Scope of Final Exam 2020

Chapters 1-3: just as in midterm exam

Chapter 4: Expectation and variance formulas of the 6 major distributions need to be memorized. The 6 major distributions: binomial (which includes Bernoulli as special case), Poisson, geometric, uniform, normal, exponential.

The PDF expression for the multivariate normal distribution is not required, as well as the derivations based on this expression. But you need to memorize the results and know how to use them.

Chapter 5:
You don’t need to know De Moivre-Laplace theorem since it is a special case of the central limit theorem. Any problem that is supposed to involve De Moivre-Laplace theorem you can solve it directly by using the central limit theorem itself.

Chapter 6:
Sections included in the scope of the final exam: Population and Sample, Part of 6.2 Moment Estimation (the definitions of moments are required, but the method of moments is not), Maximum Likelihood Estimation, Properties of Estimators.

Symbols that need special attention

Var(X) stands for the variance of X

$\rho_{X,Y}$ stands for the correlation coefficient of X and Y

$P(\lambda)$ stands for Poisson distribution with parameter λ. The symbol P is used both for probability and for Poisson distribution, so you need to decide which is the right interpretation based on the context.

$E(\lambda)$ or $Exp(\lambda)$ stands for exponential distribution with parameter λ. The symbol E is used both for expectation and for exponential distribution, so you need to decide which is the right interpretation based on the context.

B(n,p): binomial distribution with parameters n,p

Geo(p): geometric distribution with parameter p

U(a,b) or U[a,b]: both mean uniform distribution on interval [a,b]

An Incomplete Compilation of the

Knowledge Points in Probability and Statistics

No.	Knowledge Points	Examples in the textbook
	Chapter 1	
	Sample space construction	
	Probability computation based on axioms (including probability of union of events)	
	Combinatoric probability computing	
	Geometric probability computing	
	Check independence of two events (key: express everything using P(A),P(B),P(AB))	
	Probability computation with independence assumptions	
	Computing conditional probability using definition	
	Computing (conditional) probability using multiplication rule for conditional probabilities	
	Law of total probability, Bayes' law	
	Chapter 2	
	Complete incompletely specified PF/PDF	
	Compute PF by combinatoric methods	
	Given PF/PDF/CDF, compute probability of event	
	Given PF/PDF, compute CDF	
	Use of the PF/PDF formulas of the 6 major distributions that you must memorize	
	Approximation of binomial distribution by Poisson distribution	
	Computing probability when the distribution is normal by standardization	
	Use of the symmetry of Φ	
	Given PF of X, compute PF of Y=r(X)	
	Given PDF of X, compute PDF of Y=r(X), with r one-to-one	
	Given PDF of X, compute PDF of Y=r(X), with r not one-to-one	
	Chapter 3	
1	Compute joint PF by combinatoric methods	3.1-3.5
2	Given joint PF/PDF, compute probability of event defined by inequality	3.6(3-5), 3.8(3)
3	Given joint PF/PDF, compute marginal PF/PDF	3.8(2), 3.9(2), 3.10(1)
4	Given joint PF/PDF, compute conditional PF/PDF	3.11(1),

5	Given PDF of X and conditional PDF of Y given X, compute joint PDF	3.13
6	Given PDFs of independent X and Y , compute PDF of max(X, Y) or min(X, Y)	3.25
7	Given joint PDF , compute PDF of X+Y and X-Y	3.18, 3.19
8	Given joint PF/PDF, check independence	3.12(2)
	Chapter 4	
9	Given joint PF/PDF, compute expectation	4.1-4.5
10	Given joint PF/PDF compute variance	4.2, 4.5
11	Given joint PF/PDF, compute covariance and correlation	4.23-4.25
12	Given joint PF/PDF, compute the expectation of functions of X,Y	4.4, 4.5, 4.6, 4.9
13	Use of the expectation and variance formulas of the 6 major distributions that you must memorize	4.21, 4.22
14	Application of properties of expectation	4.16, 4.17
15	Application of properties of variance	4.26, 4.27
16	Application of properties of covariance	4.23, 4.32
17	Each entry of the covariance matrix is a covariance	4.35
18	Linear combinations of independent random variables having normal distribution	
19	Application of Chebyshev inequality	5.12
	Chapter 5	
20	Use of central limit theorem	5.1, 5.2, 5.4, 5.6, 5.7, 5.9
21	Use of central limit theorem with correction for continuity	5.3, 5.5, 5.11
	Chapter 6	
22	Decide whether it is a stochastic	6.1
23	Given data, compute sample mean, sample variance, A2, B2	6.32
24	Find a sampling distribution, i.e. given a statistic, find its distribution	6.3
25	Derive a moment estimator	6.5
26	Derive a maximum likelihood estimator	6.6-6.11
27	Find the bias of an estimator	6.13, 6.14, 6.17
28	Find the efficiency of an unbiased estimator	6.14
29	Find the distribution of a random variable derived from normal random variables	6.18-6.23
30	Probability computation involving chi-square distribution	6.23-6.27
31	Probability computation involving t distribution	6.29
32	Given observed data, find a confidence interval for the mean of the normal population distribution, with variance known	6.32
33	Given observed data, find a confidence interval for the mean of the normal population distribution, with variance unknown	6.32

Note 1: This is only an incomplete list of knowledge points that will be tested. Do not blame me if

the exam paper includes a problem that involves knowledge points not in the list.

Note 2: Knowledge points in blue color are not included in the scope of final exam 2020.