生物統計 Homework 4

1.

In guinea pigs, short hair (L) is dominant to long hair (l) and black fur (B) is dominant to albino fur (b). A female which is black with short hair is mated to a male that is albino with long hair.

(a) What are the possible genotypes for the female? What are the possible genotypes for the male?

(b) For each possible genotype for the female, construct a tree to represent the possible outcomes for the offspring.

(c) Find the probability of obtaining an albino with short hair in each case.

2.

In the pea plant, tallness (T) is dominant to shortness (t). Yellow seeds (Y) are dominant to green (y), and the round shape (W) is dominant to wrinkled (w). Suppose that two plants are cross-matched. One has genotype *TTYYWw* and the other *TtYyWw*.

(a) Describe each of the parent plants relative to the three characteristics mentioned.

(b) Draw a tree to represent the possible ways in which the cross-match can occur. (*Hint:* Extend the idea of Example 2.2.5 to a six-stage process.)

(c) Describe the plant associated with each path through the tree.

(d) Use the tree to find the probability that the cross-match will result in a tall pea plant.

(e) What is the probability that the cross-match will result in a tall, yellow, wrinkled pea plant?

(f) What is the probability that the cross-match will produce a green pea plant?

3. <Hint: 用 binomial & Poisson 分析，哪個容易求答案？請用好求的方法作答>

(a) In fruit flies, 4 sperm cells in every 10^5 carry a mutation for red eye to white eye, or vice versa. How many mutations would you expect to occur in 200,000 sperm cells? What is the probability that at most 10 would occur? What is the probability that between 6 and 10, inclusive, would occur?

(b) In human beings, mutations for Huntington's disease occur in about 5 of every 10^6 gametes. What is the probability that in 2 million gametes there will be at least one mutation?

(c) It is estimated that only 1 in every 50 parrots captured in the Amazon Basin for use as household pets will survive the transition. During the course of a day, 700 birds are captured. What is the expected number of survivors? What is the probability that at most 10 birds will survive? During a given 3-day period, 700 birds are captured each day. What is the probability that on each of the 3 days at most 10 birds will survive?

4. The following table shows the density for random variable X, the number of adult females in a band of howler monkeys:

x	1	2	3	4	5
$f(x)$	.1	.15	.5	.15	.1

(a) (i) Find $P(X \le 3)$

(ii) Find $P(X > 1)$

(iii) Find $P(2 \le X \le 4)$

(b) Find the average number of adult females per band.

(c) Find σ^2

(d) Find $E(e^X)$

(e) Find $E(\sqrt{X})$

5.

(a) A nuclear power plant is to be built. Local public opinion is sought. A random sample of 20 individuals is selected and polled. It is thought that 60% of the local inhabitants favor the project. If this is true, how many would you expect to express a favorable opinion? If nine or fewer express such an opinion, do you think that there is strong reason to suspect the 60% figure? Explain on the basis of the probability involved.

(b) Albino rats used to study the hormonal regulation of a metabolic pathway are injected with a drug that inhibits body synthesis of protein. Usually, 4 out of 20 rats die from the drug before the experiment is over. If 10 animals are treated with the drug, what is the probability that at least 8 will be alive at the end of the experiment?