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
Take this book when you leave the examination room.
Planning space
Part A: Deductive Logic – Propositional Logic

Attempt all questions in Part A.
Suggested time allocation: 60 minutes.

Question 1

Let: 

P = Property prices continue to decline.
R = Interest rates rise.
F = The bank forecloses on my mortgage.
B = I go bankrupt.

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

i. If interest rates rise, then the bank will foreclose on my mortgage and I will go bankrupt.

ii. I will go bankrupt if and only if both property prices continuing to decline and interest rates rising are together sufficient for the bank to foreclose on my mortgage.

iii. If neither property prices continue to decline nor interest rates rise, then the bank will not foreclose on my mortgage and I will not go bankrupt.

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

i. (~ P & ~ R) v (B & F)

ii. ~ B  (~ P v (~ R & F))

iii. ~ (F  B) ≠ R

Question 2

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

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.

a. ((p & q) ≠ ~ p)  ~ q

b. (p  (q  r)) ≡ (~ (~ p v ~ q) v r)
**Question 3**

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

<table>
<thead>
<tr>
<th>(a)</th>
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(a) Determine the truth-tabular relationships between the following pairs of formulas:

i. (a) and (b)

ii. (a) and (c)

iii. (a) and (d)

iv. (a) and (e)

(b) Respond to the following:

i. What truth-tabular relationship exists between (b) and (c)?

ii. Explain (in English) the reasoning supporting your response.

**Question 4**

Use **truth trees** (or any other appropriate method) to determine whether each of the following symbolised arguments 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)**

\[
\begin{align*}
K &\equiv M \\
(\neg L \lor M) &\Rightarrow S \\
(\neg S \land W) &\Rightarrow Q \\
W &\land K \\
\therefore & L \Rightarrow Q
\end{align*}
\]

**(b)**

\[
\begin{align*}
P &\Rightarrow Q \\
\neg Q &\land \neg S \\
(P &\land R) &\not\equiv S \\
\neg R &\Rightarrow (T &\land U) \\
\therefore & U &\land T
\end{align*}
\]

Note: Types of responses required are:

(m) is equivalent to (n)

(m) is contradictory to (n)

(m) is contrary to (n)

(m) is subcontrary to (n)

(m) implies (n)

(m) is implied by (n)

(m) is indifferent to (n)
Question 5

a. Explain why, when testing for tautology using a truth tree, the formula is first negated. (Respond in English, in 1–2 sentences.)

b. Describe how you would use a truth tree to test whether two formulas were equivalent. (Respond in English, in 1–2 sentences.)

End of Part A
Part B: Deductive Logic – Monadic and Dyadic Logic

Attempt all questions in Part B.
Suggested time allocation: 60 minutes.

Question 6

Let:  
- a = Alan  
- b = Betty  
- c = Candace  
- Px = x is a person  
- Hx = x is happy  
- Sx = x is sad  
- xJy = x is jealous of y  
- xLy = x loves y

Note: The universal quantifier (\(\forall x\)) is often abbreviated to (x). Either form is appropriate.

a. Translate each of the following into a single well-formed formula of Predicate Logic (QT) using only the dictionary provided.
   i. All people who love someone, but are not loved by that person, are sad.
   ii. Betty and Candace both love Alan, and are jealous of the happy person that Alan loves.

b. Translate each of the following well-formed formulas of Predicate Logic (QT) into a single meaningful English sentence, using only the dictionary provided.
   i. \((\forall x)((Px & Hx & aLx & xLa) \rightarrow cJx)\)
   ii. \((\exists x)(Hx & Px & (\forall y)(Py \Rightarrow yJx))\)

Question 7

a. Test

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

\((\exists x)(Fx & Gx)\)
\((\forall x)(Fx \Rightarrow \sim Hx)\)
\(\therefore (\exists x)(Fx & Hx)\)
b. Test

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

\[(\forall x)(\exists y)xFy \supset (\exists x)(\forall y)yGx\]

**Question 8**

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

\[
\begin{align*}
(\forall x)(Fx \supset Gx) \\
(\exists x)(Fx & Hx)
\end{align*}
\]

\[\therefore (\forall x)(Hx \supset Gx)\]

b. Use a truth tree to test the following argument 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.

\[
\begin{align*}
(\forall x)(\exists y)(Fx \supset (Gy & xLy)) \\
(\forall x)(Gx \supset \neg (Hx & Ix)) \\
Fa & (\forall x)((Gx & aLx) \supset Hx)
\end{align*}
\]

\[\therefore \neg (\exists x)(aLx & Gx & Ix)\]

**Question 9**

For each of the following, taken separately, state whether the meaning of the sentence can be adequately conveyed by a symbolic logic language. For those whose meaning cannot be adequately conveyed, explain (in 1–2 sentences) why the true meaning of the sentence is difficult to convey with a symbolic logic language.

a. “I promise to tell the truth, the whole truth, and nothing but the truth in this court of law.”

b. He is not the sharpest tool in the toolshed.

c. If she’s a good teacher, I’m going to do well in this subject.

d. If he’s telling the truth, I’m Copernicus.

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

Attempt all questions in Part C.
Suggested time allocation: 40 minutes.

Question 10

a. If a representative sample of 500 voters in the electorate of South Brisbane was surveyed during the week leading up to the Queensland state election, and 70% said that they would vote Labor, which of the following claims has the highest inductive probability? Give reasons for your choice.

X: The Labor candidate will win in South Brisbane, with 70% of the primary vote.
Y: Labor will win the election.
Z: The Labor candidate will win in South Brisbane.

b. Kane is one of the finalists on So You Think You Can Dance. He is a ballet specialist, and the probability of his winning if he dances ballet in the final is estimated at 7/8. The probability of his winning if he dances any other style is only 4/8. The dance style is chosen randomly, so the probability of choosing ballet is 1/5. What is the probability of Kane winning?

Let: \[ B = \text{Kane dances ballet in the final.} \]
\[ W = \text{Kane wins So You Think You Can Dance.} \]
(Note: Your response should be in the form of fractions, for example \( \frac{1}{4} \times \frac{1}{2} \), \( \frac{2}{3} + \frac{1}{8} \) etc. No further calculation from this form is required.)

c. The local primary school is having a fundraiser, and the Year 2 class wants to run a “Lucky Lick-a-Stick” stand. Their plan is to make 100 fruit iceblocks, one of which will have the “lucky stick”. If they sell their iceblocks for $1 each, and the lucky stick wins a prize of $50, what is the expected value of the investment for each individual iceblock purchaser? Set out a table (or other evidence) to verify your response.

d. A casino patron has been watching the roulette table for several hours and has noticed that number 23 has not been spun since his arrival. He reasons that he should start betting heavily on number 23 because it is bound to come up soon. Is this argument a fallacy? Justify your response in 2–4 sentences.
Question 11

A group of health and physical education students are investigating weight loss methods. They conduct a study on the attempts made by six of their classmates to lose weight. A summary of their research is presented in Table 1 below.

Key:  
- A = doing aerobics regularly
- B = bicycle riding regularly
- C = drinking chocolate “meal-replacement” milkshakes
- D = drinking Diet Coke
- E = enthusiasm about losing weight
- Z = significant weight loss
- 1 = present
- 0 = absent

<table>
<thead>
<tr>
<th>Person</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>A&amp;D</th>
<th>AvB</th>
<th>DvE</th>
<th>Z</th>
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Use only the simple conditions or complex conditions (conjunctions and disjunctions) listed in Table 1.

a. In your response book, reproduce the three columns for the complex factors A&D, AvB, DvE, and fill in the values.

b. Using your chart, respond to the following questions:
   i. Was any listed simple condition a possible necessary condition for significant weight loss? If so, list all these conditions.
   ii. Was any listed complex condition a possible necessary condition for significant weight loss? If so, list all these conditions.
   iii. Was any listed simple condition a possible sufficient condition for significant weight loss? If so, list all these conditions.
   iv. Was any listed complex condition a possible sufficient condition for significant weight loss? If so, list all these conditions.
   v. Was any listed simple or complex condition a possible both necessary and sufficient condition for significant weight loss? If so, list all these conditions.

Question 11 continues overleaf
c.

i. Based on the results of this study, what advice might you give to someone wishing to lose weight?

ii. Identify and briefly explain one of the problems affecting the quality of this study.

End of Part C

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

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<tr>
<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>
</tr>
<tr>
<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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<tr>
<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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