

2021 SYLLABUS OF BASIC EDUCATION				
KNOWLEDGE STATEMENT MAPPING FOR EXAM MAS-I				
SECTION B				
			Hogg,	
			McKean	
			& Craig	Tse
Learning				
Objective	Knowledge Statement		Section	Section
B.1	a.	Equations for MLE of mean, variance from a sample	Section 6.1	
B.1	b.	Estimation of mean and variance based on sample	Section 2.8	
B.1	c.	General equations for MLE of parameters	Section 4.1, 6.1	
B.1	d.	Recognition of consistency property of estimators and alternative measures of consistency	Section 5.1	Section 10.1
B.1	e.	Application of criteria for measurement when estimating parameters through minimization of variance, mean square error	Section 7.1	Section 10.1
B.1	f.	Definition of statistical bias and recognition of estimators that are unbiased or biased	Section 4.1	Section 10.1
B.1	g.	Application of Rao-Cramer Lower Bound and Efficiency	Section 6.2	
B.1	h.	Relationship between Sufficiency and Minimum Variance	Section 7.3, 7.4	
B.1	i.	Develop and estimate a sufficient statistic for a distribution	Section 7.2	
B.1	j.	Factorization Criterion for sufficiency	Section 7.2	
B.1	k.	Application of Rao-Cramer Lower Bound and Fisher Information	Section 6.2, 6.4	
B.1	l.	Application of MVUE for the exponential class of distributions	Section 7.5, 7.6	
B.1	m.	Linkage between Score Function, Fisher Information and maximum likelihood	Section 6.2	
B.1	n.	Method of Moments		Section 12.1
B.1	o.	Percentile Matching		Section 12.1
B.1	p.	Kernel Density Estimation		Section 11.1.2
B.1	q.	Maximum Likelihood with Censoring & Truncation		Section 10.2, 12.3
B.2	a.	Presentation of fundamental inequalities based on general assumptions and normal assumptions	Section 4.5	
B.2	b.	Definition of Type I and Type II errors	Section 4.5, 8.1	
B.2	c.	Significance levels	Section 4.5, 8.1	
B.2	d.	One-sided versus two-sided tests	Section 4.6, 6.2	
B.2	e.	Estimation of sample sizes under normality to control for Type I and Type II errors	Section 4.5, 4.6	
B.2	f.	Determination of critical regions	Section 4.5	
B.2	g.	Definition and measurement of likelihood ratio tests	Section 6.3, 8.1, 8.2, 8.3	
B.2	h.	Determining parameters and testing using tabular values	Section 4.5, 4.6	
B.2	i.	Recognizing when to apply likelihood ratio tests versus chi-square or other goodness of fit tests	Section 4.7, 6.3, 8.1-8.3	
B.2	j.	Apply paired t-test to two samples	Section 4.5, 4.6	
B.2	k.	Test for difference in variance under Normal distribution between two samples through application of F-test	Section 8.3	
B.2	l.	Test of significance of means from two samples under Normal distribution assumption in both large and small sample cases	Section 4.5, 4.6, 5.3	
B.2	m.	Test for significance of difference in proportions between two samples under Binomial distribution assumption in both large and small sample case	Section 4.5, 4.6, 5.3	
B.2	n.	Application of contingency tables to test independence between effects	Section 4.7	
B.2	o.	Asymptotic relationship between likelihood ratio tests and the Chi-Square distribution	Section 6.3, 6.5	
B.2	p.	Application of Neyman-Pearson Theorem to Uniformly Most Powerful hypothesis tests	Section 6.4, 8.1	
B.2	q.	Equivalence between critical regions and confidence intervals	Section 4.5	
B.2	r.	Kolmogorov -Smirnov Test		Section 13.2.1
B.3	a.	Frequency, severity, and aggregate loss		Section 1.1
B.3	b.	Common continuous distributions for modeling claim severity		Section 2.2
B.3	c.	Mixing distributions	Section 2.2, 2.7, 3.7	Section 2.3
B.3	d.	Tail properties of claim severity	Section 3.7	Section 2.4
B.3	e.	Effects of coverage modifications including, for example: limits, deductibles, loss elimination ratios and effects of inflation	Section 1.7.1	Section 2.5
B.4	a.	General form for distribution of nth largest element of a set	Section 4.4	
B.4	b.	Application to a given distributional form	Section 4.4	

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SECTION C				
Learning Objective	Knowledge Statement	Chapter	Section	Section
			Hogg, McKean & Craig	James et al.
		Dobson & Barnett		Larsen
C1.	a. Understand the relationship between mean and variance by model family member for the exponential distribution	Chapter 3	Section 7.5	x
C1.	b. Understand how to select the appropriate distribution function for the dependent variable and the implication for the appropriate model form	Chapters 2 & 3		
C1.	c. Link Functions (Identity, Log, Logit, Power, Inverse)	Chapter 3	Section 7.5	x
C1.	d. Characteristics of Exponential Family (Binomial, Normal, Exponential, Gamma, Poisson, Inverse Gaussian, Negative Binomial, and Tweedie)	Chapter 3	Section 7.5	x
C1.	e. Canonical Forms of link function and effect of non-canonical link function on bias	Chapter 3		
C1.	f. Penalized Regression as implemented using the Lasso or Ridge Regression			Section 6.2
C1.	g. Understand concept of models within models for Generalized Additive Models			Section 7.7
C1.	h. Understand dimension reduction using Partial Least Squares or PCA Regression			Section 6.3, 6.4
C2.	a. Raw and studentized Residuals	Chapter 2, Section 6.2, Section 7.6		Section 3.1, 3.2, 3.3
C2.	b. R-Squared statistic	Section 6.3		Section 3.1
C2.	c. Cook's Distance and outliers	Section 6.2		Section 3.3
C2.	d. Influential points	Section 6.2		Section 3.3
C2.	e. Leverage	Section 6.2		Section 3.3
C2.	f. Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) penalized log likelihood measures	Section 7.5		Section 6.1
C2.	g. Standardized/Studentized Residuals	Section 6.2		Section 3.3
C2.	h. Deviance, Deviance Residuals and relationship to likelihood	Sections 5.6, 7.4, & 7.5		Section 6.1
C2.	i. Pearson Residuals vs. Deviance Residuals	Section 7.6		
C2.	j. Scatter, QQ and Box Plots	Chapter 2	Section 4.4	Chapter 1
C2.	k. Type III Sequential Chi-Square test	Section 7.4	Section 6.5	x
C2.	l. T-test and Wald test for significance of regression coefficients	Section 5.4 & 5.7	Section 9.6 & 6.3	Section 3.1
C2.	m. Prediction intervals for response variable			Section 3.2
C2.	n. Mean square error and standard error	Section 6.3		Section 2.2, 3.1-3.2
C2.	o. Calculation and validity of F test to compare two models (under OLS)	Section 5.7	Sections 9.1 - 9.5	Section 3.2
C2.	p. Cross Validation			Section 5.1
C2.	q. Test vs. Train Error			Section 2.2
C2.	r. Bootstrapping to test model validity			Section 5.2
C2.	s. Prediction vs. Forecast Error			Section 3.2
C2.	t. Overfitting			Section 2.2
C2.	u. Bias-Variance Tradeoff			Section 2.2
C2.	v. Evaluate collinearity using variance inflation factor	Section 6.3		Section 3.3
C2.	w. Evaluate appropriateness of underlying assumptions including:	Section 2.3		Section 3.3
	Homoscedasticity			
	Autocorrelation of residuals			
C3.	a. Maximum Likelihood & Ordinary Least Squares	Chapter 4	Section 9.6	Section 4.3
C3.	b. Fisher Scoring (iterative weighted least squares)	Chapter 4		
C3.	c. Quasi-Likelihood and relationship to maximum likelihood	Section 7.7		x
C3.	d. Collinearity (Aliasing) and model stability	Section 6.3		Section 3.3
C3.	e. Hat matrix	Section 5.6 & 6.2		
C3.	f. Design matrix	Section 2.4		Chapter 1
C3.	g. Fitting adjoining, overlapping observations in groups for Local Regression			Section 7.6
C3.	h. Supervised vs. Unsupervised learning methods			Section 2.1
C3.	i. Modeling functions within functions for Generalized Additive Models			Section 7.7
C3.	j. Penalty function in Penalized regression models (Lasso and Ridge Regression)			Section 6.2
C3.	k. Partial Least Squares Supervised learning vs. PCA Regression Unsupervised learning			Section 6.3

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C4.	a. Predictor variables	Chapter 1		Section 2.1
C4.	b. Response variables	Chapter 1		Section 2.1
C4.	c. Regression through the origin			x
C4.	d. Transformation of variables	Section 6.6 & 9.2		Section 3.3, Chapter 7
C4.	e. Categorical vs. continuous explanatory variables	Chapter 1 & Section 6.5		Section 3.3
C4.	f. Interaction terms	Section 6.4 & 6.6		Section 3.3
C4.	g. Significance and model comparison statistics	Chapters 5, 6, 7, 8 & 9		Section 3.2
C4.	h. Residuals and model parameter selection	Section 2.3		
C4.	i. Piecewise Linear and Smoothing Splines			Section 7.4, 7.5
C4.	j. Smoothing parameter for splines			Section 7.5
C4.	k. Basis Functions			Section 7.3
C4.	l. Knot Selection for Splines			Section 7.4
C4.	m. Weighting function for local regression			Section 7.6
C4.	n. Selection of functions within functions for Generalized Additive Models			Section 7.7
C4.	o. Selection of appropriate tuning factor for Lasso or Ridge Regression			Section 6.2
C4.	p. Select either Lasso or Ridge Regression depending on desired effect from penalized regression			Section 6.2
C4.	q. Curse of High Dimensionality			Section 6.4
C4.	r. Forward or backward or best subset selection			Section 6.1