# Problem 1

Prove $r$ from $(p \wedge \neg p)$.

| | | |
|---|---|---|
| 1 | $(p \wedge \neg p)$ | Premise |
| 2 | $\neg r$ | Proof by contradiction |
| 3 | $p$ | 1, Simp. |
| 4 | $(\neg p \wedge p)$ | 1, Comm. |
| 5 | $\neg p$ | 4, Simp. |
| 6 | $r$ | 3, 5 Contradiction |

# Problem 2

Prove $\neg r$ from $(p \wedge \neg p)$.

| | | |
|---|---|---|
| 1 | $(p \wedge \neg p)$ | Premise |
| 2 | $r$ | Proof by contradiction |
| 3 | $p$ | 1, Simp. |
| 4 | $(\neg p \wedge p)$ | 1, Comm. |
| 5 | $\neg p$ | 4, Simp. |
| 6 | $\neg r$ | 3, 5 Contradiction |

# Problem 3

Draw a configuration of worlds where $(\neg p \wedge \Box\Diamond p)$ and explain clearly why it works.

One set of worlds might look like this:

$W_1 = \{\neg p\}$

$W_2 = \{p\}$

In this configuration, one world, $W_1$ satisfies the $\neg p$. The second world, $W_2$ satisfies that it be necessary that $p$ is possible.

# Problem 4

$(\Box p \rightarrow \Diamond p)$ is a tautology. Explain clearly why.

If you have a configuration of worlds such that $\Box p$ is true, then each world in the configuration has $p$. Thus, $\Diamond p$ would be true for this configuration. If the configuration of worlds does not satisfy $\Box p$, then the implication is satisfied regardless of $\Diamond p$.