MATH 232: Engineering Mathematics
Problem Set 16, Final version
Due Date: Mon., Apr. 12, 2010

Day 1 (Wednesday)

• Read Section 3.13 from MRH4e.

• Section 3.13: Do Problems 171, 173, 175, 178 (assume that the underlying population is “nice enough” that a sample size of 5 is large enough to put the CLT in play), 179, and 180. Practice doing these calculations using both R and the Fundamentals of Engineering “unit normal” table.

Day 2 (Thursday)

• Read (if you have not already) Section 3.10 in MRH4e. Pay particular to the “rules of thumb” offered therein for when it is OK to use a normal approximation to evaluate binomial and Poisson probabilities (bottoms of pages 109 and 110 respectively).

• Section 3.10: Do Problems 127, 128, 129, and 135.

• The following is a list of problems which need not be handed in, but may provide more practice in preparing for Exam #2.

  Chapter 2 Supplemental Exercises: No new ones besides the ones already assigned in problem sets.

  Chapter 3 Supplemental Exercises: 183 (be able to set these up and evaluate them as integrals), 185, 186, 190 (Can you answer these knowing the pmf given in the blue box on p. 101?), 191, 194, 195, 196, 197, 201, 210, 215, and 223

For the Exam this coming Wed., be comfortable with the following general areas:

• What is statistics?

• R commands. In particular, the common commands we have used are ones you should know what they do and (forgiving some mistakes in syntax) how to use them.

• Various techniques for displaying data. Be able to construct tables, boxplots, histograms, stemplots, etc. (by hand) for small univariate categorical and quantitative data sets as appropriate. Be able to read and understand such displays when provided.
Similarly, be able to read and understand displays of bivariate data (in various combinations of quantitative and categorical data).

- Various ways to summarize data (mean and s.d./variance, median and IQR)

- Probability
  - as long-term relative frequency
  - axioms
  - events
    * random process (authors call it an *experiment*)
    * sample space (something of a “universal” event)
    * complements
    * disjointness/mutual exclusivity
    * independence
  - tree diagrams, probabilities of **and**-ed/ **or**-ed events, conditional probabilities

- Distributions
  - what a distribution is
  - features of interest (# of modes, shape, outliers)
  - probability distributions
    * continuous and discrete ones
    * distribution families and their parameters
      - binomial, uniform, normal, Weibull, Poisson, exponential
      (Note: You will be provided expressions for the means and variances of these families as they depend on parameter values.)
      - situations they do and do not model
    * use of pdfs/pdfs in calculating probabilities
    * cdfs, and their computation (as sums or integrals) from pdfs/pdfs
    * graphs of pdfs/pdfs/cdfs
    * computing means and variances

- Random variables
  - continuous vs. discrete
  - independence
when $Y = c_0 + c_1X_1 + \cdots + c_nX_n$, relationships between mean, variance of $Y$ and those of $X_1, \ldots, X_n$ along with knowledge of the distribution of $Y$ under various assumptions

* the $X_j$ are independent
* the $X_j$ are independent and normal
* the $X_j$ are an i.i.d. random sample

- Central limit theorem
  - Know
    * its content
    * rules of thumb concerning sample size
  - Be able to determine which normal distribution yields approximate probabilities given knowledge of mean/s.d. for underlying population
  - Be able to use standardization in order to compute normal probabilities for any $\mu, \sigma$ using the unit normal table

- Miscellaneous concepts
  - Correlation: possible values and what they reveal
  - Quantile-quantile plots: how they work; what to look for
  - Simpson’s paradox