Study Problems BIO300

1. Researchers have asked several smokers how many cigarettes they had smoked in the previous day. Here are the data.

Women	Men
4	2
7	2
20	5
20	6
	8
	16

The distribution that these data are drawn from is not normal. Is there a difference between number of cigarettes smoked per day between the sexes?

2. A forensic pathologist wants to know whether there is a difference between the rate of cooling of freshly killed bodies and those which were reheated, to determine whether you can detect an attempt to mislead a coroner about time of death. He tested several mice for their "cooling constant" both when the mouse was originally killed and then after the mouse was re-heated. Here's the results:

Mouse	Freshly killed	Reheated
1	573	481
2	482	343
3	377	383
4	390	380
5	535	454
6	414	425
7	438	393
8	410	435
9	418	422
10	368	346
11	445	443
12	383	342
13	391	378
14	410	402
15	433	100
16	405	360
17	340	373
18	328	373
19	400	412

The distribution of differences is normal. Is there any difference in the cooling constants between freshly killed and reheated corpses?

3. A plant ecologist wishes to test the hypothesis that the height of species X depends on the type of soil it grows in. She measures the height of 3 plants in each of 4 plots representing 4 different soil types. The results are tabulated below. (Height in centimeters.) Do the results support her hypothesis, assuming normality and equality of variances?

Observation	Plots			
	1	2	3	4
1	15	25	17	10
2	9	21	23	13
3	4	19	20	16

4. Hanna (1953) studied hair pigment concentration in 39 pairs of monozygotic twins, Two samples were taken from each person and analyzed separately. Three readings on a spectrophotometer were taken for each sample. Here's the partial ANOVA table:

Source of variation	df	MS
Among pairs	38	2676.2
Between twins within pairs	39	44.2
Between samples within twins	78	3.2
Among readings within samples	312	0.066

What kind of analysis has been done?

5. Data extracted from the Canadian record book of purebred dairy cattle were used to calculate the buttermilk percentages of 5 different breeds (Ayrshire, Canadian, Guernsey, Holstein-Friesian, and Jersey) each at 2 different age classes (2-yr-old and 5-yr-old). 10 of each type of cow were used, chosen at random from the available data. If we wish to know whether the different breeds change in the same way from one age to the next, what kind of test could be done?

6. Data were collected in Switzerland about the relationship between timing of metamorphosis and the subsequent survivorship of frogs for the first month of adult life. What test would we use to ask "Does the time of metamorphosis (expressed in days) affect the survivorship probability of adult frogs?"?

7. Allee and Brown (1932) studied the survival time of goldfish (in minutes) when placed in colloidal silver suspensions. (Who knows why.) They used three different treatments, which differed in the concentrations of silver and other solutes. Here's a list of the survival times:

Treatment 1	Treatment 2	Treatment 3
210	150	330
180	180	300
240	180	300
210	240	420
210	240	120

Assume that the variances of the three groups is not equal. Are the survivorship times equal in the three groups?

8. The following temperatures were recorded in a rabbit various times after being introduced with rinderpest virus. We want to predict body temperature from knowing the time since infection of a rabbit.

Time after injection (hours)	Temperature (F)
24	102.8
32	104.5
48	106.5
56	107.0

a. What is the best estimate of temperature from time after injection? Calculate.

b. Test the hypothesis that $\beta = 0$.

c. What is the 99% confidence interval for β.

9. The mean tibia length (Y_1) and mean tarsus length (Y_2) of aphids (*Pemphigus populitransversus*) from different localities were measured. Is there a correlation of these two measurements across localities?

Y_1	Y_2
.631	.140
.644	.139
.612	.140
.632	.141
.675	.155
.653	.148
.655	.146
.615	.136
.712	.159
.626	.140

10. Compare the assumptions of correlation with the assumptions of regression.

11. In an experiment to determine the mode of inheritance of the *green* mutant, 146 wild type and 30 mutant offspring were obtained when F_1 generation houseflies were crossed. test whether the data agree with the hypothesis that the ratio of wild types to mutants is 3:1.

12. Locality A has been sampled extensively for snakes of species S. An examination of the 167 adult males that have been collected reveals that 35 of these have pale-colored bands around their necks. From locality B, 90 miles away, we obtain a sample of 27 adult males of the same species, 6 of which show the bands. What is the chance that both samples are from the same statistical population with respect to bands?

13. In a very large *Drosophila* population, 30% of the flies are black and 70% are brown. Suppose that two flies are drawn at random from this population. What is the chance that these two flies are the same color? If they are the same color, what is the chance that they are both black?

14. Consider a string of 5 random digits (that is, each digit is equally likely to be any of 0,1,2,3,…9 regardless of the other digits). What is the probability that all the digits are different?

15. What is the probability that if you are dealt 5 cards at random from a normal 52-card deck that you will have four-of-a kind?