

This recitation assignment is due at the end of your recitation 1-12-09. A key will be posted to www.stt.msu.edu/~lepage that Tuesday evening after all recitations have ended.

1. One may disagree with the following definition from page 378 since there is no notion of *probability* present in the definition.

Random phenomenon 364, 365. A phenomenon is random if we know what outcomes could happen, but not which particular values will happen.

Especially, I am troubled by the following false claim made for it on pg. 379.

► Understand that random phenomena are unpredictable in the short term but show long-run regularity.

In this course we explore many useful examples *intentionally introducing randomness* as when shuffling a deck of cards, spinning a well made roulette wheel, or randomly selecting a portfolio of investments. This differs from a deck of cards we know nothing about, spinning a toy roulette wheel, or selecting a portfolio based on the insights of a columnist. We are generally not in a position to say anything much about probabilities in the latter cases and may not be in a position to claim long run average behaviors should we be inclined to replicate many such activities.

Natural processes often appear to be random and do exhibit long run regularities. Fiddler crabs have one very large claw and another very small. In most species this "handedness," some left clawed the rest right clawed, appears in captured examples to behave like independent tosses of a slightly biased coin. We discover this from observation. Things seem to be random. The probabilities are empirical (derived from experience) although they could change if something alters the breeding population. Some such populations are around 98% right clawed.

Do you find randomness or only the possibility of differing outcomes in the examples below? If I have empirical data I may find randomness where you only see the possibility of differing outcomes. Perhaps surprisingly, you may think there is probability present where I do not.

- a. On the first day of class some students sit in the first two rows. The last digits of each of their student numbers are integers in the range 0 through 9. I will look up the last digits of these students on the class list.
- b. Same as (a). Some of these students have at least one quarter on their person. I will ask

which ones do.

c. A weather report says *twenty percent chance of rain tomorrow*. I will check to see if it rains tomorrow.

2. Engineering studies for a particular model of twin engine aircraft suggest that failure of the left engine upon landing has probability on the order of 0.0001, same as for the right engine.

a. What is the probability the left engine does not fail upon landing? See pg. 371.

b. Assuming that the events $A = \text{left engine fails}$, $B = \text{right engine fails}$ are *statistically independent* what is the probability that both engines fail? See pg. 373.

c. From (b) and the addition rule determine the probability that at least one of the two engines fails. See pg. 372 (**actually we need pg. 385**).

d. From (d) determine the probability that *it is not true that at least one engine fails*. See pg. 371.

e. The event that *it is not true that at least one engine fails* is the same as *the left engine does not fail and the right engine does not fail*. If engines fail *independently* this may be determined as .9999 times .9999 (why?). See pg. 373 and compare your answer with the other solution (d).

f. Suppose engine failures are mainly caused by flocks of birds some of whom enter the engine air intake. Would this be consistent with engines failing independently?

g. Are the events *left engine fails* and *right engine fails* disjoint? Why?

3. Here are counts of people cross classified by gene type and sex.

	AA	Aa	aa
male	20	30	10
female	30	45	15

- How many people are there in all?
- Determine the marginal counts for males and females (there are 60 males) and place them as row totals to the right margin of the table.
- Determine the marginal counts for gene types (there are 50 who are AA) and place them as column totals to the bottom of the table.
- Place the grand total (a) to the lower right corner of the table.

Suppose we are to sample **one of these **150** people, each one of them having an equal chance to be selected. We are *introducing* probability. All individuals are equally likely so a *classical probability model will apply*.**

- If John A. F. Hampel is in the group what is the probability we select him?
- What is the probability that we select a male?
- What is the probability that we select a person with gene type AA?
- What is the probability that we select a male having gene type AA?
- Are the events
 - select a male
 - select an AA
 disjoint events?

j. Are the events
 select a male
 select an AA
independent events?

k. We say sex is independent of gene type if all six of the sex by gene type pairs are independent. Is it so for this table?

l. Look carefully at the table. Is there anything special about its numbers that betray independence?

4. Here are all 36 ways that a red and green die might turn up. By looking at favorable cases determine the probability that the total of the numbers thrown by the dice is 5. Assume all 36 outcomes are equally likely and check off favorable cases.

G	1	2	3	4	5	6
R						
1						
2						
3						
4						
5						
6						

5. A box contains three bills \$1 \$1 \$5. Jack will draw first with equal probability on the three. Jill will then draw with equal probability from the two then remaining.

a. What is the probability that Jack gets 5? Answer on an intuitive basis.

b. What is the probability that Jill gets \$5? Answer on an intuitive basis.

c. We are actually drawing pieces of paper. Consider a classical probability model as follows. Label the papers a, b, c (c is the \$5). We regard all of the following equally probable:

Jack	Jill
a	b
a	c
b	a
b	c
c	a
c	b

By checking off favorable cases determine the probability Jack gets \$5.

By checking off favorable cases determine the probability Jill gets \$5.

Are your answers just obtained in agreement with your intuitive ones?

Do you believe the answers of (c) are the correct ones?