Theory of Probability

Class code: MATH-UA 9233 - 001

Instructor Details
Prof. David Larman
Room 806, 25 Gordon Street (UCL Mathematics Department).

Class Details
Fall 2013
Thursdays 1:30-4:30
Location to be confirmed.

Prerequisites
Calculus 11 or Calculus 111 with grade C or higher.

Class Description
An introduction to the mathematical treatment of random phenomena occurring in the natural, physical and social sciences. Axioms of mathematical probability, combinatorial analysis, binomial distribution, Poisson and normal distribution, random variables and probability distributions, generating functions, Markov chains, applications.

The course will be delivered via lectures, discussions and weekly assignments. Results will be proved wherever possible.

Desired Outcomes
1. Understanding of the mathematical model of probability theory.
2. Feel comfortable with the concepts of conditional probability and random variables.
3. Appreciate the limit theorems we observe in everyday life.

Assessment Components
Weekly assignments 40%. Mid-term exam. 20%. Final exam. 40%.

Failure to submit or fulfil any required course component results in failure of the class.

Assessment Expectations
Grade A: A thorough understanding of both theory and methods
Grade B: A good understanding of the theory and complete confidence in applying the methods
Grade C: A good understanding of the theory and reasonable competence in the methods
Grade D: A reasonable understanding of both theory and methods
Grade F: An inability to master the theory and methods to an acceptable level

NYU in London uses the following scale of numerical equivalents to letter grades:

A=94-100
A-=90-93
B+=87-89
B=84-86
B-=80-83
C+=77-79
C=74-76
C-=70-73
D+=67-69
D=65-66
F=below 65

Where no specific numerical equivalent is assigned to a letter grade by the class teacher, the mid point of the range will be used in calculating the final class grade (except in the A range, where 95.5 will be used).

NYU in London aims to have grading standards and results in all its courses similar to those that prevail at Washington Square.

NYUL has a strict policy about course attendance. No unexcused absences are permitted. While students should contact their class teachers to catch up on missed work, you should NOT approach them for excused absences.

Excused absences will usually only be considered for serious, unavoidable reasons such as personal ill–health or illness in the immediate family. Trivial or non-essential reasons for absence will not be considered.

Excused absences can only be considered if they are reported in accordance with guidelines which follow, and can only be obtained from the appropriate member of NYUL's staff.

Please note that you will need to ensure that no make-up classes – or required excursions - have been organised before making any travel plans for the semester. See also section 11.1 - Make up days.

Absence reporting for an absence due to illness

1. On the first day of absence due to illness you should report the details of your symptoms by e-mailing absences@nyu.ac.uk including details of: class(es) missed; professor; class time; and whether any work was due including exams. Or call free (from landline) 0800 316 0469 (option 2) to report your absences on the phone.

2. Generally a doctor’s note will be required to ensure you have sought treatment for the illness. Contact the Gower Street Health Centre on 0207 636 7628 to make an appointment,
or use HTH general practitioners if you cannot get an appointment expediently at Gower Street.

3. At the end of your period of absence, you will need to complete an absence form online at http://bit.ly/NuCl5K. You will need to log in to NYU Home to access the form.

4. Finally you must arrange an appointment to speak to Nigel Freeman or Donna Drummond-Smart on your first day back at class. You must have completed the absence form before making your appointment.

Supporting documentation relating to absences must be submitted within one week of your return to class.

**Absence requests for non-illness reasons**

Absence requests for non-illness reasons must be discussed with the Academic Office prior to the date(s) in question – no excused absences for reasons other than illness can be applied retrospectively. Please come in and see us in Room 308, 6 Bedford Square, or e-mail us at academics@nyu.ac.uk.

**Further information regarding absences**

Each unexcused absence will be penalized by deducting 3% from the student’s final course mark. Students are responsible for making up any work missed due to absence.

Unexcused absences from exams are not permitted and will result in failure of the exam. If you are granted an excused absence from an examination (with authorisation, as above), your lecturer will decide how you will make-up the assessment component, if at all (by make-up examination, extra coursework, viva voce (oral examination), or an increased weighting on an alternate assessment component, etc.).

NYUL also expects students to arrive to class promptly (both at the beginning and after any breaks) and to remain for the duration of the class. If timely attendance becomes a problem it is the prerogative of each instructor to deduct a mark or marks from the final grade of each late arrival and each early departure.

Please note that for classes involving a field trip or other external visit, transportation difficulties are never grounds for an excused absence. It is the student’s responsibility to arrive at an agreed meeting point in a punctual and timely fashion.

Please refer to the Student Handbook for full details of the policies relating to attendance. A copy is in your apartment and has been shared with you on Google Docs.

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**Late Submission of Work**

Written work due in class must be submitted during the class time to the professor. Late work should be submitted in person to a member of NYU London staff in the Academic Office (Room 308, 6 Bedford Square) during office hours (Mon – Fri, 10:30 – 17:30). Please also send an electronic copy to academics@nyu.ac.uk for submission to Turnitin.

Work submitted within 5 weekdays after the submission time without an agreed extension receives a penalty of 10 points on the 100 point scale.

Written work submitted more than 5 weekdays after the submission date without an agreed extension fails and is given a zero.
Please note end of semester essays must be submitted on time.

Plagiarism Policy

Plagiarism: the presentation of another piece of work or words, ideas, judgements, images or data, in whole or in part, as though they were originally created by you for the assignment, whether intentionally or unintentionally, constitutes an act of plagiarism.

Please refer to the Student Handbook for full details of the plagiarism policy.

All students must submit an electronic copy of each piece of their written work to www.turnitin.com and hand in a printed copy with the digital receipt to their professor. Late submission of work rules apply to both the paper and electronic submission and failure to submit either copy of your work will result in automatic failure in the assignment and possible failure in the class.

Electronic Submission

The Turnitin database will be searched for the purpose of comparison with other students’ work or with other pre-existing writing or publications, and other academic institutions may also search it.

In order for you to be able to submit your work onto the Turnitin website, you will need to set up an account:

1) Go onto the Turnitin website http://www.turnitin.com
2) Click ‘Create Account’ in the top right hand corner
3) Select user type of ‘student’
4) Enter your class ID & Turnitin class enrolment password (these will be e-mailed to you after the drop/add period, or contact academics@nyu.ac.uk if you have misplaced these).
5) Follow the online instructions to create your profile.

To submit your work for class, you will then need to:

1) Log in to the Turnitin website
2) Enter your class by clicking on the class name
3) Next to the piece of work you are submitting (please confirm the due date), click on the ‘submit’ icon
4) Enter the title of your piece of work
5) Browse for the file to upload from wherever you have saved it (USB drive, etc.), please ensure your work is in Word or PDF format, and click ‘submit’
6) Click ‘yes, submit’ to confirm you have selected the correct paper (or ‘no, go back’ to retry)
7) You will then have submitted your essay onto the Turnitin website.
8) Please print your digital receipt and attach this to the hard copy of your paper before you submit it to your professor (this digital receipt appears on the web site, immediately after you submit your paper and is also sent to your e-mail address). Please also note that when a paper is submitted to Turnitin all formatting, images, graphics, graphs, charts, and drawings are removed from the paper so that the program can read it accurately. Please do not print the paper in this form to submit to your lecturers, as it is obviously pretty difficult to read! You can still access the exact file you uploaded by clicking on the ‘file’ icon in the ‘content’ column.

Please also see the Late Submission of Work policy, above.

Students must retain an electronic copy of their work for one month after their grades are posted online on Albert and must supply an electronic copy of their work if requested to do so by NYU in London. Not submitting a copy of a piece of work upon request will result in automatic failure in the
**Assignment and possible failure in the class.** NYU in London may submit in an electronic form the work of any student to a database for use in the detection of plagiarism, without further prior notification to the student.

Penalties for confirmed cases of plagiarism are set out in the Student Handbook.

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<tbody>
<tr>
<td>Supplemental Text(s) (not required to purchase as copies are in NYU-L Library)</td>
<td>An introduction to Probability Theory and its Applications(volume 1) by William Feller (John Wiley) ISBN 0 471 25708-7</td>
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<tr>
<td>Internet Research Guidelines</td>
<td>Not appropriate.</td>
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<td>Additional Required Equipment</td>
<td>Pen and paper.</td>
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### Session 1
5th Sept.

- Combinatorics, basic principles, permutations, combinations, multinomial coefficients, Chapters 1.1-1.6
- First assignment set

### Session 2
12th Sept.

- Fundamental concepts; outcomes, events and ample spaces, axioms of probability, sample spaces having equally likely outcomes, Chapters 2.1-2.7
- First assignment due. Second assignment set

### Session 3
19th Sept.

- Conditional Probability and independence. Bayes formula, conditional probability as a probability function. Chapters 3.1-3.5
- Second assignment due. Third assignment set

### Session 4
26th Sept.

- Discrete random variables. Expectation and variance. Chapters 4.1-4.5
- Third assignment due. Fourth assignment set
<table>
<thead>
<tr>
<th>Session 5</th>
<th>Special random variables (Bernoulli, Binomial, Poisson, geometric, hypergeometric). Cumulative distribution function. Chapters 4.6-4.10.</th>
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<td>3rd Oct.</td>
<td>Fourth assignment due. Fifth assignment set</td>
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<tr>
<th>Session 6</th>
<th>Continuous random variables, expectation and variance. Special random variables (uniform, normal, exponential). Chapters 4.6-4.10.</th>
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<td>10th Oct.</td>
<td>Fifth assignment due. Sixth assignment set</td>
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<th>Session 7</th>
<th>Distribution of a function of a random variable. Jointly distributed random variables. Sums of independent random variables. Chapters 5.7-6.9.</th>
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<td>17th Oct.</td>
<td>Sixth assignment due. Seventh assignment set</td>
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<tr>
<th>Session 8</th>
<th>Conditional Distributions; properties of expectations, expectations of sums of random variables. Chapters 6.4-6.8, 7.1,7.2.</th>
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<tr>
<td>24th Oct.</td>
<td>Seventh assignment due. Eighth assignment set</td>
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<tr>
<th>Session 9</th>
<th>Mid-Term exam.. It will be a two hour written exam and any topic covered in sessions 1-8 may be examined.</th>
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<tr>
<td>31st Oct.</td>
<td>No assignment</td>
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<tr>
<th>Session 10</th>
<th>Covariance, variance of sums, correlations, conditional expectations. Chapters 7.4-7.9.</th>
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<tr>
<td>14th Nov.</td>
<td>Eighth assignment due. Ninth assignment set</td>
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[Click and enter co-curricular activities, etc.]
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<thead>
<tr>
<th>Session 12</th>
<th>The strong law of large numbers. Jensen's inequality. Chapters 8.4-8.6.</th>
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<tr>
<td>21\textsuperscript{st} Nov.</td>
<td>Tenth assignment due. Eleventh assignment set.</td>
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<tr>
<td>28\textsuperscript{th} Nov.</td>
<td>Eleventh assignment due.</td>
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<th>Session 14</th>
<th>Revision of topics</th>
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<tr>
<td>5\textsuperscript{th} Dec’</td>
<td>No assignment</td>
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<tr>
<th>Session 15</th>
<th>Final exam will be a written exam and will last two hours and thirty minutes. Any topic covered in the course may be examined.</th>
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| Classroom Etiquette | Mobile phones and other electronic devices switched off. |

| Required Co-curricular Activities | None |

| Suggested Co-curricular Activities | None |

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<th>Your Instructor</th>
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<tr>
<td>Professor of Mathematics at UCL since 1967. Harkness Fellow 1966-7. Former Vice President of the U.K. mathematical society. Many International Prizes from Mathematical Societies. Visiting Professor at the University of Washington, Seattle; University of British Columbia, Vancouver; University of Minnesota.</td>
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