Philosophy & Reason

Tuesday 11 November 2014

Paper One — Question book

Time allowed

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

Examination materials provided

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

Equipment allowed

- QCAA-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 (Monadie and Dyadic Logic)
- Part C — Critical Reasoning (Probability and Causation)

Attempt all questions.

Suggested time allocation

- Part A: 60 minutes
- Part B: 70 minutes
- Part C: 30 minutes

The suggested time allocation allows 20 minutes for checking responses.

Assessment

Paper One assesses the following assessment criteria:

- Knowledge
- Application
- Communication

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 17 questions. Attempt all questions.
Suggested time allocation: 60 minutes.

Section 1 — Multiple choice

Section 1 has six questions. Attempt all questions.
Each question contains four options. Select the option that you think is correct or is the best option. Respond on page 1 of the response book.

Questions 1–6 use the following dictionary.

Let:

- B = The band plays Colonel Bogey’s March
- C = The crowd cheers
- D = The drummers keep the beat
- E = The euphonium is too loud
- F = The weather is fine
- G = The parade is a great success

Question 1

Choose the best translation of:

\((F \land D) \supset (B \supset G)\)

A  If the weather is fine and the drummers keep the beat, then if the band plays Colonel Bogey’s March the parade is a great success.

B  If the band plays Colonel Bogey’s March then the parade is a great success, but only if the weather is fine and the drummers keep the beat.

C  If the weather is fine and the drummers keep the beat, then the parade is a great success only if the band plays Colonel Bogey’s March.

D  If the weather is fine and the drummers keep the beat, then the band will play Colonel Bogey’s March because the parade is a great success.
**Question 2**

Choose the best translation of:

\((\neg D \lor E) \land (\neg C \land D)\)

A Either the drummers don’t keep the beat or the euphonium is too loud, and it’s not the case that both the crowd cheers and the band plays Colonel Bogey’s March.

B Neither the drummers keep the beat nor is the euphonium too loud, which means the crowd doesn’t cheer despite the band playing Colonel Bogey’s March.

C Either the drummers don’t keep the beat or the euphonium is too loud, and the crowd doesn’t cheer even though the band plays Colonel Bogey’s March.

D Neither the drummers keep the beat nor the crowd cheers, and the euphonium is too loud when the band plays Colonel Bogey’s March.

**Question 3**

Choose the best translation of:

\(G \equiv (F \neq B)\)

A The parade is a great success only if neither the weather is fine nor the band plays Colonel Bogey’s March.

B The parade is a great success if and only if either the weather is fine or the band plays Colonel Bogey’s March (but not both).

C Exactly one of the following is true: the parade is a great success; the weather is fine; the band plays Colonel Bogey’s March.

D That the parade is a great success is both necessary and sufficient for the weather to be fine or the band to play Colonel Bogey’s March.

**Question 4**

Choose the best symbolisation of:

The parade is a great success because the weather is fine.

A \(F \supset G\)

B \(G \supset F\)

C \(F \equiv G\)

D \(G \nleftrightarrow F\)
Question 5

Choose the best symbolisation of:

If neither the drummers keep the beat nor the euphonium is not too loud, then the crowd does not cheer and the parade is not a great success.

A \((\sim D \lor \sim E) \supset (\sim C \land G)\)
B \((\sim D \land \sim E) \supset \sim (C \land G)\)
C \(\sim (D \lor \sim E) \supset (\sim C \land \sim G)\)
D \(\sim (D \land \sim E) \supset (\sim C \land \sim G)\)

Question 6

Choose the best symbolisation of:

That the weather is fine is not sufficient for the parade to be a great success.

A \(~F \supset G\)
B \(F \supset \sim G\)
C \(\sim F \supset G\)
D \(\sim (F \supset G)\)

End of Section 1
Section 2 — Short response

Section 2 has 11 questions. Attempt all questions.
Write your responses in the response book.

Questions 7–10 use the following dictionary.

Let:  B = The band plays Colonel Bogey’s March
     C = The crowd cheers
     D = The drummers keep the beat
     E = The euphonium is too loud
     F = The weather is fine
     G = The parade is a great success

Question 7
Translate the following formula into a single meaningful English sentence using only the dictionary provided.

$$(((B \supset C) \& (C \supset \neg D)) \lor E) \supset \neg G$$

Question 8
Translate the following formula into a single meaningful English sentence using only the dictionary provided.

$$\neg G \equiv (\neg D \& E) \not\equiv \neg F$$

Question 9
Symbolise the following sentence into a single well-formed formula using only the dictionary provided.

The parade is not a great success only if either the band doesn’t play Colonel Bogey’s March, or they do play it but the drummers don’t keep the beat.

Question 10
Symbolise the following sentence into a single well-formed formula using only the dictionary provided.

The band plays Colonel Bogey’s March and the crowd cheers even though the euphonium is too loud, which is sufficient for the parade to be a great success.
Question 11

In the truth table below, the main operator is missing.

<table>
<thead>
<tr>
<th>P</th>
<th>Q</th>
<th>(P ⊃ Q)</th>
<th>(~P v Q)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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</tbody>
</table>

Identify which of the following symbols could be the main operator, and explain why.

a.  ≢  

b.  v  

c.  ≡  

d.  &  

Question 12

Use a truth table to determine whether the formula below is a tautology, a contradiction or a contingency.

\[(P \supset \neg Q) \& (P \not\equiv Q) \equiv \neg (P \& Q) \& (\neg P \supset Q)\]

Note: Your truth table must contain a clearly identified main operator 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 operator column value.

Question 13

Use a truth table to determine whether the argument below is valid or invalid. If it is invalid, state a counter-example.

\[
P \equiv (Q \lor R) \\
P \supset (Q \supset \neg R) \\
\therefore R \equiv (P \lor Q)
\]

Note: Responses which are not complete truth tables must contain sufficient truth value entries to provide evidence of the reasoning supporting the main operator column values.
**Question 14**

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

<table>
<thead>
<tr>
<th>(a)</th>
<th>(b)</th>
<th>(c)</th>
<th>(d)</th>
<th>(e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Determine the truth-tabular relationship between the following pairs of formulas:

i. (a) and (b)
ii. (a) and (c)
iii. (a) and (d)
iv. (a) and (e)
v. (b) and (e)

**Question 15**

Use the truth tree method to determine whether the following formula is a tautology, a contradiction or a contingency.

\((P \land Q) \equiv \sim P \supset \sim Q\)

**Question 16**

Use the truth tree method to determine whether the argument below is valid or invalid. If it is invalid, state a counter-example. (This is the same argument that appeared in Question 13. Check that your answers are consistent!)

\[ \begin{align*}
P & \equiv (Q \lor R) \\
\neg P & \supset (Q \supset \neg R) \\
\therefore R & \equiv (P \lor Q)
\end{align*} \]
Question 17

Consider the following statement:

*In the proposition ‘A is a necessary condition for B’, A must be the antecedent and B must be the consequent. This is because, in general, the antecedent is the condition that needs to be fulfilled; and the proposition clearly states that A is the condition. Anyone who says any different is wrong.*

Demonstrate your understanding of propositional logic by writing a paragraph evaluating the accuracy of the statement. You may provide your own example to aid your explanation. Write approximately 100 words in total.

End of Section 2

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

Part B has 13 questions. Attempt all questions.
Suggested time allocation: 70 minutes.

Section 1 — Multiple choice

Section 1 has six questions. Attempt all questions.
Each question contains four options. Select the option that you think is correct or is the best option. Respond on page 1 of the response book.

Questions 1–6 use the following dictionary.

Let:  

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ax</td>
<td>x is an animal</td>
</tr>
<tr>
<td>Nx</td>
<td>x is native</td>
</tr>
<tr>
<td>Fx</td>
<td>x is feral</td>
</tr>
<tr>
<td>Bx</td>
<td>x is a bilby</td>
</tr>
<tr>
<td>Cx</td>
<td>x is a cat</td>
</tr>
<tr>
<td>xK</td>
<td>x kills y</td>
</tr>
<tr>
<td>xI</td>
<td>x inhabits y</td>
</tr>
<tr>
<td>a</td>
<td>Australia</td>
</tr>
<tr>
<td>c</td>
<td>Charles</td>
</tr>
</tbody>
</table>

Question 1

Choose the best translation of:

$(\forall x)((Ax & Fx) \supset (\exists y)(Ay & Ny & xK))$

A  All native animals are killed by feral animals.
B  All feral animals kill at least one native animal.
C  At least one native animal has been killed by a feral animal.
D  If all animals are feral, then some native animals are killed by them.

Question 2

Choose the best translation of:

$\sim (\forall x)(\exists y)((Fx & Cx) \supset (By & xK))$

A  Some feral cats kill bilbies.
B  Some bilbies are killed by feral cats.
C  Not all bilbies are killed by feral cats.
D  It’s not the case that all feral cats kill bilbies.
Question 3
Choose the best translation of:
\((\exists x)(\sim(\exists y)(Bx & Cy & Fy & yKx))\)
A Some bilbies kill no feral cats.
B Not all cats that kill bilbies are feral.
C Many bilbies are not killed by feral cats.
D Every bilby that is killed, is killed by a feral cat.

Question 4
Choose the best symbolisation of:
If any feral cat kills a bilby, then Charles kills that cat.
A \((\forall x)(Bx & Cy & xKy) \supset cKx\)
B \((\exists x)((Bx & (Fy & Cy & yKx)) \supset cKx)\)
C \((\forall x)((Cx & Fx & (\exists y)(By & xKy)) \supset cKx)\)
D \((\exists x)(((Fx & Cx) & (\exists y)(By & xKy)) \supset cKx)\)

Question 5
Choose the best symbolisation of:
Bilbies are native animals of Australia.
A \((\forall x)(Bx \supset (Ax & Na))\)
B \((\exists x)(Bx & Nx & Ax & aIx)\)
C \((\forall x)((Nx & Ax & xIa) \supset Bx)\)
D \((\forall x)((Bx & xIa) \supset (Ax & Nx))\)

Question 6
Choose the best symbolisation of:
All cats are either feral animals or native animals, but never both.
A \((\forall x)((Cx & Ax) & (Fx \neq Nx))\)
B \((\forall x)(Cx \supset ((Fx & Ax) \neq (Nx & Ax)))\)
C \((\forall x)(Cx & Fx & Ax) \neq (Ax)(Cx & N & A)\)
D \((\forall x)((Cx & Ax) \supset Fx) \neq (\forall x)((Cx & Ax) \supset N)\)

End of Section 1
Section 2 — Short response

Section 2 has seven questions. Attempt all questions.
Write your responses in the response book.

Questions 7–10 use the following dictionary.

Let:

- \( A(x) \) = \( x \) is an animal
- \( N(x) \) = \( x \) is native
- \( F(x) \) = \( x \) is feral
- \( B(x) \) = \( x \) is a bilby
- \( C(x) \) = \( x \) is a cat
- \( \exists y \) = \( x \) kills \( y \)
- \( x I y \) = \( x \) inhabits \( y \)
- \( a \) = Australia
- \( c \) = Charles

Question 7

Translate the following formula into a single meaningful English sentence using only the dictionary provided.

\((\exists x)(C(x) \& N(x) \& A(x))\)

Question 8

Translate the following formula into a single meaningful English sentence using only the dictionary provided.

\(C(c) \& \neg F(c) \& (\exists x)(B(x) \& cK(x))\)

Question 9

Symbolise the following sentence into a single well-formed formula using only the dictionary provided.

There are native bilbies and native cats inhabiting Australia.

Question 10

Symbolise the following sentence into a single well-formed formula using only the dictionary provided.

If all bilbies are killed by feral cats, there will be no bilbies inhabiting Australia.
Question 11

Test:

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>M</th>
<th>O</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
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<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>b</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

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

\[
\sim (\forall x)((Lx \lor Mx) \supset Ox) \\
(\exists x)((Ox \equiv Mx) \land Rx) \\
\therefore (\forall x)(Rx \supset (Ox \neq Lx))
\]

Question 12

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

\[
(\exists x)(Fx \land Dx) \\
(\forall x)(Dx \supset \neg Px) \\
\therefore (\exists x)(Fx \land \neg Px)
\]

Question 13

Symbolise the following argument using only the dictionary provided, and use the truth tree method to test it for validity. If the argument is invalid, set out as much of a counter-example as the tree provides. No test of any counter-example is required.

Let:  
\begin{align*}
Ux &= x \text{ is a university student} \\
Mx &= x \text{ is an amount of money} \\
Ex &= x \text{ is the earnings from a part-time job} \\
Lx &= x \text{ is a loan from parents} \\
xSy &= x \text{ spends } y \text{ on books} \\
a &= \text{ Anita}
\end{align*}

All university students spend an amount of money on books. Any amount of money spent by a university student on books is either from a part-time job or a loan from parents (or both). Anita is a university student. No amounts of money Anita has spent on books are from earnings from part-time jobs. Therefore Anita has spent an amount of money on books that is a loan from parents.

End of Section 2

End of Part B
Question 1

Margaret, Shuktika and Danny each buy a box containing the following chocolates: three Mars Bars, two Snickers, one Cherry Ripe and two Turkish Delights.

Consider each of the following situations separately:

i. Margaret randomly picks one chocolate from her box, eats it, then picks again. What is the probability that she picked two Mars Bars?

ii. Shuktika randomly picks one chocolate from her box, replaces it, then picks again. What is the probability that she picked the same kind of chocolate both times?

iii. Danny is allowed to pick from his box a maximum of three times. If he is happy with his pick, he keeps it and does not pick again. If he is not happy with his pick, he must replace it before picking again. Danny doesn’t like Turkish Delights. What is the probability that he will end up unhappy?

Question 2

Amanda is a 21-year-old student who wears glasses, studies conscientiously and achieves good grades.

Which of the following statements is more likely to be true?

a. Amanda lives with her parents.

b. Amanda lives with her parents and is a regular visitor to the library.

Explain your response.
Question 3

1 = present
0 = absent

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>(A v B)</th>
<th>(A v C)</th>
<th>(B v D)</th>
<th>Z</th>
</tr>
</thead>
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<td>Case 2</td>
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<tr>
<td>Case 3</td>
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<td>Case 4</td>
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<td>Case 5</td>
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</table>

Answer the following questions based on the information in the table.

i. One simple condition is a possibly necessary but not sufficient condition for effect Z. Name this condition.

ii. Was any simple condition a possibly necessary and sufficient condition for effect Z? If so, list all such conditions.

iii. Was any listed complex condition a possibly sufficient but not necessary condition for effect Z? If so, list all such conditions.

iv. In your response book, supply a complete possible case 5 in which effect Z is present that will:

   • preserve the possibly necessary but not sufficient simple condition for effect Z
   • reduce to one the number of listed complex conditions that are possibly both necessary and sufficient for effect Z.

End of Part C

End of Paper One
### Assessment standards derived from the Philosophy & Reason Senior External Syllabus 2004

**Paper One**

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Knowledge</strong></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>
</tr>
<tr>
<td><strong>Application</strong></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>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td>The candidate: • consistently organises and presents information 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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</tbody>
</table>