Stats 506, F18, Problem Set 4

Xinye Jiang (xinyej@umich.edu)

December 11, 2018

Question 1

Table 1: **Table 1.** *The all-time leader in hits for each birth country.* Each row shows the player name, debut, country of birth and the number of hits for the all-time leader of a birth country. Rows are sorted by the number of hits.

Player	Debut	Country of Birth	Hits
Pete Rose	1963-04-08	USA	4,256
Rod Carew	1967-04-11	Panama	3,053
Ichiro Suzuki	2001-04-02	Japan	3,030
Rafael Palmeiro	1986-09-08	Cuba	3,020
Roberto Clemente	1955-04-17	P.R.	3,000
Adrian Beltre	1998-06-24	D.R.	2,942
Omar Vizquel	1989-04-03	Venezuela	2,877
Chili Davis	1981-04-10	Jamaica	2,380
Edgar Renteria	1996-05-10	Colombia	2,327
Patsy Donovan	1890-04-19	Ireland	2,253
Larry Walker	1989-08-16	CAN	2,160
Tom Brown	1882-07-06	United Kingdom	1,951
Andruw Jones	1996-08-15	Curacao	1,933
Vinny Castilla	1991-09-01	Mexico	1,884
John Anderson	1894-09-08	Norway	1,841
Joe Quinn	1884-04-26	Australia	1,797
Elmer Valo	1940-09-22	Czech Republic	1,420
Horace Clarke	1965-05-13	V.I.	1,230
Shin-Soo Choo	2005-04-21	South Korea	1,206
Glenn Hubbard	1978-07-14	Germany	1,084
Marvin Benard	1995-09-05	Nicaragua	714
Eddie Ainsmith	1910-08-09	Russia	707
Andre Rodgers	1957-04-16	Bahamas	628
Xander Bogaerts	2013-08-20	Aruba	528
Didi Gregorius	2012-09-05	Netherlands	451
Gerald Young	1987-07-08	Honduras	446
Reno Bertoia	1953-09-22	Italy	425
Yan Gomes	2012-05-17	Brazil	367
Steve Jeltz	1983-07-17	France	367
Tony Solaita	1968-09-16	American Samoa	336
Jack Quinn	1909-04-15	Slovakia	248

Question 2

a.

Table 2: **Table 2.** *The Monte Carlo estimate and its standard error for each metric and each method when the sigma of y is 1 and rho of X is -0.75, -0.5, -0.25, 0, 0.25, 0.5, 0.75 using mclapply. (Only partial data is shown.)*

Rho	Sigma	Metric	Method	Est	SE
-0.75	1	FWER	holm	0.04650	0.00211
-0.75	1	FDR	holm	0.01283	0.00066
-0.75	1	Sensitivity	holm	0.31779	0.00152
-0.75	1	Specificity	holm	0.99947	0.00002
-0.75	1	FWER	bonferroni	0.04530	0.00208
-0.75	1	FDR	bonferroni	0.01263	0.00066
-0.75	1	Sensitivity	bonferroni	0.31486	0.00150
-0.75	1	Specificity	bonferroni	0.99949	0.00002
-0.75	1	FWER	BH	0.24230	0.00428
-0.75	1	FDR	BH	0.04493	0.00089
-0.75	1	Sensitivity	BH	0.50577	0.00203
-0.75	1	Specificity	BH	0.99663	0.00007
-0.75	1	FWER	BY	0.03550	0.00185
-0.75	1	FDR	BY	0.00871	0.00052
-0.75	1	Sensitivity	BY	0.27674	0.00183
-0.75	1	Specificity	BY	0.99959	0.00002
-0.50	1	FWER	holm	0.04390	0.00205

b.

Table 3: **Table 3.** *The Monte Carlo estimate and its standard error for each metric and each method when the sigma of y is 0.25, 0.5, 1 and rho of X is -0.75, -0.5, -0.25, 0, 0.25, 0.5, 0.75 using doParallel. (Only partial data is shown.).*

Rho	Sigma	Metric	Method	Est	SE
-0.75	0.25	FWER	holm	0.04630	0.00210
-0.75	0.25	FDR	holm	0.01288	0.00065
-0.75	0.25	Sensitivity	holm	0.30439	0.00150
-0.75	0.25	Specificity	holm	0.99947	0.00002
-0.75	0.25	FWER	bonferroni	0.04480	0.00207
-0.75	0.25	FDR	bonferroni	0.01262	0.00065
-0.75	0.25	Sensitivity	bonferroni	0.30172	0.00148
-0.75	0.25	Specificity	bonferroni	0.99949	0.00002
-0.75	0.25	FWER	BH	0.23750	0.00426
-0.75	0.25	FDR	BH	0.04469	0.00089
-0.75	0.25	Sensitivity	BH	0.48565	0.00203
-0.75	0.25	Specificity	BH	0.99674	0.00006
-0.75	0.25	FWER	BY	0.03440	0.00182
-0.75	0.25	FDR	BY	0.00898	0.00054
-0.75	0.25	Sensitivity	BY	0.26087	0.00179
-0.75	0.25	Specificity	BY	0.99960	0.00002

Rho	Sigma	Metric	Method	Est	SE
-0.75	0.50	FWER	holm	0.04320	0.00203

c.

Table 4: **Table 4.** *The Monte Carlo estimate and its standard error for each metric and each method when the sigma of y is 0.25 and rho of X is -0.75, -0.5, -0.25, 0, 0.25, 0.5, 0.75 using future. (Only partial data is shown.).*

Rho	Sigma	Metric	Method	Est	SE
-0.75	0.25	FWER	holm	0.04390	0.00205
-0.75	0.25	FDR	holm	0.01284	0.00068
-0.75	0.25	Sensitivity	holm	0.30337	0.00153
-0.75	0.25	Specificity	holm	0.99949	0.00002
-0.75	0.25	FWER	bonferroni	0.04220	0.00201
-0.75	0.25	FDR	bonferroni	0.01255	0.00068
-0.75	0.25	Sensitivity	bonferroni	0.30085	0.00151
-0.75	0.25	Specificity	bonferroni	0.99952	0.00002
-0.75	0.25	FWER	BH	0.23270	0.00423
-0.75	0.25	FDR	BH	0.04447	0.00091
-0.75	0.25	Sensitivity	BH	0.48606	0.00206
-0.75	0.25	Specificity	BH	0.99675	0.00007
-0.75	0.25	FWER	BY	0.03310	0.00179
-0.75	0.25	FDR	BY	0.00869	0.00054
-0.75	0.25	Sensitivity	BY	0.26102	0.00183
-0.75	0.25	Specificity	BY	0.99962	0.00002
-0.50	0.25	FWER	holm	0.04860	0.00215

Table 5: **Table 5.** *The Monte Carlo estimate and its standard error for each metric and each method when the sigma of y is 0.5 and rho of X is -0.75, -0.5, -0.25, 0, 0.25, 0.5, 0.75 using future. (Only partial data is shown.).*

Rho	Sigma	Metric	Method	Est	SE
-0.75	0.5	FWER	holm	0.04890	0.00216
-0.75	0.5	FDR	holm	0.01427	0.00073
-0.75	0.5	Sensitivity	holm	0.30533	0.00154
-0.75	0.5	Specificity	holm	0.99944	0.00002
-0.75	0.5	FWER	bonferroni	0.04740	0.00212
-0.75	0.5	FDR	bonferroni	0.01410	0.00073
-0.75	0.5	Sensitivity	bonferroni	0.30244	0.00153
-0.75	0.5	Specificity	bonferroni	0.99946	0.00002
-0.75	0.5	FWER	BH	0.24130	0.00428
-0.75	0.5	FDR	BH	0.04633	0.00092
-0.75	0.5	Sensitivity	BH	0.48738	0.00210
-0.75	0.5	Specificity	BH	0.99660	0.00007
-0.75	0.5	FWER	BY	0.03620	0.00187
-0.75	0.5	FDR	BY	0.00934	0.00057
-0.75	0.5	Sensitivity	BY	0.26171	0.00185

Rho	Sigma	Metric	Method	Est	SE
-0.75	0.5	Specificity	BY	0.99958	0.00002
-0.50	0.5	FWER	holm	0.04460	0.00206

Table 6: **Table 6.** *The Monte Carlo estimate and its standard error for each metric and each method when the sigma of y is 1 and rho of X is -0.75, -0.5, -0.25, 0, 0.25, 0.5, 0.75 using future. (Only partial data is shown.).*

Rho	Sigma	Metric	Method	Est	SE
-0.75	1	FWER	holm	0.04800	0.00214
-0.75	1	FDR	holm	0.01375	0.00069
-0.75	1	Sensitivity	holm	0.31251	0.00155
-0.75	1	Specificity	holm	0.99945	0.00003
-0.75	1	FWER	bonferroni	0.04720	0.00212
-0.75	1	FDR	bonferroni	0.01366	0.00069
-0.75	1	Sensitivity	bonferroni	0.30962	0.00153
-0.75	1	Specificity	bonferroni	0.99946	0.00002
-0.75	1	FWER	BH	0.24000	0.00427
-0.75	1	FDR	BH	0.04471	0.00088
-0.75	1	Sensitivity	BH	0.49862	0.00207
-0.75	1	Specificity	BH	0.99661	0.00007
-0.75	1	FWER	BY	0.03700	0.00189
-0.75	1	FDR	BY	0.00940	0.00055
-0.75	1	Sensitivity	BY	0.27093	0.00186
-0.75	1	Specificity	BY	0.99956	0.00002
-0.50	1	FWER	holm	0.04920	0.00216

Question 3

Table 7: **Table 7.** *The MRI procedures determined by the highest volume, highest total payment and highest average payment in part c.* Each row shows one MRI procedures determined by the criterion.

HCPCS Description	Volume	Total Payment	Average Payment
MRI scan of lower spinal canal	1,430,104	134,223,519.4	93.9
MRI scan of one breast with contrast	161	43,337.4	269.2

Table 8: **Table 8.** *The MRI procedures determined by the highest volume, highest total payment and highest average payment in part d.* Each row shows one MRI procedures determined by the criterion.

HCPCS Description	Volume	Total Payment	Average Payment
MRI scan of lower spinal canal	1,430,104	134,223,519.4	93.9
MRI scan of one breast with contrast	161	43,337.4	269.2

From the above output tables from “c” and “d”, we can see that the results do match.