STAT 500 Homework 2

Yifan Zhu

September 8, 2016

1. (a) **experimental units:** 20 human volunteers

   treatments: drug A, drug B

   response variable: white blood cell counts

   control: (i) specimens to be drawn just before the drug is administered and at 24 hours after the administration of the drug; (ii) same person to draw blood from each subject; (iii) same lab to determine the white blood cell counts for each specimen.

   randomization: 20 human volunteers randomly divided into two groups

   replication: 10 receiving drug A and 10 receiving drug B

   (b) **experimental units:** 30 Xbox machines

   treatments: old fan, two fans, high quality fan

   response variable: time until machine overheats

   control: i. control group of 10 machines installed the old fan; ii. a large room keep at a constant 72 degrees Fahrenheit with 30 different stations setup in equally spaced distances across the room iii. same style television and television stand iv. run with the same graphic intensive game room.

   randomization: rolling the dice to assign 30 machines to 3 different groups

   replication: 10 machines in each group

   (c) **experimental units:** 60 one-week old soybean seedlings

   treatments: 3 types of plant nutrient (A, B or C) applied to the soil in the pots for each group

   response variable: dried weight after 10, 20, 30 and 40 days' growth

   control: (i) all one week old (ii) set in individual pot in one green house (iii) drying process

   randomization: (i) 60 pots randomly divided into 3 groups; (ii) 5 pot randomly selected in each group after evey 10 days' growth.

   replication: (i) 20 pots with soil applied nutrient of the same kind in each group; (ii) 5 pots selected in each group every 10 days.

   (d) **experimental units:** 20 specimens

   treatments: standard method, new method

response variable: concentration of the solution

control:(i) 20 specimens from the same batch of solution with a specific concentration of compound; (ii) same person to analyze all specimens;

randomization: 10 specimens randomly assigned to be analyzed with standard method and the other 10 with new method

replication: 10 specimens analyzed with the same method

(e) **experimental units:** 1,200 soybean plants

treatments: usual pesticide, new organic pesticide, untreated

response variable: proportion of infected soybean plants in each plot

control: (i) land far from any trees to prevent any area getting less sunlight to plant soybeans; (ii) each plot watered equally by the same farmer and using the same equipment

randomization: randomly choosing 10 plots to receive usual pesticide, 10 plots to receive a new organic pesticide, and the last 10 plots were left untreated

replication: 10 plots to get the same treatments and 40 soybean plants in each plot

2. Denote the sample mean of survival times with Bacilli treatment $\overline{Y_1}$, sample mean of survail times in the control group $\overline{Y_2}$, expectation of of survival time with Bacilli treatment μ_1, expectation of survail time in the control group μ_2.

$H_0 : \mu_1 - \mu_2 = 0$

$H_a : \mu_1 - \mu_2 \neq 0$

test statistic: $\overline{Y_1} - \overline{Y_2}$

oberved test statistics: $\overline{Y_1} - \overline{Y_2} = 102.69$

p-value: 0.28%

decision: reject H_0

conclusion: there is difference in survival times between two treatments

Table 1: Differences as Extreme as the Observed Difference (102.69)

Obs	sample	n1	mean1	css1	n2	mean2	css2	diff
1	3252	58	227.552	1320272.34	64	358.797	2380060.36	-131.245
2	4795	58	231.362	1570027.40	64	355.344	2186710.44	-123.982
3	2786	58	232.621	1282443.66	64	354.203	2492220.36	-121.582
4	3870	58	234.052	1354166.84	64	352.906	2440453.44	-118.855
5	3459	58	234.483	1116184.48	64	352.516	2684357.98	-118.033
6	8926	58	236.569	1371854.22	64	350.625	2456771.00	-114.056
7	8358	58	239.776	1520548.09	64	347.719	2349368.94	-107.943
8	4167	58	239.845	1176373.60	64	347.656	2694406.44	-107.811
9	6222	58	240.517	1440398.48	64	347.047	2438740.86	-106.530
10	8545	58	240.793	1141899.52	64	346.797	2740640.36	-106.004
11	1370	58	241.914	1343452.57	64	345.781	2552728.94	-103.867
12	4784	58	242.276	1498929.59	64	345.453	2401599.86	-103.177
13	3223	58	242.310	1439354.41	64	345.422	2461587.61	-103.112
14	4721	58	242.483	1496336.48	64	345.266	2406664.48	-102.783
15	9271	58	350.483	2164246.48	64	247.391	1736817.23	103.092
16	2589	58	350.759	2451534.62	64	247.141	1446221.73	103.618
17	7438	58	350.914	2311334.57	64	247.000	1584554.00	103.914
18	7246	58	351.776	2360392.09	64	246.219	1525022.94	105.557
19	8036	58	352.672	2275648.78	64	245.406	1598699.44	107.266
20	1462	58	353.000	2184956.00	64	245.109	1685304.23	107.891
21	4996	58	354.138	2187582.90	64	244.078	1668292.61	110.060
22	8413	58	354.414	2274582.07	64	243.828	1577763.11	110.586
23	9994	58	354.897	2301007.38	64	243.391	1545119.23	111.506
24	6390	58	355.845	2214001.60	64	242.531	1619759.94	113.314
25	3204	58	356.034	2349153.93	64	242.359	1482110.73	113.675
26	8504	58	357.328	2403198.78	64	241.188	1410829.75	116.140
27	1243	58	358.069	2270599.72	64	240.516	1533379.98	117.553
28	8262	58	367.741	2522509.12	64	231.750	1139232.00	135.991

Differences for 10000 Random Permutations