THE UNIVERSITY OF MINNESOTA

Statistics 5021 March 30, 2003

Sample Midterm Examination II

1. A grocery store attempts to stock many food items, among them asparagus (A), rye bread (B), and cheddar cheese (C). On any randomly chosen day an item may be available or not available. The following table lists symbols for some events defined in terms of availability of these foods.

Food	Available	Not Available
Asparagus	A+	A–
Rye bread	B+	B–
Cheddar cheese	C+	C–

Here is a table of the probabilities of all combinations of these events.

	B+			B–			
	A+	A–	Totals	A+	A–	Totals	Totals
C+	.25	.10	.35	*.20*	.15	.35	.70
C–	.10	.05	.15	.10	.05	.15	.30
Totals	.35	.15	.50	.30	.20	.50	1.00

For example, P(Cheddar cheese and asparagus are available but not rye bread) = P(**C+ *and* A+ *and* B–**) = .20 (value in *italics* in the table)

(a) Find the conditional probability P(**C– | A–**) = P(cheese not available given asparagus not available)

(b) Find P(**(C– *and* A–) *or* B–**)

(c) Are events **C+** and **B+** independent? Justify your answer.

(d) Are outcomes **C–** and **A–** independent? Justify your answer.

2. In a test for ESP (extrasensory perception), the experimenter uses cards that are hidden from a subject. Each card contains one of a star ☆, a circle ○, a wave ≈, a square □ or a cross +. The experimenter looks at many cards in random order, thinks of the shape on the card, and the subject guesses what the shape actually is. If a subject does not have ESP, the probability of a correct guess should be 1/5 = .2 and getting success on different cards should be independent.

Suppose the experiment consisted of guesses as to the contents of 800 cards.

(a) If the subject does not have ESP, what are the mean and standard deviation of the proportion of correct guesses out of the 800 guesses?

(b) If the subject does not have ESP, what is the approximate probability that the percent of correct guesses is less than 17.5%.

(c) If the subject does not have ESP, find the number y of successful guesses such that P(number of correct guesses $\geq$ y) = .01.

3. The level of calcium in the blood of healthy young adults varies with mean about 9.5 milligrams per deciliter and standard deviation about σ = .4. Here are data on the blood calcium level of 40 healthy rural Guatemala pregnant women

Calcium level in blood of 40 women									
10.63	9.25	9.66	9.20	9.97	9.28	9.65	9.57	9.16	9.42
9.73	9.57	9.78	9.17	9.63	9.79	8.92	9.91	10.20	9.69
9.93	10.11	9.83	9.65	9.53	9.69	9.71	9.41	9.47	8.86
9.79	10.16	9.52	9.48	9.50	9.67	10.00	8.85	9.94	9.10

Here's a little MacAnova output

```
Cmd> x <- \
    vector(10.63,9.25,9.66,9.20,9.97,9.28,9.65,9.57,9.16,9.42,\
           9.73,9.57,9.78,9.17,9.63,9.79,8.92,9.91,10.20,9.69,\
           9.93,10.11,9.83,9.65,9.53,9.69,9.71,9.41,9.47,8.86,\
           9.79,10.16,9.52,9.48,9.50,9.67,10.00,8.85,9.94,9.10)

Cmd> sum(x)
(1)      384.38

Cmd> sum((x - sum(x)/40)^2)
(1)      5.5344
```

(a) Is there statistical evidence that the mean blood calcium level in this population of women is higher than that in the population of healthy young adults. Use α = .05. State hypotheses and show your work which should include an approximate P-value.

(b) Find a 95% confidence interval for the mean calcium level in this population,

4. In the following, decide whether each underlined statement is **true** or **false**. Then circle your choice and *explain why*.

(a) Based on a readings from 12 radiation detectors exposed to radon (a radioactive gas), a confidence interval for the mean radioactivity level μ was calculated to be (98.16 , 110.10).

The probability is .95 that μ is between 98.16 and 110.10 **True** **False**

(b) Using the same data, a test of H_0: μ = 105 vs H_a: $\mu \neq$ 105 yielded a P-value = 0.755.

The probability that H_a is true is 1 – .755 = .245 **True** **False**

(c) The 7 Twin Cities area counties are Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington. Let Y be the number of these counties in which there will be a thunderstorm on July 1, 2001.

Y is binomial with n = 7 and unknown probability p **True** **False**