

**PHILOSOPHY TRIPOS Part IA**

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Tuesday 27 May 2008

09.00 to 12.00

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Paper 3

LOGIC

Answer **three** questions only; at least **one** from **each** section.

*Write the number of the question at the beginning of each answer.*

**STATIONERY REQUIREMENTS**

*20 Page Answer Book x 1*

*Rough Work Pad*

**You may not start to read the questions  
printed on the subsequent pages of this  
question paper until instructed that you  
may do so by the Invigilator**

SECTION A

- 1 Attempt all parts of this question.
- (a) Carefully define the following:
- (i) a truth-function
  - (ii) a truth-functional connective
  - (iii) an expressively adequate set of connectives
- (b) Explain carefully the differences and relations between what is symbolized by ' $\therefore$ ', ' $\models$ ', and ' $\supset$ '.
- (c) Consider PL\*, a variant version of PL whose sole connective is the two-place material conditional ' $\supset$ ' but which also has the falsum or absurdity constant ' $\perp$ ' (which you can treat as a sentence in its own right, and which is always false on any valuation).
- (i) Show how negation, conjunction and disjunction can be expressed in PL\*
  - (ii) Show that PL\* can express any truth-function
- 2 Attempt all parts of this question.
- (a) Using the following translation manual:
- 'a' denotes Arthur
  - 'b' denotes Brian
  - 'Kx' expresses: x is a Kung-Fu fighter
  - 'Nx' expresses: x is a Ninja
  - 'Axy' expresses: x kicks y
- and taking the domain of quantification to be all people, translate the following into QL= as best you can:
- (i) Only if Arthur is a Ninja are all Kung-Fu fighters Ninjas.
  - (ii) Only Arthur and Brian are both Kung-Fu fighters and Ninjas.
  - (iii) No Kung-Fu fighters who are not Ninjas are kicked by Brian.
  - (iv) Every Ninja kicks some Kung-Fu fighter.
  - (v) Any Kung-Fu fighter who kicks some Ninja kicks Brian.
  - (vi) The Kung-Fu fighter who does not kick himself does not kick the Ninja who does not kick himself.
  - (vii) If two Kung-Fu fighters kick Arthur then at least one of them is a Ninja.
  - (viii) The Kung-Fu fighter who kicks Brian either kicks or is kicked by the Ninja who kicks Brian.
  - (ix) If Arthur and Brian are different then there are exactly two Ninjas.

[TURN OVER for continuation of question 2]

(b) Render the following arguments into QL= and use trees to show that they are valid.

- (i) Some logicians are philosophers. All philosophers are wise.  
So some logicians are wise.
- (ii) Jacques is baffled by the predicate calculus. No logician is baffled by the predicate calculus. All mathematicians are logicians. Hence Jacques is not a mathematician.
- (iii) There is a logician whom everyone admires. So everyone admires some logician.
- (iv) Arthur and Brian kicked each other and they are the only people who kicked each other. Nobody loves anybody whom he has not kicked. So if any two people love one another, then Arthur and Brian love one another.
- (v) There are exactly two Ninjas. Arthur and Brian are both Ninjas and are not the same person. Mr Jones is also a Ninja. So Mr Jones is identical to either Arthur or Brian.
- (vi) All Kung-Fu fighters are Ninjas, hence anyone who is the master of a Kung-Fu fighter is the master of a Ninja.

3 Attempt all parts of this question.

(a) Define the notions of transitivity, symmetry and reflexivity.

(b) Let us say that a relation R is *Euclidean* iff  $\forall x \forall y \forall z ((Rxy \ \& \ Rxz) \supset Rzy)$ . For each of the following relations say, if you can, whether it is or is not (A) Transitive (B) Symmetric (C) Reflexive (D) Euclidean. If the answer is no, or if the relation could be either, then say briefly why. You may take the domain to be the set of all people. You may assume that x is a brother of y iff x is male and shares *both* of y's parents.

- (i) x and y are brothers
- (ii) x and y are not brothers
- (iii)  $x = y$
- (iv)  $\sim (x = y)$
- (v)  $\forall z (z \text{ loves } x \supset z \text{ loves } y)$
- (vi) Most people prefer x to y
- (vii) x is a brother of y  $\leftrightarrow$  y is a brother of x

4 Attempt all parts of this question.

(a) A die is thrown twice. It always lands with a number from 1 – 6 showing; every such result has equal probability. Calculate the probability that:

- (i) It lands 6 on the first throw
- (ii) It lands 6 on the first throw or the second throw
- (iii) The sum of the two results is 4
- (iv) The first result is 6 given that the sum of the two results is greater than 7

[TURN OVER for continuation of question 4]

- (b) You are playing *Who Wants to be a Millionaire*. The correct answer to the present question is exactly one of A, B, C and D. You have  $\Pr(A) = \Pr(B) = 30\%$  and  $\Pr(C) = 20\%$ . Chris asks the computer to take away two wrong answers and it removes B and C. Calculate the new probability that A is the right answer.
- (c) Susan visits an island on which there are equal numbers of men and women and on which everyone has exactly two siblings who are also on the island. She marries one of the men at random. What is the probability that he has at least one brother?

#### SECTION B

- 5 What kinds of necessary truth, if any, are not knowable a priori?
- 6 Do empty definite descriptions pose philosophical puzzles? If so, why — and can the puzzles be solved?
- 7 'If ice is heavier than water then ice floats on water.' Make the best case you can for regarding this claim as true. If you are not persuaded by that case, then say where its main weakness lies.
- 8 Is it defensible to draw a sharp line between analytic and synthetic truths?

END OF PAPER