Possible Topics to focus for FINAL examination

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For all topics, read the Lecture Notes, sections from Greene's book mentioned in the course outline and any other additional references mentioned in the class and loaded in the NYU Brightspace Website

Topics from Lecture 5 – Testing of Hypothesis and Testing with Restrictions

1) Definition of Type I and Type II error and Level of significance in the context of Hypothesis Testing
2) Describe the Type I and Type II error and level of significance with proper diagrams.
3) Describe Two-tailed versus one-tailed hypothesis testing and describe the critical Regions and critical values and P-Values which are important for decision making regarding hypothesis testing. Learn to show each of the above concept with proper diagrams
4) Describe the methods of testing restrictions on the coefficients of Linear Regression Model using proper mathematical expressions.
5) Learn how to formulate restriction matrix in the following format.

   $R\beta = q$

   Where R has K columns and J Rows, where

   K = 1 + number of Independent variables used in linear regression and

   J = number of restrictions we are imposing for testing.

   Study some example restrictions (discussed in class lecture) for a certain number of K (say K=6).

Topics from Lecture 6-7 – Dummy Variables and Structural Changes

i) Definition and characteristics of Dummy variables
ii) Use of dummy variables as regressors in different situations
iii) Benefits of using dummy variables under different situations

For example: Possible situations

- Existence of outlier in the data
- Identify and estimate the seasonal factors in the data

- Capture the individual specific characteristics
- Capture the geographic differences in model results
- Capture the group differences in model results
- Application of dummy variables to capture the threshold effect and categorical variables

iv) Study about Dummy Variable Trap. Explain what it means and how to avoid such trap to successfully use dummy variables in regression.

v) Dummy variables to capture the difference in intercepts and/or difference in the slopes regarding the relationships between Dependent and Independent variables across the individuals/groups/sub sets of data
Study the rules of formulation of appropriate dummy variables to capture such effects (study both the mathematical models as well as the representations of various situations using diagrams) –

Note: IN ADDIITONA TO CLASS NOTES READ THE NOTE FROM THE BOOK by D. Gujarati which is posted in NYU Brightspace website.

STRUCTURAL CHANGE

i) When we run a regression, we are assuming that the regression coefficients are the same for all observations in the data set. However, some or all of the coefficients may be different for different subsets of data.
(Such differences could exist due to structural changes (mostly present in time series observations)

ii) Study various tests to identify the structural changes

iii) Study about use of dummy variables to identify such structural changes and estimation of parameters most efficiently

Topics from Lecture 8 – Instrumental Variable (IV)

i) Define and describe the Instrumental Variables in the context of regression models

ii) Violation of which assumption of GLS requires the use of Instrumental variables?

iii) What are the different circumstances when use of Instrumental Variable method can provide better estimates of parameters and how?
- Simultaneous equation bias
- Errors in variable measurements
- Model with lagged dependent variable

- Other situations where the assumption of exogeneity of regressors and error terms is violated

iv) Study the formula for IV estimator for estimating parameter vector β

v) Basic model assumptions for applying IV method (basic characteristics of IV candidates)

vi) **How do we use the available information optimally when "excess" of instrumental variables is available? (Z contains more variables than X)**

vii) Study the role of Two Stage Least Square in the context of IV estimator. How 2SLS can help to solve the issue of availability of excess instrumental variables.

viii) Asymptotic Covariance Matrix for 2SLS and **comparison** of Asymptotic Variances of the 2SLS to that of OLS

ix) What is the meaning of suitable Instruments? What is weak Instrumental variable and what is strong instrumental variable? Study the proper tests for identifying the strength of available instrumental variables

Topics from Lecture 9– Extremum Estimators and Maximum Likelihood Estimator (MLE)

i) Define and describe the Extremum Estimators using mathematical expressions for it. Provide some examples of Extremum Estimators

ii) Study the assumptions of Asymptotic properties of Extremum Estimators

iii) Define and describe Maximum Likelihood Estimator (MLE) with appropriate **mathematical expressions, diagrams and examples.**

Note: Read chap 6 -section 6.2 from book by J. Kmenta and Chap 14 on MLE in book by Greene

iv) Write the log likelihood function when distribution of observed data is assumed to be normal distribution. Derive the First Order conditions for MLE estimator and estimate the parameters.

NOTE: Read class notes, MLE_NOTES posted in NYU Brightspace under lecture 8 and chap on MLE from Greene's book.

v) Properties of the MLE estimator

vi) 3 Basic techniques of hypothesis testing when Likelihood function is known: (a) Likelihood Ratio Test (b) Wald Test (c) Lagrange Multiplier Test. Read the mathematical formula to use in each case and describe each test very clearly

Topics from Lecture-10 – No spherical Disturbances

- **A4. Homoscedasticity and nonauto correlation:**

- Each disturbance, ε_i, has the same finite variance, σ^2, and is uncorrelated with every other disturbance, ε_j, conditional on x. Disturbances that meet both of these assumptions are sometimes called **spherical disturbances**

i) Violation of assumption -4 and Generalized Regression Models
ii) Describe covariance matrix under non-spherical disturbances
iii) Properties of the OLS estimator in the Generalized Regression Model
iv) Given the effect of non-spherical disturbances on OLS, what approach should we take for estimating β. There are 3 basic scenarios that will determine our approach: (a) Ω is known (b) Ω is unknown but its structure is known (c) Ω is completely unknown
v) Learned in Detail all aspects of GENERALIZED LEAST SQUARE estimator]: transformation of data, formula for slope estimate, covariance matrix, etc.
vi) Properties of GLS estimator
vii) Detail about Feasible GLS (FGLS) and various steps to estimate parameter under FGLS
viii) Difference between estimated covariance matrix under OLS vs. true estimate of variance.
ix) **White's** estimator of variance when disturbances are heteroskedastic
x) **Tests of Heteroskedasticity: (a) White's General test and (b) Breusch-Pagan/Godfrey test**
xi) Study the factors that determine the efficiency gains of GLS over OLS estimates