Practice Problems **Statistics 301**

1. You are given the following probability distribution for a random variable X.

value	Probability
0	.1
1	.2
2	.3
3	.4

   (a) Find the probability that X is greater than 1.

   (a) Find the population mean.

   (c) Find the population variance.

   (d) Find the population standard deviation.

2. **True or False**

   (a) The normal approximation to the binomial is appropriate for $n = 200$ and $p = .03$

   (b) Based on a random sample of size $n = 4$, the sampling distribution of $\bar{X}$ has variance $= 8$. If the sample size is increased to 16, the variance becomes 4 .

3. Let the weight X of books carried in a backpack have a normal distribution with mean 3.7 pounds and standard deviation 1.2 pounds.

   (a) Find the probability that X is greater than 5.5 pounds.

   (b) Standardize X.

3. The population has probability distribution

value x	Probability f(x)
0	.3
2	.4
4	.3

   A sample of size 2 is taken. That is, X_1 and X_2 have the same distribution as the population and they are independent.

   (a) Construct and urn and describe a sampling scheme that would have these probabilities.

   (b) Determine the rest of the sampling distribution of

$$T = \frac{X_1 + X_2}{2} - 2$$

value t	Probability g(t)
-2	.09
-1	.24
2	.09

4. The amount of PCB's was measured in 40 samples of soil that were treated with contaminated sludge. The following summary statistics were obtained.

$$\overline{x} = 3.56 \qquad s = .5 \text{ p.p.m}$$

   (a) Obtain a 95% confidence interval for the population mean, μ, amount of PCB's in the soil.

   (b) Does μ lie in your interval obtained in Part(a)?

   (c) Why are you 95% confident about you interval in Part(a)?

5. A company wants to establish that the mean life of a printer ink cartridge is over 9000 copies. The data will consist of data on 81 cartridges.

   (a) Formulate the null and alternative hypotheses.

   (b) Determine the test statistic.

   (c) Give the form of the rejection region.

   (d) What is the conclusion to your test if $\bar{x} = 9100$ and $s = 180$? Take $\alpha = .05$.

6. A sample of size $n = 500$ observations are made on the quality of sheets of copy paper from different production runs. Based on the sample, it is found that 45 fail to pass the check. Find a 95 % confidence interval for the population proportion of sheets that fail to pass.

7. A sample of 12 (non-digital) answering machines yielded a mean tape life of 1.4 years with a standard deviation of .6 year.

   (a) Obtain a 95 % confidence interval for the population mean life μ.

   (b) What did you assume about the population in your answer to part a?

8. Two procedures for etching integrated circuits are to be compared. Given 10 units, five are prepared using etching procedure A and five are prepared using etching procedure B.

   (a) How would you randomize in this experiment?

   (b) The response is the number of locations on the circuit where the etching was inadequate. The results are

Procedure A	Procedure B
5	1
2	3
9	4
6	0
3	2

   Find a 95 % confidence interval for the difference in means.

   (c) What assumptions did you make for your answer to part(b)?

9. An environmentalist wants to compare two instruments for measuring the amount of PCB's in corn stalks. A sample of stalks is cut and crushed and two scoops of the material taken. One is measured with the first instrument and the other with the second instrument. This whole process is repeated five times. The results, in parts per billion, are

Sample No.	Instrument 1	Instrument 2
1	3	4
2	8	7
3	9	6
4	4	3
5	6	5

(a) Find a 95 % confidence interval for the mean difference in instrument readings.

(b) How would you randomize in this experiment?

10. A chemist found that by adding different amounts of an additive to gasoline, she could reduce the amount of nitrous oxides(NOX) coming from an automobile engine. A specified amount was added to a gallon of gas and the total amount of NOX in the exhaust collected.

Amount of Additive	Amount NOX
1	9
2	8
3	3
4	4
5	1

(a) Obtain the least squares fit, of a line, to the amount of NOX.

(b) Give a point estimate of the mean value of NOX when the amount of additive is 8.

(c) What additional danger is there when using your estimate in Part (b)?

(d) How would you randomize in this experiment?

Partial answers 1. (d) 1, 2.(a) F, (b) F 3. g(1) = .24

4. (c) long run relative frequency that intervals calculated in this way will be about .95.

5. One-sided test. $Z = (9100 - 9000)/(180/9) = 5$. Reject $H_0 + \mu = 9000$

7. Population normal. 8. Independent samples design. (c) normal populations

9. Matched pair design.

10. $\hat{\beta}_1 = 2$.