GER1000 QUANTITATIVE REASONING

(Semester 2 : AY2016/2017)

TEST

4 March 2017

1:30—2:30 pm

Instructions:

(i) This test paper contains 7 printed pages. Answer all 16 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 1 mark. Otherwise, 0 mark is given. The total score for this test is 16.

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

1. 3,000 middle-aged women with heart problems consented to participate in a drug trial. 2,000 of them were randomly assigned to receive the new drug, while the remaining 1,000 were given the standard drug.

(I) The result of this experiment may not generalise to all middle-aged women with heart problems.

(II) The treatment and control groups may not be similar, aside from treatment, because their sizes are different.

(A) Both (I) and (II) are true.
(B) Only (I) is true.
(C) Only (II) is true.
(D) Neither (I) nor (II) is true.

The next two questions are based on the following.

The National Literary Reading and Writing Survey was conducted on both residents and non-residents in Singapore. It found that among Singapore residents, the rate of reading (a book between March 2014 and March 2015) is less than the rate of not reading.

2. The rate of reading among Singapore residents was ___

(A) less than 50%
(B) more than 50%
(C) There is insufficient information to choose between (A) and (B).

3. It follows from the given information that ___

(A) there was an association between reading and being a resident in Singapore.
(B) there was no association between reading and being a resident in Singapore.
(C) There is insufficient information to choose between (A) and (B).

4. In a certain year, the Ministry of Education accepted 20% of female applicants, and 20% of male applicants; the Ministry of Culture, Community and Youth accepted 40% of female applicants, and 40% of male applicants. Suppose that each applicant only applied to one ministry.

(I) Of female applicants to both ministries, the overall acceptance rate is between 20% and 40%.
(II) The overall acceptance rate of female applicants is equal to the overall acceptance rate of male applicants.

Based on the information given,

(A) Both (I) and (II) are true.
(B) Only (I) is true.
(C) Only (II) is true.
(D) Neither (I) nor (II) are true.

5. In a country, among all university graduates, 20% feel they are ready to face a lifetime of VUCA (volatility, uncertainty, complexity and ambiguity). Among university graduates from professional programmes, 10% feel the same. Among university graduates from non-professional programmes (including philosophy and mathematics), ___ feel the same.

(A) more than 20%
(B) between 10% and 20%
(C) less than 10%
(D) There is insufficient information to choose among (A), (B) and (C).

6. A study was done in Germany to compare the conventional treatment of acute sinusitis with a new complementary treatment. 63 patients consented to be treated at one of five medical centres, of which three offered only the conventional treatment, and two offered only the complementary treatment. The patients were free to choose a physician (and hence the therapy) among the five centres. This study is

(A) a randomised controlled experiment
(B) a controlled experiment with historical control
(C) a controlled experiment without randomisation

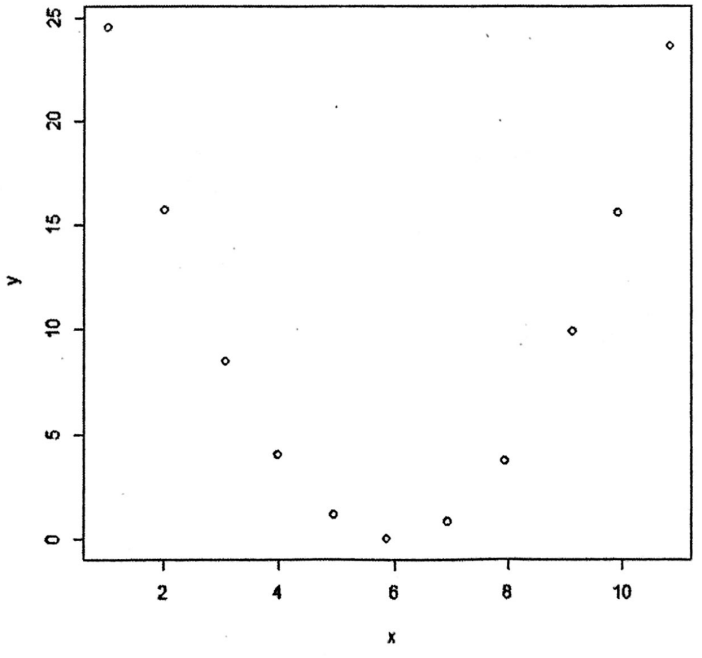
7. In a city of 5,000 inhabitants, the odds of owning a personal mobility device (PMD) is 1 to 7. The rate of owning a PMD in this city is closest to

(A) 1/7 %
(B) 7%
(C) 12%
(D) 20%

8. The statements concern the scatter diagram shown on the right.

(I) The correlation between x and y is close to 0.
(II) There is a strong non-linear association between x and y.

(A) Both (I) and (II) are true.
(B) Only (I) is true.
(C) Only (II) is true.
(D) Neither (I) nor (II) are true.



The next two questions are based on the 100 individuals summarised in the table below.

		Diseased	Not diseased
Group A	Exposed	16	18
	Not exposed	14	27
Group B	Exposed	4	2
	Not exposed	6	13

9. Among the 100 individuals, there is an association between being exposed and being diseased.

(A) True
(B) False
(C) There is insufficient information to choose between (A) and (B).

10. In the question of how exposure might cause the disease, group membership is

(A) a confounder, because it is associated with exposure.
(B) a confounder, because it is associated with disease.
(C) not a confounder, because it is not associated with exposure.
(D) not a confounder, because it is not associated with disease.

11. The inhabitants of a village are classified as shown in the table

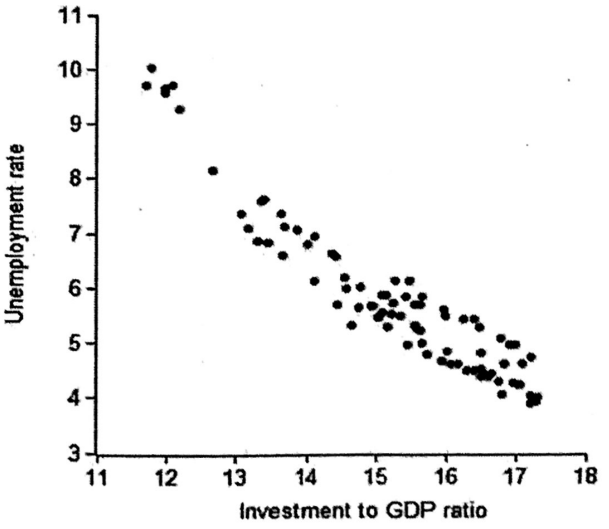
	Diseased	Healthy
Unexposed	30	19
Exposed	23	55

The odds ratio for the disease between the exposed villagers and the unexposed villagers is

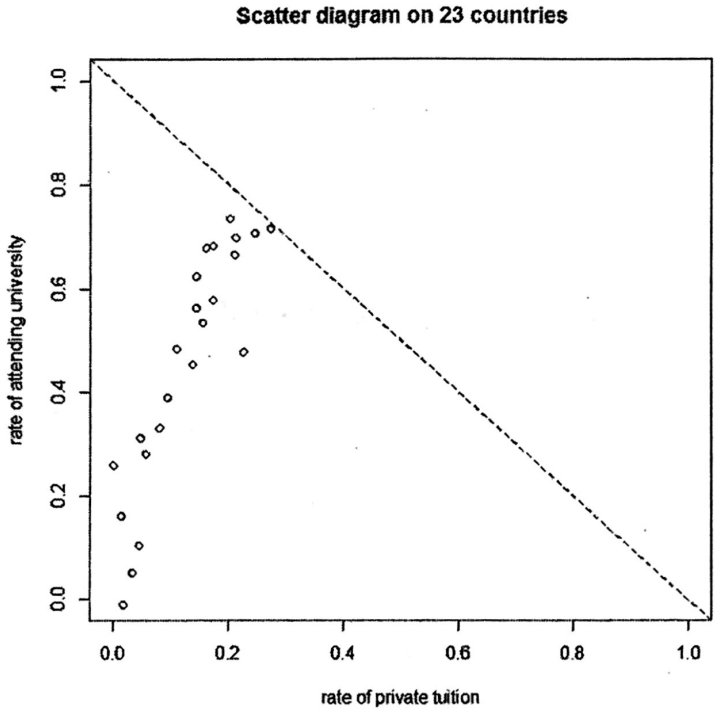
(A) (30x55)/(19x23)
(B) (30x23)/(19x55)
(C) (19x23)/(30x55)
(D) (19x55)/(30x23)

12. Economic data are often reported every three months, or "quarterly". The quarterly US unemployment rate and investment to GDP ratio from 1990 to 2010 are negatively correlated, with r around -0.7. For the points with unemployment rate less than 6%, the correlation is closest to

(A) -0.9
(B) -0.7
(C) -0.4
(D) 0.0
(E) 0.4



13. Suppose that for each of twenty-three European countries, an investigator determined the rate of having received private tuition while in high school and the rate of attending a university, among youths of 25 years old. The scatter diagram is shown below. For points on the dashed line, the x and y values sum up to 1.



(A) It is possible that in every country in the study, none of the youths who had tuition during high school attended university.
(B) Someone in some country must have had tuition during high school and attended university.
(C) There is insufficient information to choose between (A) and (B).

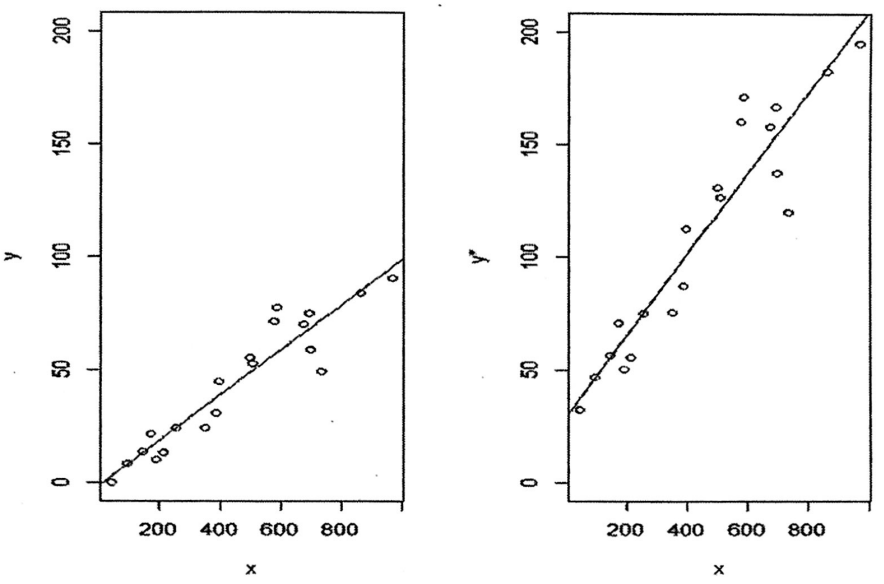
14. A module has a test and a final. For both assessments, the average score is 65, and the SD is 10. The scatter diagram looks like an oval, and the correlation is 0.7. Students who scored 50 in the test were given extra classes. They improved tremendously in the final, scoring an average of 75. Can this event be explained by the regression effect completely?

(A) Yes.
(B) No. I expect the regression effect to push their final average to more than 75.
(C) No. I expect the regression effect to push their final average to between 65 and 75.
(D) No. I expect the regression effect to push their final average to between 50 and 65.
(E) No. I expect the regression effect to push their final average to less than 50.

15. A student collected data on x and y, and produced the scatter diagram on the left below. He defined a new quantity y* from y, by multiplying 1.8 and adding 32, i.e.,

$$y^* = 1.8 \times y + 32$$

He then made a scatter diagram from x and y*, shown on the right. Noticing that the regression line on the right is steeper than that on the left, he wrote "the correlation between x and y* is larger than the correlation between x and y." This statement is



(A) true
(B) false
(C) There is insufficient information to choose between (A) and (B).

16. In a study on factors contributing to smoking in a city of 10,000 people, 90% of the smokers were randomly selected, and 10% of the non-smokers were randomly selected. The selected individuals were interviewed, and one question yielded data organised in a table like below:

	Smoke	Not smoke
Had senior smokers in family	600	100
No senior smokers in family	400	800

(I) The risk ratio for smoking between those who had senior smokers in family and those who did not have senior smokers in family can be accurately estimated from the data.
(II) The odds ratio for smoking between those who had senior smokers in family and those who did not have senior smokers in family can be accurately estimated from the data.

(A) Both (I) and (II) are true.
(B) Only (I) is true.
(C) Only (II) is true.
(D) Neither (I) nor (II) are true.

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

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

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

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

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