**GER1000 2018 Sem 2**
**Quiz 9 and solutions**

Q1. Some scientists have found that drinking coffee is associated with students' ability to sleep (enough vs not enough sleep). Sex was a confounder. This means that:

(I) Percentage of coffee drinkers among males is different from the percentage of coffee drinkers among females.

(II) Percentage of males among coffee drinkers is different from the percentage of females among coffee drinkers.

(III) Percentage of males among students who have enough sleep is different from the percentage of males among students who do not have enough sleep.

(a) (I) and (II) only
(b) (II) and (III) only
(c) (I) and (III) only
(d) (I), (II) and (III)

Answer: C

To be a confounder, sex must be associated with both drinking coffee and sleep.

(I) says rate (coffee drinker | male ) $\neq$ rate (coffee drinker | female), which expresses an association between sex and drinking coffee.

(II) says rate(male | coffee drinker) $\neq$ rate (female | coffee drinker). It only means that the number of males who drink coffee is not the same as the number of females who drink coffee, and doesn't express an association between sex and drinking coffee.

(III) says rate (males | students with enough sleep) $\neq$ rate (males | students without enough sleep), which expresses an association between sex and sleep.

Q2. 100,000 women were encouraged to do annual screening for breast cancer; 40,000 accepted, but 60,000 refused. After 5 years, death rates from breast cancer (per 10,000) were 1.1 for the women who were screened, and 2.5 for the women who refused. It is known that poorer women were less likely to accept screening than richer ones, and that breast cancer affects the rich more than the poor.

To show that screening reduces the risk from breast cancer, someone wants to compare the death rates from breast cancer among the screening group and the non-screening group, which are 1.1 and 2.5. Only based on the given information, 2.5 – 1.1 = 1.4 is likely _____ of the reduction in death rate from breast cancer due to screening.

(a) an underestimate

(b) a reasonable estimate

(c) an overestimate

Answer: A.

From the given information, the richer women were more likely to accept screening than the poorer ones. Note that "A is associated with B" is equivalent to "B is associated with A". Therefore, the women who accepted screening were more likely to be richer.

On the other hand, the richer people tends to have higher death rate from breast cancer, compared with the poorer people. Hence, the women who accepted screening shall have a higher death rate from breast cancer, if they weren't receiving the screening. The rate must be a number larger than 2.5, say 3.0, and screening actually helped reduce the death rate from 3.0 to 1.1. In any case, 1.4 is an underestimate.

Q3. Players can spend $1 to play a lottery game, which has 7 prizes in total. The prize amount and the corresponding chance of winning the prize have been summarized in the following table.

| | Prize amount | Winning chance |
|---|---|---|
| 1st prize | 1,500,000 | 1 / 14,000,000 |
| 2nd prize | 100,000 | 1 / 2,330,000 |
| 3rd prize | 2,000 | 1 / 55,500 |
| 4th prize | 350 | 1 / 22,200 |
| 5th prize | 50 | 1 / 1,080 |
| 6th prize | 25 | 1 / 810 |
| 7th prize | 10 | 1 / 60 |

Suppose net profit is defined as winnings subtracted by cost. What is the average net profit of playing this game? (choose the closest one)

(a) – 0.70

(b) – 0.55

(c) – 0.45

(d) 0.45

Answer:

B.

Average value = 1,500,000 * 1 / 14,000,000 + 100,000 * 1 / 2,330,000 + 2,000 * 1 / 55,500 + 350 * 1 / 22,200 + 50 * 1 / 1,080 + 25 * 1 / 810 + 10 * 1 / 60 – 1 = 0.107 + 0.043 + 0.036 + 0.016 + 0.046 + 0.031 + 0.167 – 1 = 0.446 – 1 = -0.554.

Q4. In the Hunger Game, four families are involved and each family has two children. The details are as follows.

| Family | 1st child | 2nd child |
|---|---|---|
| Stone | Girl | Girl |
| Smith | Girl | Boy |
| White | Boy | Girl |
| Louis | Boy | Boy |

One child will be randomly selected from the 8 children of the 4 families.
What is the probability that he is the younger one in the family, if the selected child is a boy?

(A) 1/8
(B) 1/4
(C) 3/8
(D) 1/2

Answer: D.

There are four cases that the selected kid is a boy: younger brother in Family Smith, the older brother in Family W, the older and younger brothers in Family L. Among these four cases, there are two cases that the selected one is the younger brother in the family. So, P(younger one | selected a boy) = 2 / 4 = 1/2.

Q5. Suppose you want to measure the build quality of an industrial product. The factory has manufactured 200 batches, with 8 units per batch, for a total of 1600 units. You decide to sample 80 of the units. Suppose you randomly sample 10 batches and then select every unit in those 10 batches to be in your sample, for a total of 80 units. What kind of sample have you obtained?

a) A systematic sample

b) A stratified sample

c) A cluster sample

d) A simple random sample

Answer: C. See Chapter 4 slides 35-36.