

Name Jerry

Student Number _____

STA 312 f2022 Quiz 5

1. (5 points) Here is a 2×2 table of probabilities for a cross-sectional design.

	$Y = 1$	$Y = 2$
$X = 1$	π_{11}	π_{12}
$X = 2$	π_{21}	π_{22}

Give the odds ratio comparing the odds of $Y = 1$ given $X = 1$ to the odds of $Y = 1$ given $X = 2$. Show your work. Simplify. **Circle your final answer.**

$$\begin{aligned} \text{Odds Ratio} &= \frac{\pi_{11} / (\pi_{11} + \pi_{12})}{1 - \pi_{11} / (\pi_{11} + \pi_{12})} \bigg/ \frac{\pi_{21} / (\pi_{21} + \pi_{22})}{1 - \pi_{21} / (\pi_{21} + \pi_{22})} \\ &= \frac{\pi_{11} / (\pi_{11} + \pi_{12})}{\pi_{12} / (\pi_{11} + \pi_{12})} \bigg/ \frac{\pi_{21} / (\pi_{21} + \pi_{22})}{\pi_{22} / (\pi_{21} + \pi_{22})} \quad \leftarrow \text{Okay to start with this line} \\ &= \frac{\pi_{11} \pi_{22}}{\pi_{12} \pi_{21}} \quad \leftarrow \text{Denominators are needed to show they understand that these are conditional probabilities} \end{aligned}$$

2. In homework question eight, you did some analyses of the Titanic data.

- (a) (1 point) How many girls (female children) from Second Class survived? Write the number in the space below. On your printout, circle the number and write "Question 2a" beside it.

13

- (b) (1 point) For first and second class, was there a relationship between sex and survival among the children? Briefly explain.

No. All the children in 1st and 2nd class survived

- (c) (1 point) For the children in third class, you tested for a sex difference in survival. In the space below, write the Pearson X^2 statistic and the p -value. On your printout, circle the p -value and write "Question 2c" beside it.

$$X^2 = 2.74, p = 0.098$$

- (d) (2 points) In plain, non-statistical language, what do you conclude from the analysis of just the children from third class?

For children in 3d class, there is no convincing evidence of a difference in survival rate between girls and boys.

Attach your printout to the quiz paper. Make sure your name and student number are on the printout.

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```
> # R work for Titanic Question 8.
>
> # help(Titanic)
> # No Name Levels
> # 1 Class      1st, 2nd, 3rd, Crew
> # 2 Sex        Male, Female
> # 3 Age        Child, Adult
> # 4 Survived   No, Yes
>
> # No crew, adults only.
>
> # Odds ratio function
> oddrat = function(M) M[1,1]*M[2,2] / (M[1,2]*M[2,1])
>
> ship = as.data.frame(Titanic) ; ship
  Class Sex Age Survived Freq
1  1st Male Child      No    0
2  2nd Male Child      No    0
3  3rd Male Child      No   35
4  Crew Male Child      No    0
5  1st Female Child      No    0
6  2nd Female Child      No    0
7  3rd Female Child      No   17
8  Crew Female Child      No    0
9  1st Male Adult      No  118
10 2nd Male Adult      No  154
11 3rd Male Adult      No  387
12 Crew Male Adult      No  670
13 1st Female Adult      No    4
14 2nd Female Adult      No   13
15 3rd Female Adult      No   89
16 Crew Female Adult      No    3
17 1st Male Child      Yes    5
18 2nd Male Child      Yes   11
```

```

19  3rd  Male Child    Yes   13
20  Crew Male Child    Yes    0
21  1st Female Child  Yes    1
22  2nd Female Child  Yes   13
23  3rd Female Child  Yes   14
24  Crew Female Child  Yes    0
25  1st  Male Adult   Yes   57
26  2nd  Male Adult   Yes   14
27  3rd  Male Adult   Yes   75
28  Crew Male Adult   Yes  192
29  1st Female Adult   Yes  140
30  2nd Female Adult   Yes   80
31  3rd Female Adult   Yes   76
32  Crew Female Adult   Yes   20
> iceberg1 = subset(ship, Age == 'Adult') # Select adults
> iceberg1 = subset(iceberg1, Class != 'Crew')
> iceberg1
  Class  Sex  Age Survived Freq
9    1st  Male Adult      No  118
10   2nd  Male Adult      No  154
11   3rd  Male Adult      No  387
13   1st Female Adult      No    4
14   2nd Female Adult      No   13
15   3rd Female Adult      No   89
25   1st  Male Adult      Yes   57
26   2nd  Male Adult      Yes   14
27   3rd  Male Adult      Yes   75
29   1st Female Adult      Yes  140
30   2nd Female Adult      Yes   80
31   3rd Female Adult      Yes   76
>
> # 8a) Cross-sectional
>
> # 8b)
> sexBYsurv = xtabs(Freq ~ Sex + Survived, data = iceberg1)
> sexBYsurv
      Survived
Sex      No  Yes
Male   659 146
Female 106 296
> round(prop.table(sexBYsurv,margin=1),3)
      Survived
Sex      No   Yes
Male   0.819 0.181
Female 0.264 0.736
> oddrat(sexBYsurv)
[1] 12.60429
> # The odds of death were 12.6 times as great for men.
> chisq.test(sexBYsurv,correct=FALSE)

```

Pearson's Chi-squared test

```

data:  sexBYsurv
X-squared = 355.76, df = 1, p-value < 2.2e-16

```

```

> # Women were more likely to survive than men.
>
>

```

```

>
> # 8c)
> classBYsexBYsurv = xtabs(Freq ~ Sex + Survived + Class, data = iceberg1)
> classBYsexBYsurv
, , Class = 1st

      Survived
Sex      No Yes
Male    118  57
Female   4 140

, , Class = 2nd

      Survived
Sex      No Yes
Male    154  14
Female   13  80

, , Class = 3rd

      Survived
Sex      No Yes
Male    387  75
Female   89  76

, , Class = Crew

      Survived
Sex      No Yes
Male      0   0
Female    0   0

> # Get rid of empty crew.
> classBYsexBYsurv = classBYsexBYsurv[,,(1:3)]
> classBYsexBYsurv
, , Class = 1st

      Survived
Sex      No Yes
Male    118  57
Female   4 140

, , Class = 2nd

      Survived
Sex      No Yes
Male    154  14
Female   13  80

, , Class = 3rd

      Survived
Sex      No Yes
Male    387  75
Female   89  76

> # Show them how to do it later by applying factor after selection.
>

```

```
> round(prop.table(classBYsexBYsurv,margin=c(1,3)),3)
, , Class = 1st
```

	Survived	
Sex	No	Yes
Male	0.674	0.326
Female	0.028	0.972

```
, , Class = 2nd
```

	Survived	
Sex	No	Yes
Male	0.917	0.083
Female	0.140	0.860

```
, , Class = 3rd
```

	Survived	
Sex	No	Yes
Male	0.838	0.162
Female	0.539	0.461

```
> # Chi-squared separately for each class.
> for(j in 1:3) print(chisq.test(classBYsexBYsurv[,j]))
```

Pearson's Chi-squared test with Yates' continuity correction

```
data: classBYsexBYsurv[, , j]
X-squared = 137.08, df = 1, p-value < 2.2e-16
```

Pearson's Chi-squared test with Yates' continuity correction

```
data: classBYsexBYsurv[, , j]
X-squared = 153.43, df = 1, p-value < 2.2e-16
```

Pearson's Chi-squared test with Yates' continuity correction

```
data: classBYsexBYsurv[, , j]
X-squared = 57.539, df = 1, p-value = 3.313e-14
```

```
>
> for(j in 1:3) cat('Odds ratio for class ',j,' = ',
+ oddrat(classBYsexBYsurv[,j]),'\n')
Odds ratio for class 1 = 72.45614
Odds ratio for class 2 = 67.69231
Odds ratio for class 3 = 4.406292
>
> # Try children.
> # Class 1-3, All sex, 1=children, All survival outcomes
> Titanic[(1:3),1,]
, , Survived = No
```

	Sex	
Class	Male	Female
1st	0	0
2nd	0	0

```
3rd 35 17
```

```
, , Survived = Yes
```

```
Sex
Class Male Female
1st 5 1
2nd 11 13
3rd 13 14
```

```
> iceberg2 = subset(ship, Age == 'Child') # Select children
> iceberg2
```

	Class	Sex	Age	Survived	Freq
1	1st	Male	Child	No	0
2	2nd	Male	Child	No	0
3	3rd	Male	Child	No	35
4	Crew	Male	Child	No	0
5	1st	Female	Child	No	0
6	2nd	Female	Child	No	0
7	3rd	Female	Child	No	17
8	Crew	Female	Child	No	0
17	1st	Male	Child	Yes	5
18	2nd	Male	Child	Yes	11
19	3rd	Male	Child	Yes	13
20	Crew	Male	Child	Yes	0
21	1st	Female	Child	Yes	1
22	2nd	Female	Child	Yes	13
23	3rd	Female	Child	Yes	14
24	Crew	Female	Child	Yes	0

```
>
```

```
> kidstable = xtabs(Freq ~ Sex + Survived + Class, data = iceberg2)
```

```
> kidstable
```

```
, , Class = 1st
```

	Survived	
Sex	No	Yes
Male	0	5
Female	0	1

```
, , Class = 2nd
```

	Survived	
Sex	No	Yes
Male	0	11
Female	0	13

Question 2a

```
, , Class = 3rd
```

	Survived	
Sex	No	Yes
Male	35	13
Female	17	14

```
, , Class = Crew
```

	Survived	
Sex	No	Yes
Male	0	0

```
Female 0 0
```

```
> poorkids = kidstable[,3]; poorkids
      Survived
Sex      No Yes
Male    35  13
Female  17  14
> round(prop.table(poorkids,margin=1),3)
      Survived
Sex      No  Yes
Male   0.729 0.271
Female 0.548 0.452
> oddrat(poorkids)
[1] 2.217195
> chisq.test(poorkids,correct=FALSE)
```

Pearson's Chi-squared test

```
data: poorkids
X-squared = 2.7363, df = 1, p-value = 0.09809
```

Question 2c

```
>
> # In first and second class, all the children survived. In third class, there is no convincing
evidence of a difference in survival rate between boys and girls.
>
>
```