Math Camp August 2016

Course Objective
The primary objective of this course is to provide incoming graduate students with the mathematical foundations necessary for the first year sequence of theory and econometric courses. This course is designed on the presumption that students will have already been exposed to the majority of this material in previous studies. Thus the scope of the material to be covered is much larger than one would encounter in an ordinary mathematics course.

Who Should Take this Course?
Every incoming PhD student is required to take this course as part of our PhD program. All PhD students will take an exit test following Math Camp (date TBD) to determine mastery of these concepts. A successful grade on the Math Camp exit test means you will not be required to take Math for Economists I. Doctoral students who do not pass the Math Camp exit test will be required to take Math for Economists I. Incoming MA students are strongly encouraged to take this course. There are two main benefits. The first is it will help you complete work in your first year courses particularly those in the fall semester. The second benefit for MA students is that if they elect to take the Math Camp exit test and pass it, the requirement of Math for Economists I will be waived.

General Information:
Instructors: Khurram Makhdumi
Dates: August 8 - 25, 2016, Monday to Thursday
Time: 5 - 8 pm plus 1 hour after class (starting at 8pm) for advanced material.
Location: Dealy Hall, 5th floor conference room

Text Books
D. Salvatore and D. Reagle, Schaum’s Outlines, Statistics and Econometrics, 2nd Edition

Other Useful Books
E. Dowling, Schaum’s Outlines, Introduction to Mathematical Economics (recommended in Math I and Math II)

Additional texts for supplemental instruction
Note the acronym’s (e.g., OB, FMEA are used within the syllabus)

OB: “Linear Algebra with Applications” by Otto Bretscher, Pearson (2009). This is a very basic undergraduate Linear Algebra text book used in many American undergraduate programs.

FMEA: “Further Mathematics for Economic Analysis” by Knut Sydaester, Peter Hammond, Alte


MGB: “Principles of Statistics” by M.G. Bulmer, Dover Publication(1979). This is a basic, non-mathematical text book on statistics, well-written and easy to understand.


**Course Outline**

Note: Titles in RED are specifically for PhD students and are expected to be covered from 8:00 pm - 9:00 pm on days mentioned.

1 **Week 1**

8-AUG MONDAY

Algebra of sets and mapping. Types of function, Limit (existence and uniqueness), Continuity and differentiability of a function, Rules of differentiation, Partial differentiation.

**Homework**

CW: 2.3-2.4, 6.2- 6.4, 6.7, 7.1 - 7.4.

**Additional Texts used**

FMEA: Appendix A1, JS: Ch-2, 3.2, 3.4 & 14.3.

9-AUG TUESDAY


**Homework**

CW: 7.6, 8.1 - 8.5 **Additional Texts used** FMEA: 2.1, 13.1 WR: 1.5 - 1.11, 2.15 - 2.21

10-AUG WEDNESDAY

Exponential and Logarithmic functions, Concave and convex functions, Relative vs absolute extremum, Area under the curve and definite integral, Fundamental Theorem of Calculus. Compactness, Connectedness, Convex sets, Quasiconcave and Quasiconvex functions*, Hessian Matrices

**Homework**

CW: 10.1 - 10.5, 9.2-9.4
11-Aug Thursday
Homework CW: 14.2 - 14.4
Additional Texts used FMEA: 4.1, 4.2, JS: Ch-5, 7.1 & 7.8

2 Week 2

15-Aug Monday
Euclidean space, Vector spaces and vector operations, System of linear equations, Reduced Echelon Form (REF) and Rank of a matrix, Special matrices.
Homework CW: 4.1 - 4.3, Handout of extra practice questions.
Additional Texts used OB: Ch-1 & Appendix A.

16-Aug Tuesday
Matrix algebra, Matrix multiplication, Spanning, bases and Linear independence, Fundamental Theorem of Linear Algebra (Rank-Nullity Theorem). Linear Transformation and its inverse, Image and Kernel, Dimensions of subspaces of $\mathbb{R}^n$
Homework CW: 4.4 - 4.6, Handout of extra practice questions.
Additional Texts used OB: Ch-2 & 3.

17-Aug Wednesday
Matrix inverse, Orthogonality, Orthogonal projection, Pythagorean Theorem, Cauchy inequality and Correlation coefficient, Determinant of a Matrix (Algebraic and geometric interpretation), Properties of determinants, Cramers’ rule. Least Squares and Data Fitting
Homework CW: 5.1 - 5.5
Additional Texts used OB: Ch-5 & 6

18-Aug Thursday
Eigen values and Eigen vectors, Diagonalization, Quadratic form and definiteness. Characterization of Invertible matrices.
Homework Handout of practice questions.
Additional Texts used OB: Ch-7 & 8.2
3  Week 3

22-Aug Monday
Probability (Frequentist Approach), Discrete and continuous random variables and their Probability distributions (Univariate and Multivariate), Measures of central tendency, Measures of dispersion.
Homework SR: 2.1 - 2.4, 3.1 & 3.2
Additional Texts used MGB: Ch-1, 2, 3 & 4. HMC: 1.5 - 1.7, 2.1.

23-Aug Tuesday
Taylors’ approximation, Expected values & Moment Generating Functions (MGF), Binomial, Poisson and exponential distributions, Normal distribution and standard normal variates.
Homework SR: 3.3 -3.5
Additional Texts used MGB: Ch- 5, 6, & 7. HMC: 3.1, 3.2, 3.4, CW: 9.5, FMEA: 2.6

24-Aug Wednesday
Sampling, Sampling distribution of mean & Central Limit Theorem (CLT), Chi Square, t and F distributions, Tests of Significance.
Homework SR: 4.1- 4.4
Additional Texts used MGB: Ch- 7, 8& 9. HMC: 3.6, 4.1, 5.2.3 & 5.3

25-Aug Thursday
Confidence Intervals and Hypothesis Testing.
Homework SR: 5.1 - 5.5
Additional Texts used MGB: Ch- 10 & 11. HMC: 4.2, 4.3, 4.5