Homework 2(Due on Jan 31

January 24, 2013 STA 5172

1 Practical problem

The Chinese Mini-Mental Status Test (CMMS) consists of 114 items intended to identify people with Alzheimers disease and senile dementia among people in China. An extensive clinical evaluation of this instrument was performed, whereby participants were interviewed by psychiatrists and nurses and a definitive diagnosis of dementia was made. Table 3.12 shows the results obtained for the subgroup of people with at least some formal education. Suppose a cutoff value of ≤ 20 on the test is used to identify people with dementia.

Table 3.12 Relationship of clinical dementia to outcome on the Chinese Mini-Mental Status Test

CMMS score	Nondemented	Demented
0–5	0	2
6–10	0	1
11–15	3	4
16–20	9	5
21–25	16	3
26–30	18	1
Total	46	16

1. What is the sensitivity of the test?
2. What is the specificity of the test?
3. The cutoff value of 20 on the CMMS used to identify people with dementia is arbitrary. Suppose we consider changing the cutoff. What are the sensitivity and specificity if cutoffs of 5, 10, 15, 20, 25, or 30 are used? Make a table of your results.
4. Plot an ROC curve based on the table constructed above.

5. Suppose we want both the sensitivity and specificity to be at least 70%. Use the ROC curve to identify the possible value(s) to use as the cutoff for identifying people with dementia, based on these criteria.

2 Theoretical Problem

A dominantly inherited genetic disease is identified over several generations of a large family. However, about half the families have dominant disease with complete penetrance, whereby if a parent is affected there is a 50% probability that any one offspring will be affected. Similarly, about half the families have dominant disease with reduced penetrance, whereby if a parent is affected there is a 25% probability that any one offspring will be affected. Suppose in a particular family one parent and two of the two offspring are affected.

1. What is the probability that exactly two of the two offspring will be affected in a family with dominant disease with complete penetrance?

2. What is the probability that exactly two of the two offspring will be affected in a family with dominant disease with reduced penetrance?

3. What is the probability that the mode of transmission for this particular family is dominant with complete penetrance? Is this a prior probability or a posterior probability?

4. Suppose you are a genetic counselor and are asked by the parents what the probability is that if they have another (a third) child he or she will be affected by the disease. What is the answer?