TI–83 Lab 8 for Statistics 503

Topics: factorials, permutation, combinations, tests and CIs of p, $p_1 - p_2$, goodness of fit test, hypergeometric distribution

Dataset(s): "pea.dat"[5], a dataset of the *observed* frequencies of various types of peas:

type	round–yellow	wrinkled–yellow	round–green	wrinkled–green
frequency	315	101	108	32

"irritation.dat"[6], a dataset on the *observed* types of irritations for different age groups; for example, 1311 people aged 30–44 had nose irritations.

↓ irritation; age →	18–29	30–44	45–64	65 and over	totals
eye	440	567	349	59	1415
nose	924	1311	794	102	3131
throat	253	311	157	19	740
totals	1617	2189	1300	180	5286

Dataset(s): "pigeons.dat" A comparison of the number of male and female pigeons in urban and rural areas was undertaken, with the following results, based on small random samples.

	urban (1)	rural (2)	total
male pigeons	y	b	6
female pigeons	c	d	8
total	10	4	14

Factorials, Permutations and Combinations.

- A friend of mine went to a wine tasting event featuring Chardonnay wine. There were 20 wines available for tasting and she decided to try 8. Assuming the order of tasting is relevant, determine all the possible ways she can taste the 8 types of wine.

  The answer to this question (assuming sampling without replacement where order matters) is: $(20)(19)\cdots(13) = \frac{20!}{12!}$.

  The are (at least) two possible ways to use the TI–83 to perform this calculation. One involves the factorial key and the other involves the permutation key.

  Following the factorial approach, enter:

[5] 11–2, p 579, Johnson
[6] 11.24, p 597, Johnson

– 20 MATH ◁ ∇ ∇ ∇ ENTER

– 12 MATH ◁ ∇ ∇ ∇ ENTER

to arrive at 5,079,110,400.

Following the permutation approach, enter:

– 20 MATH ◁ ENTER ∇ ENTER 8 ENTER

to, once again, arrive at 5,079,110,400.

- Shortly after being put into service, some buses manufactured by a certain company have developed cracks on the underside of the main frame. Suppose a particular city has 20 of these buses and cracks have actually appeared in 8 of them. How many different ways are there to select a sample of 5 buses from the 20 for a thorough inspection?

  The answer, here, is: $\frac{20!}{5!15!}$. Using the calculator, the number is found by entering

  20 MATH ◁ ∇ ∇ 5 ENTER

  which gives 15,504.

Confidence Intervals For Proportion p. It is found that 54 of 180 randomly selected credit card purchase slips where made with the Visa credit card. Determine the 99% CI for proportion p.

The 99% CI ("z–interval") for the proportion, p, is given by:

- STAT TESTS ALPHA A
- 54 ENTER 180 ENTER 0.99 ENTER ENTER

The pair of numbers $(0.21202, 0.38798)$, which are the upper and lower limits of the 99% CI, is returned.

Test For Proportion p. Suppose that an investigator wishes to know whether the proportion of individuals in here state that are overweight *differs* from the national proportion of 71%. A random sample of size $n = 600$ results in 450 who are overweight.

The p–value for this "1–PropZTest" is given by:

- STAT TESTS 5 ENTER
- 0.71 ∇ 450 ∇ 600 ∇ $\neq p_o$ ENTER ∇ CALCULATE ENTER

The p–value 0.0308 is returned.

Confidence Interval For Difference in Proportions, $p_1 - p_2$. A comparison of obstetrical care was made between military and civilian families[7].

	military (1)	civilian (2)
prenatal care began by 2nd trimester	358	6786
total sample	407	7363

A 95% confidence interval $p_1 - p_2 \neq 0$ is given by,

- STAT TESTS B:2–PropZInt ENTER
- 358 ∇ 407 ∇ 6786 ∇ 7363 ∇ 0.95 ENTER ∇ CALCULATE ENTER

A confidence interval of (-0.0742, -0.0098) is returned.

Test For Difference in Proportions, $p_1 - p_2$. A comparison of obstetrical care was made between military and civilian families[8].

	military (1)	civilian (2)
prenatal care began by 2nd trimester	358	6786
total sample	407	7363

A test of $p_1 - p_2 \neq 0$ at $\alpha = 0.05$, is given by,

- STAT TESTS 6:2–PropZTest ENTER
- 358 ∇ 407 ∇ 6786 ∇ 7363 $\nabla \neq p_2$ ENTER ∇ CALCULATE ENTER

The p–value 0.0024 is returned.

Goodness of Fit Test, All Proportions Specified. Given the "pea.dat", test whether or not the proportion of round–yellow, wrinkled–yellow, round–green and wrinkled–green peas occurs in the ratio 9 : 3 : 3 : 1 or not.

- Determine the *expected* number of the various pea types,

type	round–yellow	wrinkled–yellow	round–green	wrinkled–green
frequency	$\left(\frac{9}{16}\right) 556 = 312.75$	104.25	104.25	34.75

- Store the observed (given above) and expected number of the various pea types in the lists (L_1,L_2), calculate $\frac{(O-E)^2}{E}$, and store the result in L_3. The sum of L_3 is found to be 0.4700.

[7] Johnson, 10.106, p 554, 1996.
[8] Johnson, 10.106, p 554, 1996.

- Under the null that the ratio 9 : 3 : 3 : 1 is true, the p–value is given by:
  - 2nd DISTR 7:χ^2cdf 0.4700 , 1 2nd EE 99 , 4 - 1) ENTER

  The p–value 0.925 is returned.

Goodness of Fit Test, No Proportions Specified. Given the "irritation.dat", test whether or not type of irritation is independent of age group.

- Store the *observed* values in "irritation.dat" in matrix [A] by typing,
  - MATRIX EDIT 3 ENTER 4 ENTER
  - 440 ENTER 567 ENTER $\cdots$ 19 ENTER

  Type 2nd QUIT to leave MATRIX.
- To determine the p–value, key:
  - STAT TESTS C:χ^2–Test...
  - DATA ∇ ∇ Calculate ENTER

  The p–value 0.034 is returned with $\chi^2 = 13.62$.
- Also notice the *expected* values have been calculated and are stored in matrix [B]

$\downarrow$ irritation; age $\rightarrow$	18–29	30–44	45–64	65 and over	totals
eye	$\frac{(1415)(1617)}{5286} \approx 433$	586	348	48	1415
nose	958	1297	770	107	3131
throat	226	306	182	25	740
totals	1617	2189	1300	180	5286

Hypergeometric Distribution.

1. Given the "pigeon.dat", probability $\Pr(Y = 4)$; in other words, $\{y, b, c, d\} = \{4, 2, 6, 2\}$.
   - Type PRGM HYPPDF ENTER 14 6 10 4 ENTER.
2. Given the "pigeon.dat", the probability $\Pr(Y \leq 3)$; in other words, $\{y, b, c, d\} = \{3, 3, 7, 1\}$ or $\{y, b, c, d\} = \{2, 4, 8, 0\}$
   - Type PRGM HYPCDF ENTER 14 6 10 3 ENTER.