

UNM Statistics Qualifying Exam
Due: 12 noon, Wed Aug 22, 2012

Aug 2012

Name: _____
UNM ID number

Qual Take Home (100 points) Complete both problems in this exam. The answer to each problem should be presented as a summary. It should be typed, double-spaced, no longer than three pages, no smaller than ten-point font with one-inch margins, and should be identified by your UNM ID number (do not include your name). A five-page appendix is allowed for each problem but will be examined only at the discretion of the graders; the better constructed your appendix, the more likely it is to get examined.

Write your answers as they might appear in the methods, results, and discussion sections of an academic paper. Insert tables and figures (well-labelled and cross-referenced from text, such as, “in Table 1 . . .”, or if in the appendix, “in Table A1 . . .”) to support your points. Computer output without explanation will not be reviewed. As necessary:

1. Plot and describe the data.
2. Clearly define population parameters and sample statistics.
3. Clearly specify hypotheses tested.
4. Define and take care to assess assumptions of methods you use.
5. Write a coherent evidence-based conclusion.

You may **not** consult any other person when working on this exam or discuss your exam with anyone else regardless of whether or not the person is taking the exam. You may use your course notes as well as any available books or web resources for the exam. If including computer text tables where alignment is important, then please use a fixed-width font, such as Courier, for that text. Any points of clarification can be directed to Erik Erhardt, erike@stat.unm.edu.

Due: 12 noon, Wed Aug 22, 2012, hand-delivered or mailed to Ana Parra Lombard in the main office of the Department of Mathematics and Statistics, MSC01 1115, 1 University of New Mexico, Albuquerque, New Mexico, 87131-0001. Please do not email your solutions.

(50^{pts}) 1. Depression

The data in Table 1 contain information on the age, sex (male=1, female=2), work problems index (wp), marital conflict index (mc), and a depression index (dep) for a sample of 39 new admissions to a psychiatric clinic at a large university hospital. Variables wp, mc, and dep are measured on a roughly continuous scale, with larger values indicating a more severe problem.

Researchers at the hospital are interested in the factors that are related to dep, and whether the relationship between dep and these factors is similar, or different for males and females. Build a regression model, or models, to answer these questions. Succinctly summarize your findings.

Data: www.stat.unm.edu/~erike/exams/UNM_Stat_Exam_Qual_takehome_201208_pr1-DATA_depression.txt

Table 1: Depression data.

id	age	sex	wp	mc	dep	id	age	sex	wp	mc	dep
1	45	2	90	70	69	21	28	1	85	30	194
2	35	1	90	75	75	22	37	1	90	9	294
3	32	2	70	32	35	23	29	1	80	14	94
4	32	2	80	30	73	24	29	1	70	24	126
5	39	2	85	55	86	25	31	1	80	21	192
6	25	2	85	6	161	26	29	1	60	11	232
7	22	1	75	20	202	27	29	1	70	10	184
8	30	2	70	63	91	28	23	2	80	10	238
9	49	2	75	4	113	29	44	2	78	19	112
10	47	1	84	12	68	30	28	1	70	22	141
11	48	1	64	11	109	31	32	2	70	21	108
12	49	2	85	7	92	32	36	2	74	77	87
13	45	2	80	8	80	33	22	2	78	67	33
14	41	2	80	15	82	34	46	2	70	25	73
15	45	2	82	6	156	35	21	1	70	14	168
16	59	2	72	5	198	36	34	1	80	17	218
17	42	2	70	17	170	37	27	2	80	18	175
18	35	1	70	29	188	38	31	2	80	42	126
19	31	2	70	80	82	39	19	2	75	36	135
20	45	1	70	126	37						

(50^{pts}) 2. Circuit boards

In inner-layer fabrication of circuit boards, copper-clad glass epoxy laminate panels are cleaned. Dry-film photoresist is applied to the panels under lamination temperature and pressure using a hot-roll laminator. The circuitry is plotted on film, placed on the panel and exposed to ultraviolet radiation. The photoresist below the opaque area of the film is not affected, the rest is polymerized. The experiment involves three factors: (a) surface preparation of the panels which is Scrub, Pumice, or Chemical, (b) preheating of the panels, Yes or No, and (c) lamination pressure, 20, 40, or 60 psi. The current operating levels are Scrub, No, and 40. The dependent variable y is a measure of short circuits in the board. Analyze the data in Table 2 assuming no three factor interaction.

Data: www.stat.unm.edu/~erike/exams/UNM_Stat_Exam_Qual_takehome_201208_pr2-DATA_circuitboards.txt

Table 2: Circuit boards data.

a	b	c	y
Scrub	No	40	26.0
Scrub	No	60	19.0
Scrub	No	80	12.6
Pumice	No	40	16.4
Pumice	No	60	11.8
Pumice	No	80	16.9
Chem	No	60	12.8
Chem	No	80	19.0
Chem	No	40	17.5
Scrub	Yes	80	11.9
Scrub	Yes	40	9.8
Scrub	Yes	60	13.3
Pumice	Yes	60	16.9
Pumice	Yes	80	11.6
Pumice	Yes	40	9.2
Chem	Yes	80	7.5
Chem	Yes	40	21.2
Chem	Yes	60	16.4