State representation

State description:

(<side for farmer>, <side for wolf>, <side for goat>, <side for cabbage>)

Initial state:

(w, w, w, w) – All participants begin on the west bank of the river.

Final (goal) state:

(e, e, e, e) – All participants end on the east bank of the river.

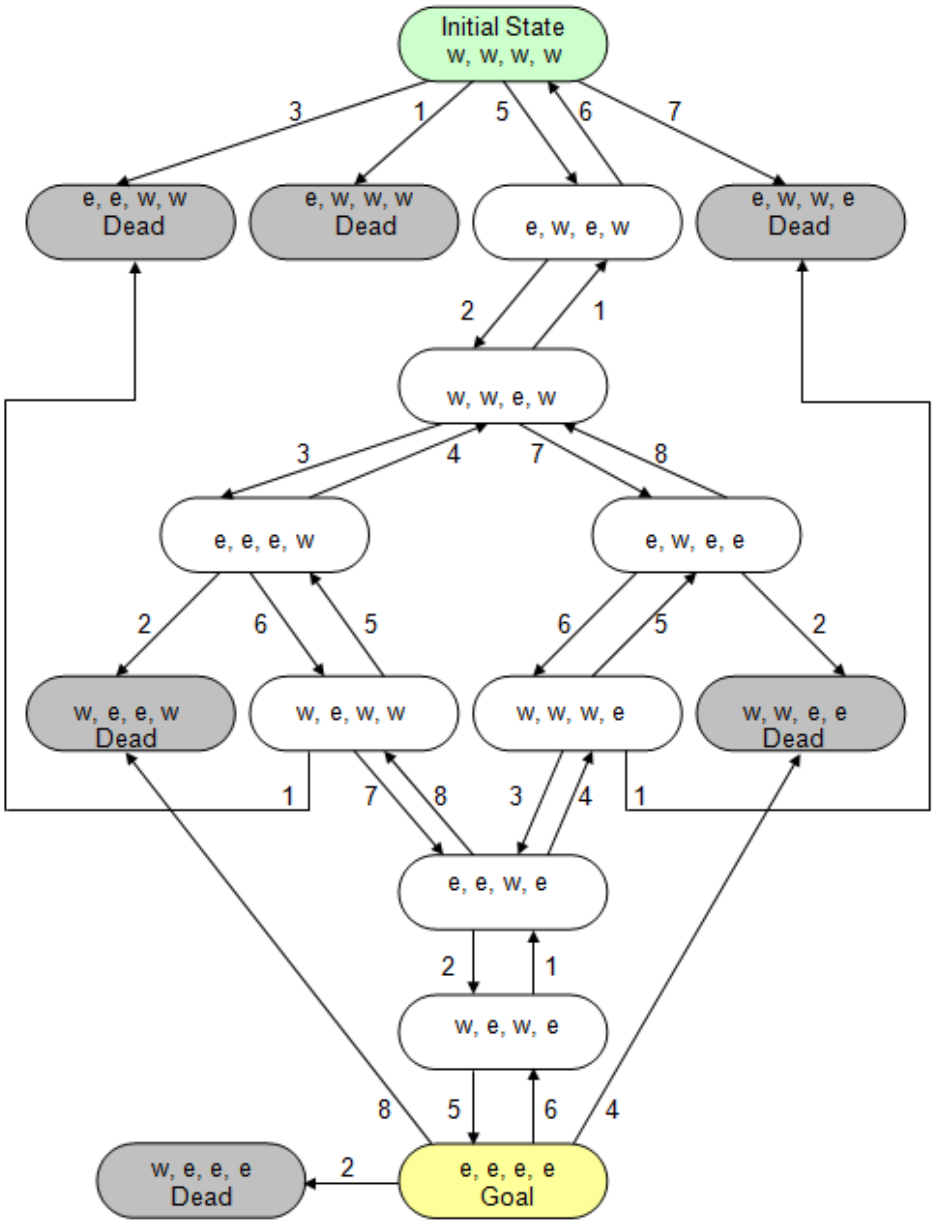
Loss (dead) states:

- (e, w, w, e) – The wolf eats the goat.
- (w, e, e, w) – The wolf eats the goat.
- (e, e, w, w) – The goat eats the cabbage.
- (w, w, e, e) – The goat eats the cabbage.
- (e, w, w, w) – The goat eats the cabbage and the wolf eats the goat.
- (w, e, e, e) – The goat eats the cabbage and the wolf eats the goat.

Transitions:

(w, LocWolf, LocGoat, LocCabbage) ⇒ (e, LocWolf, LocGoat, LocCabbage)
(e, LocWolf, LocGoat, LocCabbage) ⇒ (w, LocWolf, LocGoat, LocCabbage)
(w, w, LocGoat, LocCabbage) ⇒ (e, e, LocGoat, LocCabbage)
(e, e, LocGoat, LocCabbage) ⇒ (w, w, LocGoat, LocCabbage)
(w, LocWolf, w, LocCabbage) ⇒ (e, LocWolf, e, LocCabbage)
(e, LocWolf, e, LocCabbage) ⇒ (w, LocWolf, w, LocCabbage)
(w, LocWolf, LocGoat, w) ⇒ (e, LocWolf, LocGoat, e)
(e, LocWolf, LocGoat, e) ⇒ (w, LocWolf, LocGoat, w)

Draw the tree representation with all possible moves including problem states.


Initial State
w, w, w, w
e, e, w, w
Dead
e, w, w, w
Dead
e, w, e, w
e, w, w, e
Dead
w, w, e, w
e, e, e, w
e, w, e, e
w, e, e, w
Dead
w, e, w, w
w, w, w, e
w, w, e, e
Dead
e, e, w, e
w, e, w, e
e, e, e, e
Goal
w, e, e, e
Dead

Q2

$$start: \begin{bmatrix} 2 & 4 & 3 \\ 1 & 6 & 8 \\ 5 & - & 7 \end{bmatrix}, \quad goal: \begin{bmatrix} 1 & 2 & 3 \\ 4 & - & 8 \\ 5 & 6 & 7 \end{bmatrix}$$

City-block/Manhattan distance: sum of the absolute i and j distances of all tiles from their goal positions

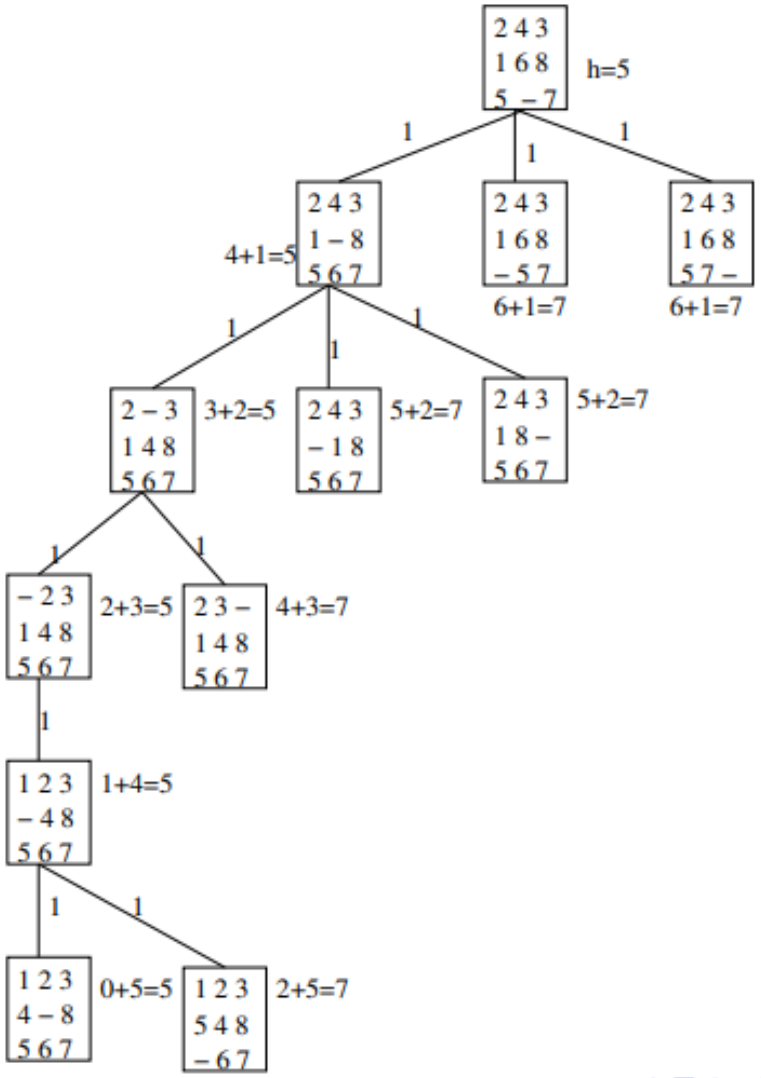
The evaluation function:

f(n) = g(n) + h(n)

where g(n) is the cost from the start node to node n

and h(n) is the heuristic estimate of the distance from node n to the goal.

Draw only those nodes that are generated by the best-first search in a tree representation.


2 4 3
1 6 8
5 – 7
h=5
1
1
1
2 4 3
1 – 8
5 6 7
4+1=5
2 4 3
1 6 8
– 5 7
6+1=7
2 4 3
1 6 8
5 7 –
6+1=7
1
1
1
2 – 3
1 4 8
5 6 7
3+2=5
2 4 3
– 1 8
5 6 7
5+2=7
2 4 3
1 8 –
5 6 7
5+2=7
1
1
– 2 3
1 4 8
5 6 7
2+3=5
2 3 –
1 4 8
5 6 7
4+3=7
1
1 2 3
– 4 8
5 6 7
1+4=5
1
1
1 2 3
4 – 8
5 6 7
0+5=5
1 2 3
5 4 8
– 6 7
2+5=7