Lab 13

Stat 426

Spring 2021

Instructions

Complete all questions. To prepare for the randomly collected lab, follow the instructions on the class website to prepare the work for submission. These submission rules will apply to all labs throughout the semester.

Submission directions:
(1) For each scenario: (a) write hypotheses (b) list test statistic, df if applicable, and *pvalue* (c) state results (reject or not) (d) state conclusion in context (2) There MUST be some sort of short paragraph write up that gives the requested answers for each question to receive full credit (3) Include ONLY SAS code; no output

Introductory inferential methods

(1) *It ain't easy bein' green.* A dealer in recycled paper places empty trailers at various sites. The trailers are gradually filled by individuals who bring in old newspapers and magazines, and are picked up on several schedules. One such schedule involves pickup every second week. This schedule is desirable if the average amount of recycled paper is more than 1600 cubic feet per 2-week period. The dealer's records for eighteen 2-week periods show the following volumes (in cubic feet) at a particular site.
   (a) Estimate the true mean weight of recycled paper with 95% confidence. Interpret.
   (b) Is there sufficient evidence that the mean amount of recycled paper is more than 1600 cubic feet per 2 week period? Conduct a hypothesis test.

(2) *My giant blue head.* Some archaeologists theorize that ancient Egyptians interbred with several different immigrant populations over thousands of years. To see if there is any indication of changes in body structure that might have resulted, in a random sample they measured 30 skulls of male Egyptians dated from 4000 BCE and 30 others dated from 200 BCE.
   (a) Is there sufficient evidence that the mean breadth of males' skulls increased (as theorized by archaeologists) over this period? Conduct hypothesis test
   (b) Estimate the true difference of means with 95% confidence and interpret

(3) Breakfast is the most important meal of the day, or so the experts have said for decades. In one office, there was a bet to see if the hours worked was greater for those that ate breakfast daily than those that did not eat a daily breakfast.
   (a) Conduct the hypothesis test to see if the mean difference of worked hours is greater with breakfast eaten than not eating breakfast
   (b) Estimate the true mean difference with 95% confidence

(4) *7 or 11!*. A six-sided die is rolled 120 times. The data in the following table are the result of the 120 rolls. Conduct a hypothesis test to determine if the die is fair (does the data follow a uniform distribution, i.e. every side has an equal probability)

Face value	Frequency
1	15
2	29
3	16
4	15
5	30
6	15

(5) A major food manufacturer is concerned that the sales for its skinny french fries have been decreasing. As a part of a feasibility study, the company conducts research into the types of fries sold across the country to determine if the type of fries sold is independent of the area of the country. The results of the study are shown in the following table. Is there evidence that fry preference is independent of location? Conduct a hypothesis test.

Type of Fries	*Northeast*	*South*	*Central*	*West*	**Total**
skinny	70	50	20	25	165
curly	100	60	15	30	205
steak	20	40	10	10	80
Total	190	150	45	65	450

(6) A video game developer is testing a new game on three different groups. Each group represents a different target market for the game. The developer collects scores from a random sample from each group. Is there evidence that the mean scores are the same for all target groups or is at one target group mean score different? Let $\alpha = 0.10$. Conduct hypothesis (anova) test including diagnostics. If appropriate, conduct Tukey's HSD.

(7) *Carbonation*: Corrosion of steel reinforcing bars is the most important durability problem for reinforcing structures. Carbonation of concrete results form a chemical reaction that lowers the pH value by enough to initiate corrosion of the rebar. Data on the carbonation depth (mm) and strength (MPa) for a sample of core specimens was taken from a particular building, and all the regression output is provided. We are interested in modeling the strength[1]

(a) State the regression model and define its components
(b) Looking at the raw data scatterplot, does it appear as if there is a linear relationship? Positive or negative slope?
(c) State the equation of the regression equation (from output). Use it to estimate the strength when the carbonation depth is 8 mm and estimate it again when the depth is 20 mm
(d) Calculate the residuals for both of your estimates in part c. The observed value for 8 mm is 22.8 MPa $((8, 22.8))$ and for 20 mm is 17.1 MPa $((20, 17.1))$

[1] "The Carbonation of Concrete Structures in the Tropical Environment of Singapore" (*Magazine of Concrete Research*, 1996: 293-300)

(e) Do a significance test of the slope. State hypotheses, t statistic, *pvalue*, results, and conclusion of the test
(f) State, define, and describe R^2 and r (R^2 is on the output and r will require a calculation from the output)
(g) List assumptions of regression. Are the assumptions of regression met? Briefly explain how each assumption is met or not
(h) How is the model? Good, bad, etc.? Give specific evidence (use answers from parts e, f, and g)

Data for some problems

Problem 1

```
input weight @@;
cards;
1935 1556 1752 1969 1804 1842 1994 1810 1827
1725 2003 1499 1809 1795 1622 1620 1777 2035
;
```

Problem 2

The variables are breadth (numeric) and era (character)

```
filename skulls url 'https://webpages.uidaho.edu/~renaes/Data/Egypt%20skulls.csv';
```

Problem 3

```
input with without;
cards;
8 6
7 5
9 5
5 4
9 7
8 7
10 7
7 5
6 6
9 5
;
```

Problem 6

```
input scores group$;
cards;
101 A
108 A
98 A
107 A
111 A
151 B
149 B
160 B
112 B
126 B
101 C
109 C
```

```
198 C
186 C
160 C
;
```

Problem 7

```
input carbonation strength;
cards;
8.0 22.8
15.0 27.2
16.5 23.7
20.0 17.1
20.0 21.5
27.5 18.6
30.0 16.1
30.0 23.4
35.0 13.4
38.0 19.5
40.0 12.4
45.0 13.2
50.0 11.4
50.0 10.3
55.0 14.1
55.0 9.7
59.0 12.0
65.0 6.8
;
```