2012 Senior External Examination

Philosophy & Reason
Paper One — Question book

Thursday 8 November 2012

Time allowed

- Perusal time: 10 minutes
- Working time: 3 hours

Examination materials provided

- Paper One — Question book
- Paper One — Response book

Equipment allowed

- QSA-approved equipment
- non-programmable calculator

Directions

You may write in this book during perusal time.

Paper One has three parts:

- Part A — Deductive Logic (Propositional Logic)
- Part B — Deductive Logic (Monadic and Dyadic Logic)
- Part C — Critical Reasoning (Probability and Causation)

Attempt all questions.

Suggested time allocation

- Part A: 60 minutes
- Part B: 60 minutes
- Part C: 40 minutes

The suggested time allocation allows 20 minutes for checking responses.

Assessment

Assessment standards are at the end of this book.

After the examination session

Take this book when you leave.
Planning space
Part A — Deductive Logic (Propositional Logic)

Part A has five questions. Attempt all questions.
Write your responses in the response book.
Suggested time allocation: 60 minutes.

Question 1

Let: 
A = I can find a suitable apartment  
P = My apartment is pet friendly  
B = My brother can look after my dog  
C = I own a cat  
M = I need to move house

a. Translate each of the following into a single well-formed formula of Propositional Logic using only the dictionary provided.

i. My apartment is pet friendly if and only if I own a cat.
ii. My apartment is not pet friendly and nor do I own a cat.
iii. Either I can find a suitable apartment; or my brother can look after my dog and I do not need to move house.
iv. If my brother cannot look after my dog, then, if I can find a suitable apartment I need to move house.
v. Because my apartment is not pet friendly, but I own a cat, I need to move house.

b. Translate each of the following into a single meaningful English sentence using only the dictionary provided.

i. \( P \lor (C \implies M) \)
ii. \( \neg (B \equiv \neg A) \)
iii. \( C \land (P \lor M) \)
iv. \( \neg ((P \land C) \land M) \)
v. \( \neg P \implies ((C \land M) \lor \neg (C \lor M)) \)

Question 2

Use truth tables to determine whether each of the formulas below is a tautology, a contradiction or a contingency.

a. \( \neg ((P \neq Q) \equiv ((P \implies \neg Q) \land (\neg Q \lor \neg P))) \)

b. \( (\neg P \lor (Q \lor R)) \equiv ((P \land Q) \implies R) \)

Note: Each response must contain a clearly identified full main column. Responses which are not complete truth tables must contain in every row sufficient truth value entries to provide evidence of the reasoning supporting the main column value.
Question 3

The main columns of Propositional Logic formulas (a) to (e) were established as follows:

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a. Determine the truth-tabular relationship between the following pairs of formulas:
   i. (a) and (b)
   ii. (a) and (c)
   iii. (a) and (d)
   iv. (c) and (d)
   
   Note: An example of an appropriate response is:
   (m) is equivalent to (n)

b. Explain fully what it means to say that one formula implies another, and give an example (in English).

Question 4

Use truth trees to determine whether each of the symbolised arguments below is valid or invalid.

Set out clearly the reasoning supporting your decisions. If invalid, provide a counter-example. No test of any counter-example is required.

a. \[ A \neq B \]
   \[ (C \lor D) \supset E \]
   \[ \sim (D \supset (F \lor G)) \]
   \[ D \supset (C \equiv \sim B) \]

\[ \therefore (B \lor \sim E) \supset A \]

b. \[ P \lor Q \]
   \[ (R \lor \sim Q) \neq F \]
   \[ (\sim S \& P) \supset T \]
   \[ \sim S \& H \]

\[ \therefore \sim T \supset (R \lor \sim H) \]
**Question 5**

Consider the following diagram:

Let: \( F = x \text{ is a frog} \)
\( G = x \text{ is green} \)

\[
\begin{array}{cc}
F & \sim F \\
G & a & b \\
\sim G & c & d \\
\end{array}
\]

State the characteristics of objects a, b, c and d.

**End of Part A**
Part B — Deductive Logic (Monadic and Dyadic Logic)

Part B has four questions. Attempt all questions.
Write your responses in the response book.
Suggested time allocation: 60 minutes.

Question 6

Let:  
Px = x is a person  
Wx = x is a wedding  
Tx = x is a toast  
xMy = x marries y  
xPy = x proposes y  
a = Alice  
g = Grant

a.  
Translate each of the following into a single well-formed formula using only the dictionary provided.
   i.  Alice marries Grant and proposes a toast.
   ii. There is a wedding attended by both Alice and Grant.
   iii. If Alice marries Grant, then many people will attend a wedding.
   iv. Any person who attends a wedding proposes a toast.
   v. There is a wedding at which no person who attends proposes a toast.

b.  
Translate each of the following well-formed formulas into a single meaningful English sentence using only the dictionary provided.
   i.  (∃x)(Wx & (aAx v gAx))
   ii. ~(∃x)(Wx & (gAx & ~ aAx))
   iii. (∃x)(Wx & aAx) & (∃y)(Ty & gPy)
   iv. (∀x)(∃y)((Tx & (Py & yPx)) ⊃ (∃z)(Wz & yAz))

Question 7

a.  
Test

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to determine whether the values provided form a counter-example to the argument below. 
Set out clearly the reasoning supporting your decision.

~ (∀x)((Ex v Fx) ⊃ Gx)
(∃x)((Gx ⊃ Fx) & Hx)
∴ (∀x)(Hx ⊃ (Gx ≠ Ex))
b. Test

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to determine whether the values provided form a counter-example to the formula below. Set out clearly the reasoning supporting your decision.

$$(\forall x)(\forall y)((x R y \supset \neg y R x) \supset x R x)$$

**Question 8**

a. Use a **truth tree** to produce a counter-example to the argument below. No test of your counter-example is required.

$$(\forall x)(A x \supset B x)$$

$$(\exists x)(B x \& \neg C x)$$

$$\therefore (\exists x)(A x \& \neg C x)$$

b. Use a **truth tree** to test the argument below for validity. Set out clearly the reasoning supporting your decision. If it is invalid, set out as much of a counter-example as the tree provides. No test of any counter-example is required.

$$(\forall x)((R x \& x Da) \supset W x)$$

$$(\forall x)(W x \supset (I x \neq F x))$$

$$\neg (\exists x)((R x \& x Da) \& I x)$$

$$\therefore (\forall x)((R x \& x Da) \supset F x)$$

**Question 9**

Write a short paragraph outlining the limitations in the capacity of symbolic logic languages to convey the meaning of English sentences.

**End of Part B**
Part C — Critical Reasoning (Probability and Causation)

Part C has two questions. Attempt both questions.
Write your responses in the response book.
Suggested time allocation: 40 minutes.

Question 10

a. You roll two standard six-sided dice simultaneously.
   i. What is the probability that exactly one of the dice will land on 3?
   ii. What is the probability that both dice will show the same number?
   iii. What is the probability that the combined total of the two dice will be 10 or greater?

   Note: Your response should be in the form of fractions, for example \( \frac{1}{4} \times \frac{1}{2} \), \( \frac{2}{3} \times \frac{1}{8} \) etc.
   No further calculation from this form is required.

b. Peter wants to purchase a jetski.
   If he is able to get a job, he will be able to purchase the jetski.
   If he does not get a job, he might able to borrow money from his parents.
   Peter estimates the probability of getting a job as approximately \( \frac{1}{3} \).
   If he doesn’t get a job, then the chances that his parents will lend him money are about \( \frac{1}{8} \).
   What is the probability that Peter can purchase a jetski?

   Note: Your response should be in the form of fractions, for example \( \frac{1}{4} \times \frac{1}{2} \), \( \frac{2}{3} \times \frac{1}{8} \) etc.
   No further calculation from this form is required.

c. Roulette is a casino game where a ball is spun around a wheel containing 37 numbered spaces. A player may place a bet on the ball landing in any one of those spaces. If the ball lands in the space chosen by the player, the casino will pay $35 for every $1 bet. (If the ball does not land in the space chosen by the player, the player loses their money.)
   How much can the casino expect to profit, over time, for every $100 wagered?
Question 11
A group of colleagues attended an office morning tea where various types of muffins were served. Following the morning tea, some of the attendees reported feeling unwell. It was suspected that a particular type of muffin or perhaps a combination of muffins was to blame.
A summary of the muffins sampled by each of the attendees is shown below.

Use only the simple conditions or complex conditions (conjunctions and disjunctions) listed in the table.


b. Based on the information in the table:
   i. Was any listed simple condition (or the absence thereof) a possible necessary condition for feeling unwell? If so, list all such conditions.
   ii. Was any listed complex condition a possible necessary condition for feeling unwell? If so, list all such conditions.
   iii. Was any listed simple condition (or the absence thereof) a possible sufficient condition for feeling unwell? If so, list all such conditions.
   iv. Was any listed complex condition a possible sufficient condition for feeling unwell? If so, list all such conditions.
   v. Was any listed simple or complex condition a possible both necessary and sufficient condition for feeling unwell? If so, list all such conditions.

c. Evaluate the usefulness of this method for identifying the cause of the illness.

End of Part C

End of Paper One
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<td>Knowledge</td>
<td>The candidate demonstrates accurate recall and extensive understanding of a comprehensive range of concepts, ideas, procedures and principles. Occasional minor errors may be made, but do not indicate fundamental misunderstandings.</td>
<td>The candidate demonstrates accurate recall and understanding of a range of concepts, ideas, procedures and principles.</td>
<td>The candidate recalls and describes most concepts, ideas, procedures and principles.</td>
<td>The candidate recalls and describes some concepts, ideas, procedures and principles.</td>
<td>The candidate describes few concepts, ideas, procedures and principles.</td>
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<td>Application</td>
<td>The candidate: • applies appropriate techniques and procedures of deductive reasoning to simple and complex tasks with facility and accuracy • classifies and evaluates a wide range of simple and complex artificial arguments and constructs well-supported arguments drawing on a wide range of inductive skills.</td>
<td>The candidate: • applies appropriate techniques and procedures of deductive reasoning with accuracy to simple (and some complex) tasks • classifies and evaluates a range of simple and complex artificial arguments and constructs, with some support; arguments that draw on a range of inductive skills.</td>
<td>The candidate: • uses prescribed techniques and procedures of deductive reasoning in most simple tasks and applies them with accuracy • classifies and evaluates simple arguments and constructs arguments drawing on some inductive skills.</td>
<td>The candidate: • uses prescribed techniques and procedures of deductive reasoning in some simple tasks, with some lapses in accuracy • classifies some simple arguments; few inductive skills are evident.</td>
<td>The candidate: • uses prescribed techniques and procedures of deductive reasoning inaccurately and incompletely • occasionally classifies some simple arguments.</td>
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<td>Communication</td>
<td>The candidate: • consistently organises and presents information cogently and coherently, and communicates both evident and implied meaning effectively • produces explanations, descriptions, arguments and justifications that are precise, pertinent and purposeful.</td>
<td>The candidate: • organises and presents information coherently, and communicates meaning effectively • produces clear and purposeful explanations, descriptions, arguments and justifications.</td>
<td>The candidate: • organises and presents information so that meaning is usually evident • produces explanations, descriptions and arguments that are adequate to convey intention.</td>
<td>The candidate: • presents information and produces explanations that lack detail and clarity.</td>
<td>The candidate: • presents disjointed information and descriptions.</td>
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