## Heuristic search

A farmer needs to move a hen, a fox, and a bushel of grain from the left side of the river to the right using a raft. The farmer can take one item at a time (hen, fox, or bushel of grain) using the raft. The hen cannot be left alone with the grain, or it will eat the grain. The fox cannot be left alone with the hen, or it will eat the hen. For example, the farmer cannot move from one side $x$ of the river to the other side $y$ if it would mean leaving the fox and hen together on side $x$.

The farmer can load an item onto the raft, move the raft from one side of the river to the other, or unload an item from the raft. The farmer wants to move the items with the fewest number of trips across the river as possible, but does not care about how much time is spent loading or unloading.

1. Classify this problem using the primary representational dimensions from lecture 2.(02 课件-RepresentationalDimensions)

2. Represent this problem as a graph search problem. Be sure to include and formally describe each component the graph search problem.

3. What is the forward branching factor for your representation from part (2)? Justify your answer.

4. Construct a non-constant admissible heuristic for this problem.

5. Argue that the heuristic from part (4) is admissible.

6.Implement your representation from part (2) and heuristic from part (4) in Python 3 by editing the River_problem class in the provided riverProblem.py. We will run your code with the command python3 riverProblem_run.py. Your code must complete within 2 minutes for full marks.[1]

Submit all of your code (including provided boilerplate files) in a single zip file.