University of Waterloo — STAT 221 – W. H. Cherry

Assignment 6

A6 – 1. Text Exercise 6.53 (page 481): *Which of the following questions does a test of significance answer?*

A6 – 2. Text Exercise 6.54 (page 481): *In an investigation of the suggestion that taking vitamin C will prevent colds, 400 .....*

A6 – 3. (a)-(c) Text Exercise 6.55 (page 481): *Every user of statistics should understand the distinction between .....*
(d)-(f) Text Exercise 6.56 (page 482): *Give a 99% confidence interval for the mean SAT-M score μ .....*

A6 – 4. Text Exercise 6.57 (page 482): *As in the previous exercises, suppose that SAT-M scores vary normally .....*

A6 – 5. Text Exercise 6.58 (page 482): *A local television station announces a question for a call-in opinion poll .....*

A6 – 6. Text Exercise 6.59 (page 482): *A researcher looking for evidence of extrasensory perception (ESP) tests 500 .....*

A6 – 7. Text Exercise 6.62 (page 483): *The text cites an example in which researchers carried out 77 separate .....*

A6 – 8. In an investigation of cereal leaf beetle damage on oats, researchers counted the number of beetle larvae per stem (y) in small plots of oats after equiprobably applying one of two treatments: no pesticide or malathion at a rate of of about 0.9 kg per hectare. The data at the right are numerical summaries based on the work of M.C. Wilson *et al.*: "Impact of cereal leaf beetle larvae on yields of oats", *Journal of Economic Entomology* **62:** 699-702 (1969). Do these data provide evidence that the treatment with malathion meaningfully reduces the average number of leaf beetle larvae per stem on oats? Also, comment briefly on an extra-statistical issue involved in interpreting 'meaningfully' in this context.

Group	**Treatment**	n	$\bar{y}$	s
1	Control	13	3.47	1.21
2	Malathion	14	1.36	0.52

A6 – 9. Text Exercise 7.62 (pages 560-561): *An investigation of iron deficiency among infants compared samples of infants .....*

A6 – 10. In a comparison of the absorption times of two drugs (*A* and *B*), two groups of ten individuals were assigned equiprobably to be treated with one of the two drugs. After the relevant drug was administered to each person, their blood level of the drug was monitored and the time taken for it to reach a given level was noted. The averages and standard deviations for the two sets of 10 measurements were as follows:

Drug *A*:	average	43.5 minutes	**Drug *B***:	average	37.2 minutes
	standard deviation	4.35 minutes;		standard deviation	4.04 minutes.

(a) Do these data provide evidence of a meaningful difference in the average absorption times of the two drugs, or could the difference observed reasonably be due to sample (and other categories of) error?

(b) Find an 90% confidence interval for the population average absorption time difference ($A - B$).

(c) What additional information should be provided about the 20 participants in this investigation? Explain briefly.

A6 – 11. An investigation was carried out to compare the taste of instant coffee with that of freshly-brewed coffee. Each participant was presented with two cups of coffee, one of each type but otherwise identical in appearance except for a coded identifier; the subjects were then asked to taste the contents of their two cups and to state which they preferred. Of the 50 participants, 31 stated a preference for the freshly-brewed coffee.

(a) Do these data provide evidence of a meaningful preference for either instant or freshly-brewed coffee, or could any apparent preference reasonably be due to sample (or other categories of) error?

(b) Find an approximate 95% confidence interval for the population proportion of people who prefer freshly-brewed coffee; comment briefly on what is meant here by 'population'.

A6 – 12. A refrigerator manufacturer offers a choice of three colours – white, harvest gold and avocado; historically, white has been the most popular colour with consumers. Of the first 1,000 refrigerators sold, 400 are white.

(a) Does this observation provide meaningful evidence that more than one-third of all consumers prefer the colour white, or could the apparent preference reasonably be due to sample (and other categoeies of) error?

(b) Find an approximate 99% confidence interval for the proportion of white refrigerators likely to be sold over the entire (large) production run.

(*continued overleaf*)

A6 – 13. Text Exercise 8.43 (page 613): *The power takeoff driveline on farm tractors is a potentially serious .....*

A6 – 14. Samples of 400 electronic components were selected equiprobably from each of two production lines (A and B) and test-
ed, to check for manufacturing problems with line B; the numbers of defectives found were 40 (line A) and 80 (line B).

(a) Do these data provide evidence that the defective rate of line B is meaningfully higher than that of line A, or could the difference reasonably be due to sample (or other categories of) error?

(b) Find an approximate 95% confidence interval for the difference ($B - A$) in the proportions of defectives produced by two production lines over the period covered by this investigation.

A6 – 15. The time ships take to pass upstream through a lock on a canal is as follows for eight randomly-chosen ships:

8.9 9.8 10.3 10.3 9.2 9.9 9.6 8.8 (minutes).

(a) Find a 99% prediction interval for the average time for the next *four* ships to pass upstream through the lock.

(b) State clearly the assumption(s) on which your Answer depends.

A6 – 16. An ordnance factory has developed a new explosive which is designed to give a muzzle velocity of 800 metres per second. Eight trials with an appropriate gun are carried out, and yield the following results (muzzle velocities in metres per second): 802 771 780 801 798 789 780 777.

(a) Do these data provide evidence that the explosive *has* met its design specification?

(b) Give a 90% confidence interval for the average muzzle velocity produced by the explosive.

(c) Indicate briefly how your solutions in (a) and in (b) would be affected if the specification for the explosive were given (more realistically) as 800 metres per second *with a tolerance of* $\pm$*10 metres per second*.

A6 – 17. The assessment section of a city tax department is checking the consistency of its property assessments. In one such check, two assessors, A and B, are asked to make independent assessments of the *same* eight properties; their figures are (in $000):

Property	1	2	3	4	5	6	7	8
Assessor *A*	72.6	96.8	80.4	109.4	57.4	85.6	72.2	78.0
Assessor *B*	70.2	93.6	74.6	101.2	58.2	82.0	70.6	78.2.

(a) Is there evidence in these data that the two assessors *do* iffer in their assessments or could any difference reasonably be due to sample (or other categories of) error?

(b) Find a 95% confidence interval for the rue average difference ($A - B$) in assessment.

(c) Comment briefly on the statistical issues raided by describing the assessors' assessments as being 'independent'.

A6 – 18. Suppose that the distribution of daily wages in a particular industry can be modelled by a normal distribution with mean $139.20 and standard deviation $27.00.

(a) If a company in this industry employing 40 workers pays them an average of $127.20, is there evidence that the company is paying meaningfully less than the industry average?

(b) What confidence interval, if any, is it appropriate to calculate from the data given? Explain briefly.

(c) Explain briefly whether it is legitimate to interpret the Answer from the test in (a) as showing that the company *is* discriminating unfairly against its workers.