GER1000 QUANTITATIVE REASONING

(Semester 1 : AY2016/2017)

TEST

1 October 2016

1:30—2:30 pm

Instructions:

(i) This test paper contains 8 printed pages. Answer all 14 questions. The last page contains some notes.

(ii) Give your answers in the bubble answer sheet provided. Fill in the bubbles neatly and completely, using a 2B pencil. Only the bubble answer sheet will be marked. Make sure you have written and bubbled in your correct matriculation number (the number starting with "A").

(iii) Only one answer per question is allowed. Each correct answer is given one (1) mark. An incorrect/incomplete/missing answer receives 0 mark. The maximum total mark for this test is 14.

(iv) This is a closed book exam. Calculators are allowed. Computers, tablets and mobile devices are not allowed.

1. Among 1000 university students who consent to participate in a psychology experiment, 700 are undergraduates and 300 are postgraduate students. The students are randomly assigned into control and treatment groups, both of size 500. The percentage of undergraduates in the treatment group is likely to be ___ the percentage of postgraduate students in the control group.

   (A) less than

   (B) equal to

   (C) more than

2. To help people start a business, is it better to give them a loan (which has to be repaid) or a grant? Controlled experiments have been conducted to answer such questions in development economics, but blinding subjects is a real challenge. Suppose a large number of subjects agree to participate in such an experiment. Which of the following is/are true about random assignment of subjects to treatment and control?

   (I) Random assignment will take care of the bias introduced by ineffective blinding.

   (II) It is essential that the treatment and control groups have the same size.

   (A) Both (I) and (II).

   (B) (I) only.

   (C) (II) only.

   (D) Neither (I) nor (II).

3. This question is about all persons of age 21 years or above in a country. The percentage of university graduates among the young adults (age 21 to 44 years) is 40%, meaning among the young adults, 40% are university graduates. Also, the percentage of university graduates among the old adults (age 45 years or more) is 15%. Which of the following can be concluded by applying the consistency rule?

   (I) The percentage of young adults among the university graduates is higher than the percentage of old adults among the university graduates.

   (II) The percentage of young adults among the non-university graduates is lower than the percentage of young adults among the university graduates.

   (A) Both (I) and (II).

   (B) (I) only.

   (C) (II) only.

   (D) Neither (I) nor (II).

4. In a 2005 study, secondary 2 students from several schools were classified into two types: those who received private tuition, and those who did not. It was found that the treatment group did worse than the control group in examinations. Does private tuition hurt academic performance? This is an observational study, and one possible confounder is the availability of the mother. Suppose the mothers of the students were classified into two groups: those who spent much time with their children, and those who spent little time. Which of the following controls for the mother's availability?

(A) Separate the students into two groups according to whether they received private tuition, and look at the association between mother's availability and academic performance.

(B) Separate the students into two groups according to the amount of time their mothers spent with them, and look at the association between tuition and academic performance.

(C) Separate the students into two groups according to academic performance, and look at the association between tuition and mother's availability.

(D) None of the above.

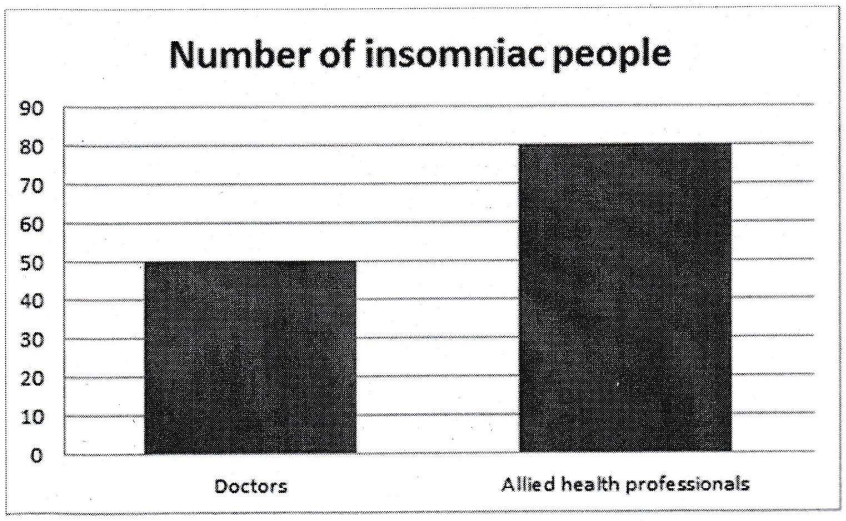
5. A hospital employs 600 people, of whom 200 are doctors and 400 are allied health professionals. The number of people suffering from insomnia (inability to sleep) in each group is shown in the graph below. Choose the best option. There is ___ between allied health professionals and insomnia in this hospital.

(A) a positive association

(B) no association

(C) negative association

(D) insufficient information to characterise the association



6. How might employment type (public vs private sectors) be related to propensity to take financial risks? An investigator selects 500 employees at random from the public sector, and 500 employees at random from the private sector, in a country. Each subject is categorised to "conservative" and "enterprising" according to attitude towards a proposal to invest $10,000 in an investment instrument. Which of the following is/are true?

(I) The data can be used to estimate the population risk ratio of being enterprising.

(II) The data can be used to estimate the population odds ratio of being enterprising.

(A) Both (I) and (II).

(B) (I) only.

(C) (II) only.

(D) Neither (I) nor (II).

7. Suppose there are two smoking cessation programmes: Quitit and Stopit. Some male smokers underwent Quitit, and 57% of them quit smoking. Some other male smokers underwent Stopit, and 61% of them quit. Some female smokers underwent Quitit, and 40% of them quit smoking. Some other female smokers underwent Stopit, and 44% of them quit. Let X be the overall quit rate of the male and female smokers who underwent Quitit. Let Y be the overall quit rate of the male and female smokers who underwent Stopit. Which of the following is/are true?

(I) X cannot be more than 57%.

(II) X is always less than Y.

(A) Both (I) and (II).

(B) Only (I).

(C) Only (II).

(D) Neither (I) nor (II).

8. A class of 50 high school students took diagnostic tests in mathematics and music, and the correlation between the scores is 0.30. A month later, they repeated the tests. For each student, the new mathematics score was almost identical to the old mathematics score, but the new music score was double the old music score. The correlation between the new mathematics and music scores is roughly

(A) 0.15.

(B) 0.30.

(C) 0.45.

(D) 0.60.

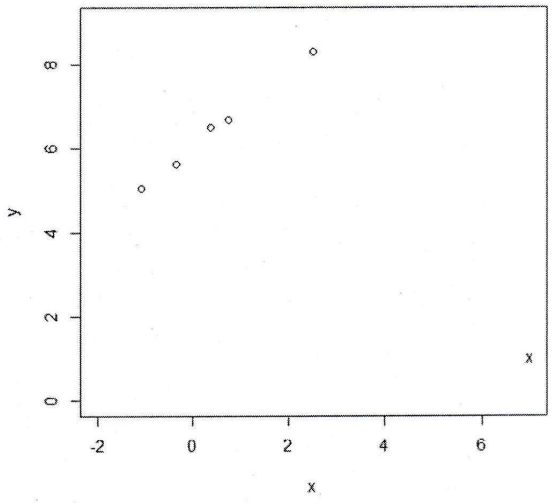
9. Let r be the correlation of the following scatter diagram which consists of 5 points represented by "o" and one point represented by "x". Let s be the correlation of the same diagram, but with the "x" removed. Choose the best option.

(A) r = 0.0, s = 0.8.

(B) r = 0.0, s = 0.4.

(C) r = -0.5, s = 0.8.

(D) r = -0.5, s = 0.4.



10. Suppose the Singapore adult population is classified into two groups according to physical exercise: "active" and "non-active", and also into two groups according to health: "healthy" and "unhealthy". Suppose the population odds ratio of being unhealthy between the active and non-active groups is equal to 0.4. Which of the following is true about the population risk ratio of being unhealthy between the two groups?

(A) It is equal to 0.4.

(B) It is equal to 2.5.

(C) It cannot be determined, but must be less than 1.

(D) It cannot be determined, but must be more than 1.

11. A village of 420 people are classified as shown below:

	Diabetic	Healthy	Row total
Female	70	140	210
Male	50	160	210
Column total	120	300	420

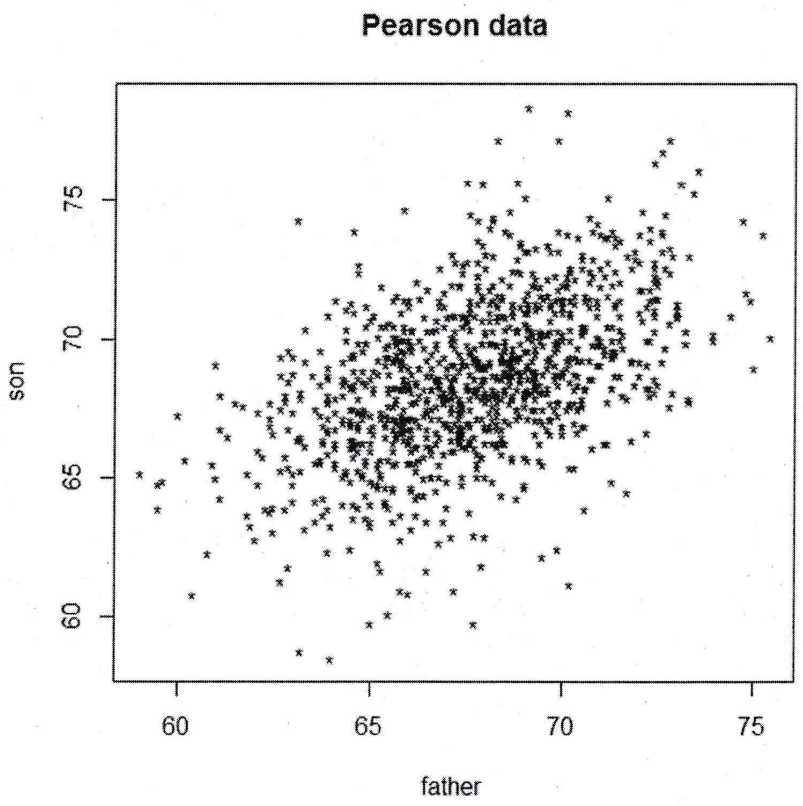
An investigator randomly samples subjects from the four types of people in the following fashion: 50% from diabetic females, 30% from healthy females, 30% from diabetic males, and 40% from healthy males. He then calculates an odds ratio for diabetes between females and males from the sample data. His result will be ___ the population odds ratio.

(A) smaller than

(B) equal to

(C) larger than

(D) Cannot be determined from the information given.



12. The Pearson's height data on 1,078 father-son pairs are shown above. The average height of sons with 68-inch fathers (those with height between 67.5 inches to 68.4 inches) is 69 inches. Consider the 64-inch fathers. Their sons' average height will be ___ 65 inches.

(A) less than

(B) roughly equal to

(C) more than

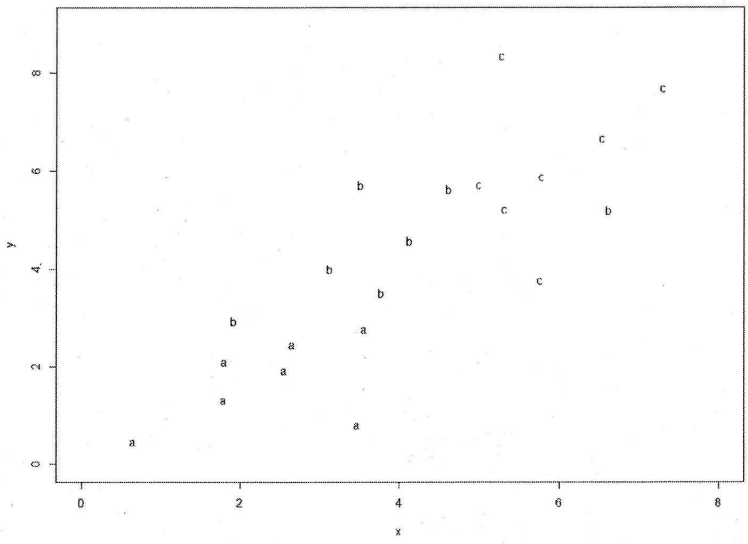
13. The correlation of the Pearson's father-son data is 0.50. The correlation of the part of the data corresponding to sons of height above the average of 69 inches is most likely

(A) less than 0.50.

(B) equal to 0.50.

(C) more than 0.50 but less than 1.

(D) equal to 1.



14. The correlation of the 21 points shown above is 0.82. Suppose the 7 points labelled "a" are replaced by a single point with coordinates given by their average x and y values, and the same is done to the 7 points labelled "b", and also the 7 points labelled "c". For the scatter diagram consisting of the 3 new points, the correlation is

(A) less than 0.50.

(B) between 0.50 and 0.82.

(C) equal to 0.82.

(D) more than 0.82.

Notes

Suppose A is a characteristic of some members of a population, but not all, so that some people belong to the category "not A". Further suppose B is another characteristic of some, but not all, members of the same population.

1. Let rate(A | B) be the rate of A among people with characteristic B, and similarly for rate(A | not B) etc. The consistency rule says that

(i) If rate(A | B) > rate(A | not B), then rate(B | A) > rate(B | not A).

(ii) If rate(A | B) = rate(A | not B), then rate(B | A) = rate(B | not A).

(iii) If rate(A | B) < rate(A | not B), then rate(B | A) < rate(B | not A).

2. Let odds(A | B) be the odds of A among people with characteristic B. It is given by

$$\text{odds}(\text{A} \mid \text{B}) = \frac{\text{rate}(\text{A} \mid \text{B})}{1 - \text{rate}(\text{A} \mid \text{B})}$$

3. The odds ratio of A between people with B and people with "not B" is

$$\frac{\text{odds}(\text{A} \mid \text{B})}{\text{odds}(\text{A} \mid \text{not B})}$$

4. Suppose the population is classified as shown below, i.e., there are w persons with characteristics A and B, x persons with characteristics A and not B, etc.

	B	not B
A	w	x
not A	y	z

Then the odds ratio of A between people with B and people with "not B" is

$$\frac{wz}{xy}$$

THE END

Answers:

1. C 2. D 3. C 4. B 5. C 6. A 7. B 8. B 9. C 10. C 11. C 12. C 13. A 14. D