MATHEMATICS 150
(2001-2002)

PROBLEM SET 6

Solutions may be submitted in class on **Monday, February 25** or to the Instructor's office (CC F30) by **3:00 pm Wednesday, February 27**. ***Print your name on the upper right-hand corner of the front page***.

1. Natural tissue variation and measurement error are such that measurements on sodium content for any given tissue section are assumed to follow a normal distribution with mean μ_X equal to the 'true' mean tissue sodium content and with standard deviation $\sigma_X = 0.008$. The mean of n measurements is to be used to estimate the 'true' content for a particular tissue section. How many measurements must be taken to have a 95% chance that the mean of the measurements will differ from the 'true' tissue mean by no more than 0.005?

2. A shipment of 2347 bundles of used newsprint has an unknown mean weight that is to be estimated. (Scales are not available to weigh large numbers of bundles and it is not practical to weigh all of the bundles individually or in small numbers.) The population mean is to be estimated with the sample mean calculated from a simple random sample of bundles from the shipment. Past experience indicates that shipment mean weights may vary, but the variance of the bundle weights in a shipment may be assumed to be 36 kg. There is to be a 90% chance that the estimation error not exceed 1. How many bundles should be in the sample?

3. The structure of a communication link has been redesigned and the chance that a message will be received within a desired time is unknown for the new structure. It is of interest to estimate this unknown chance and to have a 90% chance that the estimate will be within three percentage points of the true value. The chance is to be estimated with the percentage of messages received in the desired time in a sample of n test messages. How large must n be
   a) if there is no knowledge at all about the "true" chance?
   b) if it is assumed that there is at least a 70% chance that a message will be received in the desired time?

4. a) A polling agency has been commissioned to conduct a simple random sample of households in an area with $N = 8734$ households in order to estimate the percentage of households in which at least one adult is aware (to an arbitrarily set level) of the site selection process for determining waste disposal sites. The sample is to be large enough so that there will be a 90% chance of obtaining a sample percentage within 5 percentage points of the population percentage. What is the minimum sample size that should be used?
   b) A sample with the same conditions as in part a) is to be taken with the added belief that at most 30% of the area households would have at least one adult aware of the process. What is the minimum sample size?

5. Sheets of acrylic material are manufactured in a standard size of 30 cm by 120 cm. Sample sheets are selected at random for inspection of the sheet thickness. Measurements of the thickness (mm) of individual sheets are assumed to be normally distributed with a mean equal to the "true" process mean thickness.

Thirty sheets were selected at random for inspection and the thickness measurements were as follows

.797	.796	.826	.810	.807	.812
.783	.800	.808	.806	.789	.814
.805	.815	.811	.801	.824	.802
.816	.799	.803	.787	.813	.792
.768	.782	.794	.803	.825	.792

If you wish to use computer software, you may obtain these data electronically in the usual way from the data link at

http://www.trentu.ca/academic/math/courses/stat/files

The data are in a file acrylic.dat. To use these data with MINITAB, enter the data into MINITAB in the usual manner for a block of data; i.e. with the SET command directly to a single column or with a READ or COPY/PASTE into several columns and then STACK into a single column.

OVER

5. (Continued)

a) For these data, determine the
   i) mean
   ii) median
   iii) standard deviation
b) Determine 95% confidence limits for the process mean thickness. Do these limits provide any reason to doubt that the process mean thickness is 0.800 mm?
c) The process standard deviation is supposed to be less than 0.0175 mm. Determine a *one-sided upper* 95% confidence limit for the process standard deviation. Can the process manager be confident that the process standard deviation meets requirements?

6. A sample audit of $N = 1583$ expense accounts involved taking a simple random sample of $n = 90$ of the accounts. As part of the audit, the amount spent per day on meals was determined for each sample account. The 90 sample daily meal expenses were as listed below.

a) For these data, determine the
   i) mean
   ii) median
   iii) standard deviation
b) Determine 95% confidence limits for the mean daily meal expense for the full set of 1583 expense accounts.

49.89	54.64	56.49	55.43	58.72	54.95
41.69	58.58	37.34	49.02	52.86	46.52
51.60	49.22	57.73	46.69	60.32	41.20
55.64	58.00	55.23	38.31	57.14	58.33
52.13	65.40	46.06	44.73	49.45	50.94
60.88	39.68	45.67	43.84	39.16	54.21
41.57	44.92	50.07	44.37	53.32	42.78
52.93	45.05	42.62	38.20	44.37	53.18
45.89	54.78	32.10	47.28	38.97	43.49
27.30	35.11	46.57	25.52	32.32	35.65
36.63	33.20	40.65	48.37	32.27	44.02
33.88	46.24	40.61	49.40	39.12	43.36
37.96	41.24	45.45	68.00	77.29	58.24
60.72	73.88	85.52	66.24	74.70	74.81
61.22	76.41	82.41	60.54	71.50	79.97

If you wish to use computer software, you may obtain these data electronically as noted in problem 5, but in a file expense.dat. To use these data with software, enter the data in the usual manner for a block of data.