Review List of Topics - I

Probability from STAT 340 & 341
      Densities & distribution functions
      *Order statistics (in STAT 341 prior to midterm exam)
      Moments
          Expected value   Variance & standard deviation   Higher (kth)
      Situations where applicable
      Interpretation of parameters

Special Distributions & Processes (mostly from STAT 340)
      Bernoulli Process   Density & Distribution functions
      Bernoulli(p)   Support
      Binomial(n,p)   Assumptions
      Hypergeometric(k,N-k,n)   Moments
      Geometric(p)   ~~Mgf's~~
      Negative Binomial (r,p)   Discrete vs.continuous
      Poisson Process   Situations generating these distr's
      Exponential(λ)
      Poisson(λ)   Relationships between these
      Gamma (r, λ)   various distributions
      Uniform[a,b] (discrete & continuous)
      Normal (μ,σ^2)
      * Beta(α,β) (not covered in STAT 341 Midterm Exam)
      * t_{df}———(not covered in Midterm Exam, to be discussed later in STAT 341)
      * X^2_n———(not covered in Midterm Exam, to be discussed later in STAT 341)
      * F(df1,df2) (not covered in Midterm Exam, to be discussed later in STAT 341)

Some Statistics Basics
      Define, identify & know the relation between: (in applied & in theoretical settings)
          Population Parameter Sample Statistic
      Identify which entities are random, which are fixed (constant), which are symbols

Estimation theory – I
(**Aim for understanding & interpretation as well as theory & computations**)
      Properties of estimators & relations between these properties
          Bias   Variance   Mean Squared Error (MSE)
          "Unbiasing" estimators
          Cramer-Rao Lower Bound
          Minimum Variance ("Best") Unbiased Estimators (MVUE)
          Fisher Information
          Efficiency   Relative Efficiency
          Consistency
          Sufficient Statistics
      Method of Moments Estimation
          Moments (definitions & interpretations)
          Deriving MoMe's
      Maximum Likelihood Estimation
          Likelihood function (compare/contrast with joint pdf)
          Deriving MLE's   Properties of MLE's

Critical Thinking & Communication
      Explanations for "intelligent but statistically unsophisticated" people.

Confidence Intervals
Derivations of computational formulae for CIs
Assumptions
Interpretations
Confidence Level
Pivots
What's random & what's not
What changes if we have …
      another sample
      a different sample size
      a different confidence level
      a different parameter(s)
      a different function of the parameter(s)
      a different sampling scheme
      a different assumed underlying probability distribution
      Impact on derivation of CI formulae/computation, assumptions, interpretation, …
Mean
Proportion
Difference in means
Weighted sum or weighted mean
Variance
Ratio of variances
Stratified sampling

Hypothesis Testing
      Neyman-Pearson testing
      Likelihood ratio tests
      Generalized Likelihood Ratio Tests (GLRTs)
      CRITICAL THINKING !!!
      Null & Alternative Hypotheses   Type I and Type II errors
      Size (α)   Power ($1-\beta$), Power functions
      Fixed level vs Significance testing   Statistical significance
      Drawing conclusions   Impact of sample size on inference
      Identifying what testing procedure is suitable
      Tests for:
          small & large samples   stratified
          one- or two-groups   matched pairs
      Identify parameter(s) or function of parameter(s) of interest
      Select &/or derive suitable statistic(s) or function of statistic(s) as basis for test
      Identify and use appropriate sampling distribution to find:
          Critical values, p-values, power
      Tests for:
          Mean(s)   Proportion(s)   Variance(s)
          1 sample   2 sample   paired data
          simple random sampling   stratified random sampling
      Duality between Confidence Intervals and Hypothesis Tests (or lack thereof)

Statistician Inrerviews
      Communication with statistical researchers
      Oral presentations
      Concise poster presentations

Field Trips
      NOAA/NMFS (National Oceanic & Atmospheric Administration)
      ~~Google~~