COURSE SPECIFICATION FORM

<table>
<tr><td colspan="4">DEPARTMENT OF: Mathematics</td><td colspan="2">Academic Session: 2017-18</td></tr>
<tr><td>Course Code:</td><td>MT2320</td><td>Course Value:</td><td>0.5</td><td>Status:
(ie:Core, or Optional)</td><td>Mandatory for G1G3, optional for others</td></tr>
<tr><td>Course Title:</td><td colspan="3">Probability</td><td>Availability:
(state which teaching terms)</td><td>Term 2</td></tr>
<tr><td>Prerequisites:</td><td colspan="3">MT1720 and MT1810</td><td>Recommended:</td><td></td></tr>
<tr><td>Co-ordinator:</td><td colspan="5"></td></tr>
<tr><td>Course Staff</td><td colspan="5"></td></tr>
<tr><td>Aims:</td><td colspan="5">To introduce the formalism of the mathematical theory of probability and thereby to lay a firm foundation for applications of probability in virtually all areas of science, including statistics, economics, the mathematics of financial markets, operational research, information theory, number theory, quantum theory and statistical physics.</td></tr>
<tr><td>Learning Outcomes:</td><td colspan="5">On completion of the course, the student should be able to
demonstrate an understanding of the basic principles of the mathematical theory of probability;
use the fundamental laws of probability to solve a range of problems;
prove simple theorems involving both discrete and continuous random variables;
explain the weak law of large numbers and the central limit theorem.</td></tr>
<tr><td>Course Content:</td><td colspan="5">Elements of probability: Sets and events. Axioms of probability. Independent events. Conditional probability. Bayes' theorem.
Discrete random variables: Probability distribution function and cumulative distribution function. Joint distribution, marginal distribution, independence. Distribution of a function of a random variable. Expectation, variance, covariance. Binomial and Poisson distributions, with application to simple combinatorial problems. Chebychev's inequality and the weak law of large numbers. Further topics, such as probability generating functions, the hypergeometric and negative binomial distributions.
Continuous random variables: Definition as $X : S \to \mathbf{R}$ such that
$\Pr(a < X < b) = \int_a^b f(x)dx$. Expectation and variance. Normal and exponential distributions. Joint and marginal densities, independence. Transformations of random variables. Normal approximation to the binomial distribution. Statement of the central limit theorem. Further topics such as moment generating functions and the gamma distribution.
Further topics: Possible further topics include applications in the fields of geometric probability and simple random walks, such as Buffon's needle problem, simple problems related to the geometry of points chosen at random in the interior of squares and circles, the gambler's ruin problem, the reflection principle, the ballot theorem, first passage times.</td></tr>
<tr><td>Teaching & Learning Methods:</td><td colspan="5">33 hours of lectures and examples classes.
117 hours of private study, including work on problem sheets and examination preparation. This may include discussions with the course leader if the student wishes.</td></tr>
<tr><td>Key Bibliography:</td><td colspan="5">S M Ross – A First Course in Probability (Prentice Hall 2005) Library reference 518.1 ROS</td></tr>
<tr><td>Formative Assessment & Feedback:</td><td colspan="5">Formative assignments in the form of 10 problem sheets. The students will receive feedback as written comments on their attempts.</td></tr>
<tr><td>Summative Assessment:</td><td colspan="5">Exam (%) A two-hour paper: 100%
Coursework (%) None</td></tr>
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Updated September 2017