Statistics 865 Final Problem Sheet Spring 2007

Instructions This homework is due on in class (before the final presentation) on June 5, 2007. If you have questions, you can contact me during office hours or by email.

1. State the graphical models corresponding to the graphs (a)–(e) in Figure 4.P.3 on page 196 using generator set notation and dual generator set notation.

2. Draw the interaction graph for each of the following models, state the associated graphical model, and interpret the graphical model
   (i) [21, 23, 24, 25, 13] (in $5\minus{}d$)
   (ii) [21436, 351, 542, 1256] (in $6\minus{}d$)

3. Show that the Iterative Proportional Fitting algorithm converges $\hat{p}_{ijk} = Y_{i+k}Y_{ij+}/Y_{i++}$ in one cycle when it is applied to find the MLE of $\mu$ under the model [12, 13] for independent Poisson data $\{Y_{ijk}: i = 1(1)R, j = 1(1)C, k = 1(1)L\}$.

4. The 865 class website contains the data from Problem 4.8 from a survey of 10,318 high school seniors in Wisconsin in the text file hw5.4.dat. Find a parsimonious graphical hierarchical model that describes the underlying discrete multivariate distribution. Be sure to check the Pearson residuals for fit. Interpret your model. Use your model to estimate the conditional probability that a student plans to attend college given their (gender, level parental encouragement, intelligence, social econ. status). Interpret your model. Below, and on the class website, are the commands for reading this high dimensional table into R.

R> junk <- scan('pr4p8.dat')
R> wis.hi.sch <- array(junk,c(4,4,2,2,2))
R> plan.coll <- c('yes','no')
R> gender <- c('male','female')
R> par.encour <- c('low','hi')
R> intell <- c('L','LM','UM','H')
R> socec.stat <- c('L','LM','UM','H')
R> dimnames(wis.hi.sch) <- list(intell = intell, socec.stat = socec.stat, plan.coll = plan.coll, par.encour = par.encour, gender = gender)
Check your R object–should satisfy.

R> dim(wis.hi.sch)
[1] 4 4 2 2 2
R>
R> wis.hi.sch
,, yes, low, male
  L  LM UM H
  L 4  2  8  4
LM 9  7  6  5
UM 12 12 17  9
 H 10 17  6  8

   ETC.

,, no, hi, female
  L  LM UM H
  L 44  61  72  58
LM 47  88  90  76
UM 35  85 100  81
 H 24  50  77  98