Summary of the Course

The best material to study is the lecture notes, textbook readings and the problem sets.

I have put on the web a handout "List of topics in textbook you are NOT responsible for on the exam"

Part 1: Non-technical summary of regression.

This covered basic concepts in regression, including how to interpret OLS regression results (i.e. how coefficients are interpreted, what a confidence interval is, how to carry out a hypothesis test of whether a coefficient equalled zero, R^2 as a measure of fit, etc.). Omitted variables bias, multicollinearity and dummy variables were discussed.

Part 2:

Statistical Analysis of the Regression Model Under the Classical Assumptions

$$y_i = \beta X_i + \varepsilon_i$$

X_i is a scalar (a single number)

$$i=1,..,N$$

- **Statistical assumptions underlying regression**
- **The ordinary least squares (OLS) estimator**
- **The distribution of the OLS estimator (including its mean and variance)**
- **Using the distribution of the OLS estimator to derive a confidence interval for β (when error variance is known)**
- **Using the distribution of the OLS estimator to derive a test of the hypothesis $\beta=0$ (when error variance is known)**
- **An estimator for the error variance: s^2**
- **Confidence intervals and hypothesis tests when error variance is unknown**
- **Extension to multiple regression (F-tests, more derivations on multicollinearity and omitted variables bias, nonlinearity in regression, logs)**

Part 3:

Relaxing the Classical Assumptions

Cases where Error Variances/Correlations violate classical assumptions

- **Theory for the general case provided using intuition that you can transform the regression to get new errors that do satisfy classical assumptions (and then old theory works with transformed model)**
- **Special case 1: Heteroskedasticity**
- **Estimation with heteroskedastic errors: GLS and HCE**
- **Testing for heteroskedasticity: Goldfeld- Quandt test and White test**
- **Special case 2: Autocorrelated errors**
- **Estimation with autocorrelated errors: Cochrane-Orcutt procedure**
- **Various tests for autocorrelated errors**

Cases where X is a Random Variable (Instrumental Variables)

- **Case 1: X and ε are uncorrelated – OLS methods are still fine**
- **Case 2: X and ε are correlated – OLS methods are not fine (e.g. OLS is biased).**
- **Instrumental Variables (IV) estimator can be used for Case 2**
- **Properties of IV estimator**
- **Using the IV estimator in practice**

When might X and ε be correlated?

- **Ex. 1: Errors in variables**
- **Ex 2: Returns to schooling**

Part 4:

Time Series Econometrics

- **Univariate time series analysis: trends, differencing, non-stationary versus stationary time series**
- **The AR(p) model**
- **Testing for a unit root: the Dickey Fuller test**
- **Regression with time series variables**
- **Regression when the variables are stationary: the ADL model**
- **Regression when variables have unit roots**
- **The spurious regression problem**
- **Cointegration (interpretation and intuition)**
- **Testing for cointegration: the Engle-Granger test**
- **Regression when variables have unit roots but are not cointegrated (basic idea: difference the variables to get rid of unit roots).**