Classroom Voting Questions: Elementary Statistics

Data Analysis for Two-Way Tables

1. The following contingency table/two-way table classifies the members of a certain government into political party (Liberal or Conservative) and whether they support or oppose the spending bill that is currently up for adoption.

	Support	**Oppose**	**Total**
Liberal	47	11	58
Conservative	14	35	49
Total	61	46	107

What fraction of the government members are conservatives who support the bill?

(a) $\frac{14}{61}$
(b) $\frac{14}{49}$
(c) $\frac{14}{107}$
(d) None of the above

Answer: (c).

(a) This is the fraction of bill supporters who are conservative.
(b) This is the fraction of conservatives who support the bill.
(c) Correct.
(d) Incorrect. (c) is the correct answer. (See above.)

by David A. Huckaby

STT.02.05.010
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2. The following contingency table/two-way table classifies the members of a certain government into political party (Liberal or Conservative) and whether they support or oppose the spending bill that is currently up for adoption.

	Support	**Oppose**	**Total**
Liberal	47	11	58
Conservative	14	35	49
Total	61	46	107

What fraction of the liberals support the bill?

(a) $\frac{47}{61}$

(b) $\frac{47}{58}$

(c) $\frac{47}{107}$

(d) None of the above

Answer: (b).

(a) This is the fraction of bill supporters who are liberal.

(b) Correct.

(c) This is the fraction of government members who are liberal and support the bill.

(d) Incorrect. (b) is the correct answer. (See above.)

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STT.02.05.020
AS DH 3321 010 F16: 3/**97**/0/0 time 2:00

3. The following contingency table/two-way table classifies the members of a certain government into political party (Liberal or Conservative) and whether they support or oppose the spending bill that is currently up for adoption.

	Support	**Oppose**	**Total**
Liberal	47	11	58
Conservative	14	35	49
Total	61	46	107

The following fractions are formed by dividing numbers in the table: $\frac{11}{58}$, $\frac{58}{107}$, $\frac{11}{107}$. In order, these numbers are part of which distributions?

(a) joint, marginal, conditional

(b) joint, conditional, marginal

(c) marginal, joint, conditional

(d) marginal, conditional, joint

(e) conditional, joint, marginal

(f) conditional, marginal, joint

Answer: (f).

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STT.02.05.030
AS DH 3321 010 F16: 0/0/0/15/3/**82** time 3:30

4. Phoenix and Cassandra are professional basketball players who have dealt with injuries over the past two seasons. Two seasons ago, Phoenix made 5 out of 10 free throws, while Casssandra made 60 out of 100 free throws. Last season, Phoenix made 139 out of 200 free throws, while Cassandra made 7 out of 10 free throws. This leads to the two joint distributions below. (The first table is for two seasons ago; the second table is for last season.)

	Made	**Missed**
Phoenix	0.5	0.5
Cassandra	0.6	0.4

	Made	**Missed**
Phoenix	0.695	0.305
Cassandra	0.7	0.3

Which player was the best free-throw shooter?

(a) Phoenix

(b) Cassandra

Answer: (a). This question illustrates Simpson's Paradox. While either answer is defensible, after consideration most people would agree that in this example, (a) is the better answer. Phoenix's free-throw percentage over the two seasons: $\frac{5+139}{10+200} = \frac{144}{210} = 0.69$. Cassandra's free-throw percentage over the two seasons: $\frac{60+7}{100+10} = \frac{67}{110} = 0.61$. Granted Cassandra had the better free-throw percentage in each season. But both players had better percentages last season than they did two seasons ago. Since the bulk of Phoenix's free throws were attempted last season, it is last season's higher percentage that weighs more heavily in her overall percentage. In contrast, the bulk of Cassadra's free throws were attempted two seasons ago, so that her lower percentage that season weighs more heavily in her overall percentage. One moral of this

story is that care needs to be taken when aggregating data, since results can be very different before and after aggregation. [Follow-up question that isolates the "weighting" component of the paradox: If you are a 50% free-throw shooter one day, and a 100% free-throw shooter the next day, what is your overall free-throw percentage? Answer: It depends on how many free-throws you attempted each day. If you attemped 100 free throws the first day and only 1 the second day, your overall percentage is close to 50%. If you attempted 1 free throw the first day and 100 free throws the second day, your overall percentage is close to 100%.]

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STT.02.05.040
AS DH 3321 010 F16: **28**/72 time 3:30
AS DH 1342 010 F17: **8**/92 time 2:30