Amsterdam University College

Logic, Information flow and Argumentation

Homework exercises, Week 12, part a (due Friday 27 April).

1. Consider the following translation key:

   - B = Bill (so use $\Box_B$ and $\Diamond_B$)
   - M = Mary (so use $\Box_M$ and $\Diamond_M$)
   - S = Steve (so use $\Box_S$ and $\Diamond_S$)
   - w = it is warm
   - s = it is sunny
   - j = there is a traffic jam

   Translate the following sentences into epistemic logic:

   (a) Bill and Mary both know that it is warm and sunny.

   (b) Steve knows that it is sunny and that there is no traffic jam, but does not know whether it is warm.

   (c) Bill considers it possible that it is warm and sunny, and Mary considers it possible that it is warm and not sunny.

   (d) Neither Bill, nor Mary, nor Steve know whether it is sunny.

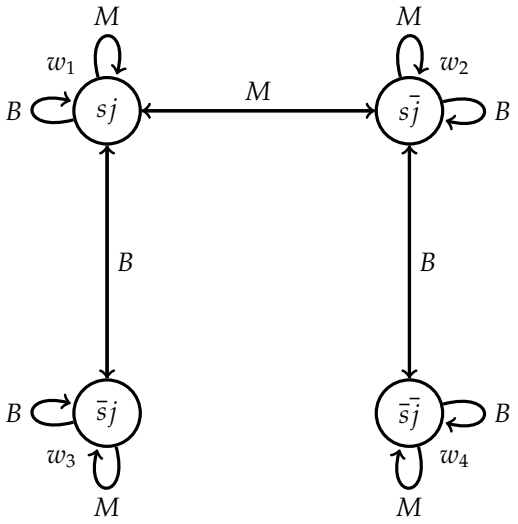
   (e) If Bill knows that there is a traffic jam, then Mary and Steve know it too.

   (f) Steve considers it possible that neither Mary nor Bill know that there is a traffic jam, but actually there is a traffic jam.

   (g) Steve knows that if Mary knows that it is sunny, then Mary also knows that it is warm; but Bill doesn't know this.

   (h) Mary knows the following: if Bill knows that Steve knows that it is warm, sunny and there is no traffic jam, then Steve knows that Bill knows this.

2. Consider the following epistemic model.



Using the same translation as above, decide whether the following sentences are valid in the actual world w_1.

(a) Mary knows that it is sunny.

(b) Bill does not know whether it is sunny or not, but he knows that Mary does know it.

(c) Mary knows that Bill does not know whether it is sunny or not.

(d) Mary knows that Bill knows that Mary knows whether it is sunny or not.

(e) Bill doesn't consider it possible that there is no traffic jam.

(f) Mary considers it possible that there is a traffic jam, and also that there isn't one.

(g) Bill knows that Mary considers it possible that there is no traffic jam, although he knows that there is one.

3. Consider the following five sentences:

   (a) It is sunny.

   (b) It is warm.

   (c) Steve knows that it is sunny.

   (d) Steve considers it possible that it is not warm.

   (e) Steve considers it possible that it is warm.

   Construct a model in such a way that all five sentences are satisfied at the actual world.