

THE UNIVERSITY OF BRITISH COLUMBIA

**Philosophy 220A**

Symbolic Logic I

ANOTHER FAKE MIDTERM EXAMINATION

TIME: 75 MINUTES

NAME: \_\_\_\_\_

STUDENT NUMBER: \_\_\_\_\_

**SPECIAL INSTRUCTIONS:**

Answer all questions. If you get stuck on a question, go on to the next, and return to it later. Indeed, it is wise to read the whole paper before you start, and begin with the easiest questions. Including this cover page, and the sheet of rules, this examination booklet should consist of eight pages. Check that these are all present before the examination begins.

Your answers to all questions should be written in this booklet, in the spaces provided.

For rough work, you may use the plain backs of the sheets in this booklet. If necessary, I can also supply a separate booklet for rough work.

INSTRUCTOR: Richard Johns

1. Translate the following sentences from English to FOL, or FOL to English, using the dictionary provided. [8, 8, 8 marks]

Cube(x)      Large(x)      Larger(x, y)      Adjoins(x,y)      Tet(x)  
 Medium(x)      Small(x)      SameRow(x, y)

(i) a is small, but it's a cube only if it's in the same row as either b or c.

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(ii) Unless it's medium, b is small if and only if it is not large.

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(iii)  $\neg(\text{Small}(a) \wedge \text{Cube}(a)) \rightarrow ((\text{Large}(a) \vee \text{Medium}(a)) \wedge \text{Tet}(a))$

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2.

Cube(a)
Large(b) $\rightarrow$ Cube(b)
Large(b) $\rightarrow$ SameShape(a, b)

Cube(a) $\rightarrow$ (Dodec(b) $\rightarrow$ a $\neq$ b)
Dodec(b) $\wedge$ a = b
$\neg$ Cube(a)

TT valid? \_\_\_\_\_

\_\_\_\_\_

Logically valid? \_\_\_\_\_

\_\_\_\_\_

(i) Answer the four questions above, filling the spaces provided with 'yes' or 'no'. [8 marks]

(ii) Show that one of the arguments is not TT valid by means of *one row* of a truth table, i.e. by providing *one* suitable assignment of truth values to the atomic sentences within the argument. [8]


3. Use a truth table to determine whether or not the conclusion of the following argument is a tautological (TT) consequence of the premises. Place an asterisk (\*) next to any row (or rows) that is sufficient to determine the answer. (There may be no such row.) [8 marks for table]

$$\begin{array}{|l}
 A \rightarrow (H \wedge J) \\
 J \leftrightarrow H \\
 \hline
 \neg J \\
 \hline
 \neg A
 \end{array}$$


Answer: \_\_\_\_\_ [6 marks]

4. Show that the following argument is not logically valid, by constructing an appropriate world. [12 marks]

$$\begin{array}{|l}
 Tet(a) \rightarrow SameRow(a, b) \\
 \neg SameSize(a, b) \wedge RightOf(b, a) \\
 \hline
 Smaller(b, a) \vee Tet(a) \\
 \hline
 Larger(a, b) \vee \neg SameShape(a, b)
 \end{array}$$

[Draw your world below.]

5. For each of the following arguments, prove that the argument is valid by providing a formal proof (in  $\mathcal{F}$ ) of the conclusion from the premises.

(i) Write your proof under the premises provided below. [6 marks]

$$\left| \begin{array}{l} \neg(A \vee B) \\ \hline \neg B \end{array} \right.$$

$$\left| \begin{array}{l} \neg(A \vee B) \\ \hline \end{array} \right.$$

(ii) Write your proof under the premises provided below. [8 marks]

$$\begin{array}{l} | G \vee N \\ | \underline{S \vee N} \\ | (G \wedge S) \vee N \end{array}$$

$$\begin{array}{l} | G \vee N \\ | \underline{S \vee N} \end{array}$$

(iii) Write your proof under the premises provided below. [8 marks]

$$\begin{array}{l} (A \wedge B) \rightarrow C \\ A \rightarrow \neg(G \vee H) \\ G \vee B \\ \hline \neg(A \wedge \neg C) \end{array}$$

$$\begin{array}{l} (A \wedge B) \rightarrow C \\ A \rightarrow \neg(G \vee H) \\ G \vee B \\ \hline \end{array}$$

(iv) Write your proof under the premises provided below. [10 marks]

$$\begin{array}{l} | A \vee C \\ | C \rightarrow \neg(\neg A \wedge \neg B) \\ \hline | \neg A \rightarrow B \end{array}$$

$$\begin{array}{l} | A \vee C \\ | C \rightarrow \neg(\neg A \wedge \neg B) \\ \hline \end{array}$$

Total: \_\_\_\_\_

100