduate, graduate and visiting students at NJIT.

If you are in need of accommodations due to a disability please If you need an accommodation due to a disability please contact the Office of Accessibility Resources and Services at oars@njit.edu. The office is located in Kupfrian Hall, Room 201. A Letter of Accommodation Eligibility from the Office of Accessibility Resources and Services office authorizing your accommodations will be required.

For further information regarding self identification, the submission of medical documentation and additional support services provided please visit the Office of Accessibility Resources and Services (OARS) website at:

https://www.njit.edu/accessibility/

**Important Dates** (See: Spring 2024 Academic Calendar, Registrar)

| Date | Day | Event |
|---|---|---|
| January 16, 2024 | Tuesday | First Day of Classes |
| January 22, 2024 | Monday | Last Day to Add/Drop Classes |
| March 10, 2024 | Sunday | Spring Recess Begins |
| March 16, 2024 | Saturday | Spring Recess Ends |
| March 29, 2024 | Friday | Good Friday - No Classes |
| April 1, 2024 | Monday | Last Day to Withdraw |
| April 30, 2024 | Tuesday | Friday Classes Meet |
| April 30, 2024 | Tuesday | Last Day of Classes |
| May 1, 2024 | Wednesday | Reading Day 1 |
| May 2, 2024 | Thursday | Reading Day 2 |
| May 3 - May 9, 2024 | Friday to Thursday | Final Exam Period |

## Course Outline (very tentative ☺ )

| Lecture | Chapter/ Sections | Topic |
|---|---|---|
| 1 | Introduction Review | Quick introduction to the course<br>What you're expected to know from MATH 244/333 |
| 2 | 3.9<br>4.9 | Moment Generating Functions (MGFs) of Discrete Variables<br>Moment Generating Functions (MGFs) of Continuous Variables |
| 3 | 5.2 | Bivariate Probability Distributions |
| 4 | 5.2 | Bivariate Probability Distributions |
| 5 | 5.3 | Marginal and Conditional Probability Distributions |
| 6 | 5.4<br>5.5-5.6 | Independent Random Variables<br>Expected Value of a Function of Random Variables |
| 7 | 5.7<br>5.8 | Covariance of Two Random Variables<br>Expected Value and Variance of Linear Functions of Variables |
| 8 | 6.3 | Method of Distribution Functions |

| 9 | 6.4<br>6.5 | Method of Transformations<br>Method of Moment-Generating Functions |
|---|---|---|
| 10 | 6.7 | Order Statistics |
| 11 | 7.2 | Sampling Distributions Related to the Normal Distribution |
| 12 | 7.2<br>Review | Sampling Distributions Related to the Normal Distribution<br>Review for Midterm Exam |
| 13  (T 2/27) | | **Midterm Exam (Chapters 3-6)** |
| 14 | 7.2 | Sampling Distributions Related to the Normal Distribution |
| 15 | 7.3<br>8.2 | The Central Limit Theorem<br>The Bias and Mean Square Error of Point Estimates |
| 16 | 8.3<br>8.6 | Some Common Unbiased Point Estimates<br>Large-Sample Confidence Intervals |
| **Spring Recess ~ No Classes ~ University Open** | | |
| 17 | 8.7<br>8.8 | Selecting the Sample Size<br>Small-Sample Confidence Intervals for Population Means |
| 18 | 8.9 | Confidence Intervals for Population Variance |
| 19 | 9.2-9.4 | Relative Efficiency, Consistency, and Sufficiency |
| 20 | 9.5 | Minimum-Variance Unbiased Estimation |
| 21 | 9.7 | Method of Maximum Likelihood |
| 22 | Chapter 10 | Hypothesis Testing |
| 23 | Chapter 10 | Hypothesis Testing |
| 24 | Chapter 10 | Hypothesis Testing |
| 25 | Chapter 10 | Hypothesis Testing |
| 26 | Chapter 13 | ANOVA |
| 27 | Chapter 13 | ANOVA |

| 28 | Catch-up Review | Review for Final Exam |
|---|---|---|
| 5-3 to 5-10 | **Final Exam (Chapters 7-10, 13)** | |

Additional Topics, time permitting: Chapter 14: Analysis of Categorical Data