Semester: FALL 2017

Class code: MATH-9140

Instructor Details: Dr Mark Roberts

Office hour to be decided

Class Details: Probability Theory, Fall 2017

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, expectations, limit theorems.

The course will be delivered via lectures, discussions and weekly assignments.

Desired Outcomes:
By the end of the course, students should be able to

1. Understand the mathematical model of probability.
2. Work with concepts of conditional probability and random variables.
3. Calculate examples.
4. Understand the limit theorems.

Assessment components:
Weekly assignments 30%, Midterm exam. 20%. Final exam 50%.

Homework exercises can be completed using pen and paper. Students may find it helpful to discuss problems together, but must always write up their solutions separately to avoid plagiarism.

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

Assessment Expectations:

Grade A: Good understanding of ideas: ability to carry out calculations: ability to produce and understand proofs and solve unseen problems.

Grade B: Reasonable understanding of ideas: ability to carry our calculations: some ability to produce proofs and solve unseen problems.

Grade C: Reasonable understanding of ideas: ability to carry our simpler calculations.

Grade D: Basic understanding of ideas and ability to carry our calculations with some degree of success.

Grade F: Ideas not understood or inability to do calculations.
| **Session 1** | Combinatorics, basic principles, permutations, combinations, multinomial coefficients (Sections 1.1-1.6)  
First assignment set. |
| **Session 2** | Fundamental concepts; outcomes, events and sample spaces, axioms of probability, sample spaces having equally likely outcomes (Sections 2.1-2.7)  
Second assignment set. First assignment handed in. |
| **Session 3** | Conditional Probability and independence. Bayes formula; independence (Sections 3.1-3.4)  
Third assignment set. Second assignment handed in. |
| **Session 4** | Discrete random variables. Expectation and variance. (Sections 4.1-4.5)  
Fourth assignment set. Third assignment handed in. |
| **Session 5** | Special random variables (Bernoulli, binomial, Poisson, geometric, hypergeometric). Cumulative distribution function (Sections 4.6-4.10)  
Fifth assignment set. Fourth assignment handed in |
| **Session 6** | Continuous random variables, expectation and variance. Special random variables (uniform, normal, exponential). (Sections 5.1-5.6)  
Sixth assignment set. Fifth assignment handed in. |
| **Session 7** | Distribution of a function of a function of a random variable. Jointly distributed random variables, Sums of independent random variables. (Sections 5.7, 6.1-6.3)  
Sixth assignment handed in. (No assignment set.) |
| **Session 8** | Mid-term exam.  
Catch up. |
Seventh assignment set.

Session 9
Conditional Distributions; properties of expectations, expectations of sums of random variables, moments. (Sections 6.4-6.5, 7.1-7.3)
Eighth assignment set. Seventh assignment handed in.

Session 10
Covariance, variance of sums, correlations, conditional expectations. (Sections 7.4-7.9)
Ninth assignment set. Eighth assignment handed in.

Session 11
Limit theorems, Chebyshev’s inequality. Weak law of large numbers. Central limit theorem. (Sections 8.1-8.3)
Tenth assignment set. Ninth assignment handed in.

Session 12
The strong law of large numbers. Jensen’s inequality. (Sections 8.4-8.6)
Eleventh assignment set. Tenth assignment handed in.

Session 13
Applications from Chapter 9. Catch-up.
Twelfth assignment set. Eleventh assignment handed in.

Session 14
Revision of topics
Twelfth assignment handed in.

Session 15
Final Exam

Classroom Etiquette
Mobile phones and other electronic devices switched off.

Required Co-curricular Activities
n/a

Estimated Travel Costs
n/a

Suggested Co-curricular Activities
n/a
Your Instructor

Departmental Tutor and lecturer in the Mathematics Department at UCL. I currently teach first year algebra and Galois Theory to undergraduates at UCL. My research interests are in abstract algebra, in particular non-commutative ring theory.

NYU GLOBAL ACADEMIC POLICIES

Policies and procedures for Global Academic Centres, including policies on academic integrity and the Study Away Standard, can be found here:
https://www.nyu.edu/about/policies-guidelines-compliance/policies-and-guidelines/student-services.html

Absences: Key information on NYU London’s absence policy, how to report absences, and what kinds of absences can be excused can be found here: http://www.nyu.edu/london/academics/attendance-policy.html

NYU London work submission policies can be found here: http://www.nyu.edu/london/academics/academic-policies.html

Classroom conduct: Academic communities exist to facilitate the process of acquiring and exchanging knowledge and understanding, to enhance the personal and intellectual development of its members, and to advance the interests of society. Essential to this mission is that all members of the University Community are safe and free to engage in a civil process of teaching and learning through their experiences both inside and outside the classroom. Accordingly, no student should engage in any form of behaviour that interferes with the academic or educational process, compromises the personal safety or well-being of another, or disrupts the administration of University programs or services.

Please refer to the NYU London Disruptive Student Behaviour Policy at https://goo.gl/Nvt5Vu for examples of disruptive behaviour and guidelines for response and enforcement.