**IA169 – Homework 5  
Timed wolf-goat-cabbage problem**

A farmer walks the land with Wolf, Goat, and 2kg of Cabbage and comes to a river. There is a raft at the bank that can be used to cross the river, however, only the farmer and one piece of cargo fit the raft. The wolf is not well trained and if it is hungry, it kills the goat and eats it at the moment when the women leave them unattended. The wolf gets hungry after 40 minutes after the last feeding and the farmer fed him when they came to the river. If the goat and the cabbage are left unattended the Goat eats the Cabbage. However, the goat is a slow-eater and it eats only 100g of cabbage per minute (it starts eating immediately when the goat and cabbage are left unattended). Crossing the river alone or with the cabbage takes the women 7-11 minutes as the cabbage does not weigh much. Crossing the river with the wolf takes 13-17 minutes and with the goat 21-27 minutes as the goat cannot stand calmly.  
  
Model the problem in UPPAAL and use the model(s) to answer these questions:

* [Q1] Is there a strategy for the women to cross the river with all of the cabbage and animals alive?
* [Q2] Is there a possibility that the farmer crosses the river with both animals alive but only with a part of the cabbage (i.e., less than 2kg but more than 0 kg of cabbage).
* [Q3] How fast can the farmer cross the river with all of the cabbage and animals alive? How many crossings with the raft does the fastest strategy take?
* [Q4] Is there a way to cross the river with the whole cabbage and both animals alive if you use the raft 7 times? And 12 times?
* [Q5] Is it possible that the farmer leaves the wolf and the goat unattended (at least once) and still is able to cross with the whole cabbage and both animals alive?
* [Q6] Is it possible that the farmer repeatedly (i.e., more than once) leaves the wolf and the goat unattended and still is able to cross the river with the whole cabbage and both animals alive?

Now assume that the wolf has a tapeworm and the farmer feeds it anytime when she leaves it on a bank (i.e., if wolf and farmer are on the same bank and the farmer is leaving, she carefully feeds it). The wolf with tapeworm gets hungry always 40 minutes after eating. Adjust the model (or create a new one) for this situation and answer questions Q5 and Q6. What are the answers to questions Q5-Q6 if the wolf gets hungry after 25 minutes?

[A1] -

[A2] -

[A3] -

[A4] -

[A5] -

[A6] -

[Adjusted model A5] -

[Adjusted model A6] -