EDMS 645 Quantitative Research Methods I

**Research Methods**
Overview of different types of research
Independent/dependent variables
Experimental/quasi-experimental/non-experimental designs
Internal validity and threats
External validity and threats
Ethical principles in the research with human participants

**Scales of measurement**
Nominal, ordinal, interval, ratio

**Organizing and graphing data**
Simple frequency distributions
Grouped frequency distributions
Frequency polygons
Cumulative frequency distributions/polygons, ogives
Concepts of skew and kurtosis
Stem and leaf displays

**Percentiles**
Concept of percentiles and percentile ranks

**Central tendency**
Computing sample and population mean
Computing the mode
Properties of the mean; e.g., principle of least squares
Means, medians, modes in distributions of various shapes

**Variation**
Range
Conceptual presentation of box-whiskers plots
Population variance and population standard deviation
Sample variance and sample standard deviation
Measures of variability in distributions of various shapes
Conceptually, why do we divide by n-1?

**Score transformations**
z-scores
T-scores
Other linearly transformed standard scores

**The normal distribution**
Properties of normal distributions: unimodal, asymptotic, etc.
z-table, percentiles, and proportions/percentile ranks associated with the normal curve

**Probability**
Conceptual definition of probability
Conditional probability
Addition rules: mutual exclusivity and non-mutual exclusivity
Multiplication rules: independence and dependence

**Sampling distributions**
Unbiasedness, conceptually
Consistency, conceptually
Relative efficiency, conceptually
Central limit theorem
Sampling procedures -- simple random, systematic, stratified

**Hypothesis testing: One-sample case for the mean**
One-sample z-tests
One-sample t-tests
Student's t-distribution
Degrees of freedom
Statistical significance vs. practical significance
Type-I error
Type-II error
Power, conceptually
Confidence intervals for the mean

t-tests for H0: \( \rho = 0 \)

**Hypothesis testing: two-sample case for the mean**
Sampling distribution of the difference between two means
Two-sample independent-groups t-tests with pooled variance estimate
Two-sample independent-groups t-tests with separate variance estimate
Assumptions underlying the two-sample t-test
Two-sample dependent-groups t-tests — using difference scores and SSD

**Correlation**
Scatterplots
Correlation coefficients -- Pearson (mention Spearman, point-biserial, and phi)
Factors affecting the size of the Pearson r
Coefficient of determination
Correlation and causality

**Simple linear regression**
Equation of a line
Formulas for determining slope and Y-intercept
Principle of least squares
Predicting Y scores from X scores
Standard error of estimate

**Chi-square tests for nominal data**
\( \chi^2 \) tests of goodness-of-fit
\( \chi^2 \) tests of independence ("homogeneity")

**Computer skills**
SPSS for Windows 9.0 or higher