STAT362 Homework Assignment 5

Sharon O'Boyle

Problem 1, Problem 3.6, p. 117

SAS Program

```
* Sharon O'Boyle;
* Stat 362;
* Homework Assignment 5;

* Problem 3.6, p. 117;
* Program to compute Odds Ratio and 95% Confidence Interval for non-
ionizing radiation;

DATA ODDS;
   INPUT OUTCOME $ EXPOSURE $ COUNT;
DATALINES;
CASE 1-YES 50
CASE 2-NO 500
CONTROL 1-YES 40
CONTROL 2-NO 500
;

PROC PRINT DATA=ODDS;
TITLE 'PRINTING DATASET TO CHECK FOR CORRECT INPUT';
RUN;


PROC FREQ DATA=ODDS;
   TABLES EXPOSURE*OUTCOME / CMH;
   WEIGHT COUNT;
   TITLE "Problem 3.6: Compute Odds Ratio and 95% Confidence Interval
for non-ionizing radiation";
RUN;
```

SAS Log

```
NOTE: Copyright (c) 2002-2010 by SAS Institute Inc., Cary, NC, USA.
NOTE: SAS (r) Proprietary Software 9.3 (TS1M1)
      Licensed to GEORGE MASON UNIVERSITY-SFA T&R, Site 70008900.
NOTE: This session is executing on the W32_7PRO  platform.



NOTE: Updated analytical products:

SAS/STAT 9.3_M1, SAS/ETS 9.3_M1, SAS/OR 9.3_M1

NOTE: SAS initialization used:
      real time           6.03 seconds
      cpu time            1.59 seconds

1     * Sharon O'Boyle;
2     * Stat 362;
3     * Homework Assignment 5;
4
5     * Problem 3.6, p. 117;
6     * Program to compute Odds Ratio and 95% Confidence Interval for
non-ionizing radiation;
7
8     DATA ODDS;
9        INPUT OUTCOME $ EXPOSURE $ COUNT;
10    DATALINES;

NOTE: The data set WORK.ODDS has 4 observations and 3 variables.
NOTE: DATA statement used (Total process time):
      real time           0.28 seconds
      cpu time            0.10 seconds


15    ;
16
17    PROC PRINT DATA=ODDS;
NOTE: Writing HTML Body file: sashtml.htm
18    TITLE 'PRINTING DATASET TO CHECK FOR CORRECT INPUT';
19    RUN;

NOTE: There were 4 observations read from the data set WORK.ODDS.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           16.56 seconds
      cpu time            0.31 seconds


20
```

```
21
22   PROC FREQ DATA=ODDS;
23      TABLES EXPOSURE*OUTCOME / CMH;
24      WEIGHT COUNT;
25      TITLE "Problem 3.6: Compute Odds Ratio and 95% Confidence
Interval for non-ionizing
25 ! radiation";
26   RUN;

NOTE: There were 4 observations read from the data set WORK.ODDS.
NOTE: PROCEDURE FREQ used (Total process time):
      real time           0.29 seconds
      cpu time            0.07 seconds
```

SAS Output

For each problem that asks you to compute a statistic or a confidence interval, list the statistic or confidence interval along with an interpretation. (That is, answer the questions: What is the meaning of the statistic in words? What does the confidence interval imply about the associated population parameter?)

Null Hypothesis: Non-ionizing radiation and leukemia are not related.

Alternative Hypothesis: People with leukemia are more likely to have been exposed to non-ionizing radiation.

Problem 3.6: Compute Odds Ratio and 95% Confidence Interval for non-ionizing radiation

The FREQ Procedure

Frequency Percent Row Pct Col Pct	Table of EXPOSURE by OUTCOME EXPOSURE / OUTCOME		
	CASE	CONTROL	Total
1-YES	50	40	90
	4.59	3.67	8.26
	55.56	44.44	
	9.09	7.41	
2-NO	500	500	1000
	45.87	45.87	91.74
	50.00	50.00	
	90.91	92.59	
Total	550	540	1090
	50.46	49.54	100.00

Estimates of the Common Relative Risk (Row1/Row2)				
Type of Study	**Method**	**Value**	**95% Confidence Limits**	
Case-Control	**Mantel-Haenszel**	1.2500	0.8100	1.9290
(Odds Ratio)	**Logit**	1.2500	0.8100	1.9290

The Odds Ratio = 1.2500.

The 95% Confidence Interval is (0.8100 to 1.9290). This means that we are 95% confident that the true population odds ratio is in this interval. Since this interval contains 1, we conclude that the odds ratio=1.250 is not significant at the .05 level. So this test does not support the alternate hypothesis.

Therefore we would not reject the Null Hypothesis and we cannot conclude that people with leukemia are more likely to have been exposed to non-ionizing radiation.

Problem 2, Problem 3.16, p. 119

Part A: Heart Attacks

SAS Program

```
* Problem 3.16, p.119
* Program to compute the Relative Risk for Aspirin Therapy;

DATA RR_HATTACK;
   LENGTH GROUP $ 9;
   INPUT GROUP $ OUTCOME $ COUNT;
DATALINES;
ASPIRIN MI 80
ASPIRIN NO-MI 920
PLACEBO MI 240
PLACEBO NO-MI 1760
;

PROC PRINT DATA=RR_HATTACK;
TITLE 'PRINTING RR_HATTACK DATASET TO CHECK FOR CORRECT INPUT';
RUN;

PROC FREQ DATA=RR_HATTACK;
   TABLES GROUP*OUTCOME / CMH;
   WEIGHT COUNT;
   TITLE "Relative Risk of Heart Attacks";
RUN;
```

SAS Log

```
27
28    * Problem 3.16, p.119
29    * Program to compute the Relative Risk for Aspirin Therapy;
30
31    DATA RR_HATTACK;
32       LENGTH GROUP $ 9;
33       INPUT GROUP $ OUTCOME $ COUNT;
34    DATALINES;

NOTE: The data set WORK.RR_HATTACK has 4 observations and 3 variables.
NOTE: DATA statement used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds
```

```
39   ;
40
41   PROC PRINT DATA=RR_HATTACK;
42   TITLE 'PRINTING RR_HATTACK DATASET TO CHECK FOR CORRECT INPUT';
43   RUN;
NOTE: There were 4 observations read from the data set
WORK.RR_HATTACK.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds
44
45   PROC FREQ DATA=RR_HATTACK;
46      TABLES GROUP*OUTCOME / CMH;
47      WEIGHT COUNT;
48      TITLE "Relative Risk of Heart Attacks";
49   RUN;

NOTE: There were 4 observations read from the data set
WORK.RR_HATTACK.
NOTE: PROCEDURE FREQ used (Total process time):
      real time           0.07 seconds
      cpu time            0.01 seconds
```

SAS Output

Null Hypothesis: Aspirin therapy does not offer a significant benefit in reducing heart attacks.

Alternative Hypothesis: Aspirin therapy offers a significant benefit in reducing heart attacks.

Relative Risk of Heart Attacks

The FREQ Procedure

Frequency
Percent
Row Pct
Col Pct

Table of GROUP by OUTCOME

GROUP	**OUTCOME**		
	MI	**NO-MI**	**Total**
ASPIRIN	80	920	1000
	2.67	30.67	33.33
	8.00	92.00	
	25.00	34.33	
PLACEBO	240	1760	2000

	8.00	58.67	66.67
	12.00	88.00	
	75.00	65.67	
Total	320	2680	3000
	10.67	89.33	100.00

Estimates of the Common Relative Risk (Row1/Row2)

Type of Study	Method	Value	95% Confidence Limits	
Case-Control	**Mantel-Haenszel**	0.6377	0.4891	0.8314
(Odds Ratio)	**Logit**	0.6377	0.4891	0.8314
Cohort	**Mantel-Haenszel**	0.6667	0.5237	0.8487
(Col1 Risk)	**Logit**	0.6667	0.5237	0.8487

The relative risk = 0.6667 with a 95% confidence of (0.5237 to 0.8487). This means that those in the Aspirin group have only a 66.67% risk of developing a heart attack compared to those in the placebo group. Since the confidence interval does not include 1, we can reject the null hypothesis and conclude that aspirin therapy does offer a significant benefit in reducing heart attacks.

Part B: Stroke

SAS Program

```
* Part B - Stroke;

DATA RR_STROKE;
   LENGTH GROUP $ 9;
   INPUT GROUP $ OUTCOME $ COUNT;
DATALINES;
ASPIRIN MI-STR 65
ASPIRIN NO-STR 935
PLACEBO MI-STR 165
PLACEBO NO-STR 1835
;
```

```
PROC PRINT DATA=RR_STROKE;
TITLE 'PRINTING STROKE DATASET TO CHECK FOR CORRECT INPUT';
RUN;

PROC FREQ DATA=RR_STROKE;
   TABLES GROUP*OUTCOME / CMH;
   WEIGHT COUNT;
   TITLE "Relative Risk of Stroke";
RUN;
```

SAS Log

```
71    * Part B - Stroke;
72
73    DATA RR_STROKE;
74       LENGTH GROUP $ 9;
75       INPUT GROUP $ OUTCOME $ COUNT;
76    DATALINES;

NOTE: The data set WORK.RR_STROKE has 4 observations and 3 variables.
NOTE: DATA statement used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds


81    ;
82
83    PROC PRINT DATA=RR_STROKE;
84    TITLE 'PRINTING STROKE DATASET TO CHECK FOR CORRECT INPUT';
85    RUN;

NOTE: There were 4 observations read from the data set WORK.RR_STROKE.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.01 seconds
      cpu time            0.00 seconds

86
87    PROC FREQ DATA=RR_STROKE;
88       TABLES GROUP*OUTCOME / CMH;
89       WEIGHT COUNT;
90       TITLE "Relative Risk of Stroke";
91    RUN;

NOTE: There were 4 observations read from the data set WORK.RR_STROKE.
NOTE: PROCEDURE FREQ used (Total process time):
      real time           0.09 seconds
      cpu time            0.03 seconds
```

SAS Output

Null Hypothesis: Aspirin therapy does not offer a significant benefit in reducing strokes.

Alternative Hypothesis: Aspirin therapy offers a significant benefit in reducing strokes.

Relative Risk of Stroke

The FREQ Procedure

Frequency Percent Row Pct Col Pct	Table of GROUP by OUTCOME GROUP / OUTCOME		
	MI-STR	**NO-STR**	**Total**
ASPIRIN	65	935	1000
	2.17	31.17	33.33
	6.50	93.50	
	28.26	33.75	
PLACEBO	165	1835	2000
	5.50	61.17	66.67
	8.25	91.75	
	71.74	66.25	
Total	230	2770	3000
	7.67	92.33	100.00

Estimates of the Common Relative Risk (Row1/Row2)

Type of Study	Method	Value	95% Confidence Limits	
Case-Control	Mantel-Haenszel	0.7731	0.5741	1.0411
(Odds Ratio)	Logit	0.7731	0.5741	1.0411
Cohort	Mantel-Haenszel	0.7879	0.5974	1.0391
(Col1 Risk)	Logit	0.7879	0.5974	1.0391

The relative risk = 0.7879 with a 95% confidence of (0.5974 to 1.0391). This means that those in the Aspirin group have only a 78.79%

risk of developing a stroke compared to those in the placebo group. However, since the confidence interval includes 1 (which would indicate no significant difference), we cannot reject the null hypothesis and we cannot conclude that aspirin therapy offers a significant benefit in reducing strokes.

Problem 3, Problem 3.18, p. 120

SAS Program

```
***Problem 3.18, p 120;
*** Program to perform meta-analysis;

DATA STUDIES;
  LENGTH TREATMENT $9 ;
      INPUT STUDY_NO $ SURVIVAL $ TREATMENT $ COUNT;
DATALINES;
STUDY1 DIED 1-MGSO4 100
STUDY1 DIED 2-PLACEBO 155
STUDY1 SURVIVED 1-MGSO4 20
STUDY1 SURVIVED 2-PLACEBO 25
STUDY2 DIED 1-MGSO4 150
STUDY2 DIED 2-PLACEBO 150
STUDY2 SURVIVED 1-MGSO4 25
STUDY2 SURVIVED 2-PLACEBO 21
STUDY3 DIED 1-MGSO4 200
STUDY3 DIED 2-PLACEBO 240
STUDY3 SURVIVED 1-MGSO4 30
STUDY3 SURVIVED 2-PLACEBO 28
;

PROC PRINT DATA=STUDIES;
TITLE 'STUDIES DATASET AFTER INPUT';
RUN;

PROC FREQ DATA=STUDIES;
  TABLES STUDY_NO*TREATMENT*SURVIVAL/ALL; /*ALL option use with the
TABLES statement requests tests and measures of association produced
by CHISQ, MEASURES, and CMH options*/
  WEIGHT COUNT;
  TITLE "PROBLEM 3.18: META ANALYSIS";

RUN;
```

SAS Log

```
20   DATA STUDIES;
21     LENGTH TREATMENT $9 ;
22         INPUT STUDY_NO $ SURVIVAL $ TREATMENT $ COUNT;
23   DATALINES;

NOTE: The data set WORK.STUDIES has 12 observations and 4 variables.
NOTE: DATA statement used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds


36   ;
37
38   PROC PRINT DATA=STUDIES;
39   TITLE 'STUDIES DATASET AFTER INPUT';
40   RUN;

NOTE: There were 12 observations read from the data set WORK.STUDIES.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.10 seconds
      cpu time            0.01 seconds


41
42   PROC FREQ DATA=STUDIES;
43     TABLES STUDY_NO*TREATMENT*SURVIVAL/ALL; /*ALL option use with the
TABLES statement requests
43 !  tests and measures of association produced by CHISQ, MEASURES, and CMH
options*/
44     WEIGHT COUNT;
45     TITLE "PROBLEM 3.18: META ANALYSIS";
46
47   RUN;

NOTE: There were 12 observations read from the data set WORK.STUDIES.
NOTE: PROCEDURE FREQ used (Total process time):
      real time           0.40 seconds
      cpu time            0.15 seconds
```

SAS Output

***Null Hypothesis*: MgSO4 does not affect survival in cardiac arrest.**

***Alternative Hypothesis*: MgSO4 improves survival in cardiac arrest.**

PROBLEM 3.18: META ANALYSIS

The FREQ Procedure

Summary Statistics for TREATMENT by SURVIVAL
Controlling for STUDY_NO

Cochran-Mantel-Haenszel Statistics (Based on Table Scores)

Statistic	Alternative Hypothesis	DF	Value	Prob
1	Nonzero Correlation	1	1.5095	0.2192
2	Row Mean Scores Differ	1	1.5095	0.2192
3	General Association	1	1.5095	0.2192

Estimates of the Common Relative Risk (Row1/Row2)

Type of Study	Method	Value	95% Confidence Limits	
Case-Control	Mantel-Haenszel	0.8050	0.5695	1.1379
(Odds Ratio)	Logit	0.8050	0.5695	1.1378
Cohort	Mantel-Haenszel	0.9721	0.9288	1.0174
(Col1 Risk)	Logit	0.9722	0.9291	1.0172
Cohort	Mantel-Haenszel	1.2070	0.8942	1.6294
(Col2 Risk)	Logit	1.2068	0.8940	1.6289

Breslow-Day Test for Homogeneity of the Odds Ratios	
Chi-Square	0.0331
DF	2
Pr > ChiSq	0.9836

Total Sample Size = 1144

The Breslow-Day Test for Homogeneity of the Odds Ratios is not significant (p=0.9836), so we can be comfortable combining the results of the three studies. The cohort relative risk, Col1 risk = 0.9722 with a 95% confidence interval of (0.9291 to 1.0172). This means that we are 95% confident that the true population odds ratio is in this interval. Since this interval contains 1, we conclude that the odds ratio is not significant at the .05 level. So this test does not support the alternate hypothesis.

Therefore we would not reject the Null Hypothesis and we cannot conclude that MgSO4 improves survival in cardiac arrest.