Statistics - 134 (Lecture - 2), Fall 2002

Syllabus for the Final Exam (December 11, 2002).

NOTE : The exam will be for 3 hours. The focus will only be on problem solving and not writing Mathematical proofs. This syllabus includes all that we did in class before and after the midterm.

Before the Midterm :

1. Chapter-1 :
   (a) Section 1.1 : Random experiments, outcomes, equally likely outcome, odds ratio, fair odds.
   (b) Section 1.2 : Interpretation of probability, frequency interpretation, subjective view point.
   (c) Section 1.3 : Mathematical set up for probability, sample space, events, probability function, rules of probability, distributions. [pp 19 - 27].
   (d) Section 1.4 : Conditional probabilities, multiplication rule, rule of average for conditional probabilities, independence of two events, tree diagram representation.
   (e) Section 1.5 : Bayes' rule.
   (f) Section 1.6 : Many events, general multiplication rule, independence of many events, pairwise independence.

2. Chapter-2 :
   (a) Section 2.1 : Success-failure experiment, repeated trials, Binomial distribution, mode of Binomial, mean and standard deviation.
   (b) Section 2.2 : Normal approximation to Binomial probabilities, De Moivre - Laplace Central Limit Theorem, continuity correction. [pp 93 - 100]
   (c) Section 2.4 : Poisson approximation to Binomial probabilities, Poisson distribution.
   (d) Section 2.5 : Sampling with and without replacement, Hypergeometric distribution.

3. Chapter-3 :
   (a) Section 3.1 : Random variables, definition, discrete random variables, examples, Bernoulli(p), Binomial(n, p), Hypergeometric($n; N, G$), Geometric(p), Poisson(λ), Uniform on $\{1, 2, \ldots, n\}$ etc. Distribution of a random variable. Joint distribution of two and many random variables, marginal distributions, independence. Indicator variable, calculus of indicators. Multinomial distribution.
   (b) Section 3.2 : Expectation of a discrete random variable, examples, interpretation. Sum rule. Indicator method, expectation of a function, expectation of square. Independence and product rule.
   (c) Section 3.3 : Expectation of a square, examples, definition of variance, standard deviation. Sum formula for independent random variables. Shifting and scaling, standardization. [pp 185 - 190]
   (d) Section 3.4 : Geometric distribution, mean, variance, memory-less property.
   (e) Section 3.5 : Poisson distribution, definition, mean, variance. [pp 222 - 223]
   (f) Section 3.6 : Hypergeometric distribution, sampling without replacement, mean of Hypergeometric. [NO Symmetry]

After the Midterm :

1. Chapter-3 :
   (a) Section 3.2 : Tail estimates, Markov Inequality, Expectation of a function of a random variable.
   (b) Section 3.3 : Chebychev's Inequality, Sums and averages of independent random variables, Law of Large Numbers (LLN), Normal approximation method in general, Central Limit Theorem (CLT). [NO Skewness.]
   (c) Section 3.5 : Sums of independent Poisson variables, Poisson Scatter. [pp 226 - 233]
2. Chapter-4 :
   (a) Section 4.1 : Continuous random variables, Uniform distribution, Normal distribution with mean μ and variance σ^2. Probability density function, interpretation. Expectation and variance. Independence of two or many continuous random variables. [pp 259 - 271]
   (b) Section 4.2 : Exponential distribution, memoryless property, mean and variance of Exponential distribution. Poisson Arrival Process of rate λ on $(0, \infty)$. Poisson, Exponential and Gamma distributions. Gamma distribution with non-integer shape parameter, Gamma function.
   (c) Section 4.4 : One-to-one change of variable formula for density computation.
   (d) Section 4.5 : Cumulative distribution function, interpretation. Properties, differences in discrete and continuous cases. Relation with distribution table and density function. "Steps 1 to 3" method of computation of distribution of a transform. Maximum and Minimum of iid random variables. [pp 311 - 319]
3. Chapter-5 :
   (a) Section 5.1 : Continuous joint distribution, joint densities. Uniform distribution from a bounded area or volume.
   (b) Section 5.2 : Joint and marginal densities. Independence.
   (c) Section 5.3 : Independent Normal distributions, linear combinations, rotation of two independent normal coordinates. Rotational symmetry of two independent normal coordinates, polar transformation. Chi-Square distribution.
   (d) Section 5.4 : Sums of independent random variables. Convolution formula. Sums of independent Gamma distributions. Product and ratio of independent random variables. [NO Beta Integral].
4. Chapter-6 :
   (a) Section 6.1 : Conditional distribution in discrete case, rule of average. Multiplication rule. Independence.
   (b) Section 6.2 : Conditional expectation in discrete case, properties of conditional expectation. Law of iterated expectation.
   (c) Section 6.3 : Conditional distribution in continuous case, conditional density. Conditional expectation, Law of iterated expectations. Multiplication rule. Independence.
   (d) Section 6.4 : Definition of Covariance of two random variables, variance sum formula. Independence and covariance. [NO Correlation].

Complete Sections of the book which are NOT included in the syllabus :

1. Chapter-2 : Section 2.3.
2. Chapter-4 : Section 4.3 and Section 4.6.
3. Chapter-6 : Section 6.5.