STA 580 — Fall 2007 — Dr. Charnigo

Final Examination

Please print your name at the tops of all seven pages. You may use the backs of the pages for scratch work, but all key steps and final answers are to be clearly recorded on the fronts of the pages.

[25] 1. Refer to "Pediatrics, Endocrinology" and Table 11.23 on page 550. Let X denote the gestational age for a group of infants (with the convention that $X = 24$ when the gestational age is less than 24 weeks), and let Y denote the mean thyroxine level for a group of infants. We have $L_{yy} = 13.22$, $L_{xx} = 82.50$, $L_{xy} = 30.30$, $\bar{y} = 7.84$, $\bar{x} = 28.50$, and $n = 10$. In what follows, we consider the linear regression model $Y_i = \alpha + \beta x_i + \epsilon_i$.

[05] a. Provide the least squares estimates of α and β.

[05] b. Test $H_0 : \beta = 0$ against $H_1 : \beta \neq 0$ at level 0.05 using an f statistic.

[05] c. Test $H_0 : \beta = 1$ against $H_1 : \beta \neq 1$ at level 0.05 using a t statistic.

[05] d. Provide a 95% prediction interval for the mean thyroxine level for a new group of infants with gestational age 30 weeks.

[05] e. What fraction of variability in mean thyroxine level is accounted for by gestational age?

[25] 2. Refer to “Endocrinology” and Table 12.32 on page 623. Let μ_1 through μ_3 be defined in the obvious manner. We have Between SS $= 90.634$ and Total SS $= 258.911$. Also, $t_{40,0.975} = 2.02$, $t_{40,0.9875} = 2.33$, $t_{40,0.9917} = 2.50$, $t_{43,0.975} = 2.02$, $t_{43,0.9875} = 2.32$, $t_{43,0.9917} = 2.49$, $f_{2,40,0.95} = 3.23$, $f_{3,40,0.95} = 2.84$, $f_{2,43,0.95} = 3.21$, and $f_{3,43,0.95} = 2.82$.

[05] a. Find Within SS.

[05] b. Find Between MS and Within MS.

[05] c. Test $H_0 : \mu_1 = \mu_2 = \mu_3$ against the complementary alternative at level 0.05.

[05] d. Test $H_0 : \mu_1 = \mu_2$ and $H_0 : \mu_1 = \mu_3$ against their respective complementary alternatives at Bonferroni-adjusted level 0.05.

[05] e. Test $H_0 : 0.5\mu_1 + 0.5\mu_2 - \mu_3 = 0$ against its complementary alternative at Scheffe-adjusted level 0.05.

[25] 3. Refer to "Endocrinology" and Table 13.43 on page 741. Confine your attention to the data for women without pre-existing fractures. Let p_1 denote the rate of new fractures in a hypothetical population of women without pre-existing fractures receiving raloxifene, and let p_2 denote the rate of new fractures in a hypothetical population of women without pre-existing fractures receiving placebo.

[05] a. Report point estimates of p_1 and p_2.

[05] b. Construct a 95% confidence interval for the risk difference.

[05] c. Construct a 95% confidence interval for the relative risk.

[05] d. Construct a 95% confidence interval for the odds ratio.

[05] e. Test $H_0 : p_1 = p_2$ against $H_1 : p_1 \neq p_2$ at level 0.05 using either a z statistic or a χ^2 statistic (your choice).

[25] 4. Mark each of the following statements as true or false.

T F [05] a. If we have an ordinal response variable and wish to compare the median from one population to the median from another population, we may draw independent samples from the two populations and then employ the sign test.

T F [05] b. If we have a cardinal response variable and wish to compare the median from one population to the median from another population, we may draw independent samples from the two populations and then employ the rank sum test.

T F [05] c. If the survival function for a given population equals 0.80 at 1 year, then the survival function for that same population cannot equal 0.90 at 2 years.

T F [05] d. If the Kaplan-Meier estimate of a survival function is 0.40 at 3 years, then we estimate that 40% of people in the population of which the sample is representative would not experience the event of interest within 3 years.

T F [05] e. The Dunn procedure may be used to perform follow-up tests concerning pairs of population means after the Kruskal-Wallis test rejects the omnibus null hypothesis of equal means for all populations of interest.