Name _____

Midterm
Philosophy 134
Spring, 2007

1. Explain why the following semantical entailment holds in *S4I*:

   $\{\Diamond\Box\Diamond\alpha\} \vDash_{S4I} \Diamond\alpha$

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2. The following semantical systems are ranked in decreasing order of strength.

$$
\begin{array}{c}
S4I \\
\downarrow \\
TI \\
\downarrow \\
DI \\
\downarrow \\
KI
\end{array}
$$

For each system stronger than KI, give a consequence relation which holds in the stronger system but not in the immediately weaker system.

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3. Show that the following derivability relation holds in KD by giving a derivation (you may **not** use Duality or derived rules of SD):

$\{\Box\Diamond P, \Box\Box Q\} \vdash_{KD} \Box\Diamond(P \equiv Q)$.

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4. Show that the following is a theorem of *TD* by giving a derivation (you **may** use derived rules of *SD* but **may not** use Duality):

$\vdash_{TD} \Diamond(P \supset \Box P)$.

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5. Show that the following semantical entailment holds in KI:
   $\{\Box D \supset \Diamond E\} \vDash_{KI} \Diamond(D \supset E)$.

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6. Show that the following semantical entailment fails in KI:
   $\{\Diamond(P \supset \Diamond Q)\} \not\models_{KI} \Diamond(P \supset Q)$.