Problem 1

A framer has a wolf, a sheep, and some of cabbage. He comes to the east side of a river and must bring these three things across to another side. The boat can only take the framer plus one of these things. There is another problem, if the cabbage is left with the sheep, the sheep will eat the cabbage. If the wolf is left with the sheep, the sheep will be devoured. How can he transport these three things to another side?

Solve:

1. Problem describing

It can represent the general state of this problem by the following list: [A, B, C, D] where:

A: the river side that framer has been found.

B: the river side that wolf has been found.

C: the river side that sheep has been found.

D: the river side that cabbage has been found.

Also:

e: the east river side has represented.

w: the west river side has represented.

2. Determine the start state and the goal state

According to the point one:

The start state is [w, w, w, w]

The goal state is [e, e, e, e]

3. Calculate the total states (state space)

It can calculate the total states by the following equation:

$$total\ states = (no.probability\ that\ taken\ each\ of\ parameter\ )^{no.paramers\ of\ the\ state}$$

$$total\ states = 2^4$$

= 16 states

The total states are divided into two parts (legal and illegal).

From the above question, we can describe the illegal states by the following:

1. The farmer is on the side and the cabbage is left with the sheep on another side (2 states)
2. The farmer is on the side and the wolf is left with the sheep on another side (2 states)

So, no. of the illegal states is four states. Therefore, the legal states will become (16-4) twelve states.

Since, the illegal states are small. We can use these states in our program as the following:

```
opp (e, w).
opp (w, e).
illegal ([ A, B, C, _ ]):- B= C, opp (A, B).
illegal ([ A, _, C, D ]):- C=D, opp (A, B).
```

4. The operators

Here, we must write all the operators that can effect to the solution.

a. The farmer across the river to another side alone.

```
Operator ([A, B, C, D], [AA, B, C, D]):- opp (A, AA), not ( illegal ([AA,B,C,D])).
```

b. The farmer and a wolf are across the river to another side

```
Operator ([A, A, C, D], [AA, AA, C, D]):- opp (A, AA), not ( illegal ([AA,AA,C,D])).
```

c. The farmer and a sheep are across the river to another side

```
Operator ([A, B, A, D], [AA,B, AA, D]):- opp (A, AA), not ( illegal ([AA,B,AA,D])).
```

d. The farmer and a cabbage are across the river to another side

```
Operator ([A, B, C, A], [AA, B, C, AA]):- opp (A, AA), not ( illegal ([AA,B,C,AA])).
```

5. After the problem describes has completed. Now, we can apply the depth search algorithm to find the solution path.

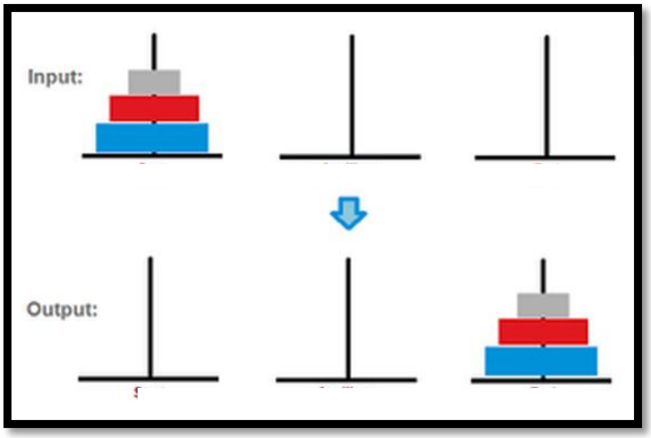
Problem 2 (Tower of Hanoi)

It is a mathematical game or puzzle. It consists of three pins and three of disks of different sizes (big, medium and small) that can slide onto any pin. The objective of the game is to move the three disks from the left pin to the right pin, where:

1. Only one disk can be moved at a time.

Each move consists of taking the upper disk from one of the pin and placing it on top of another pin.

2. No disk may be placed on top of a smaller disk.



Answer:

1. Problem describing

It can represent the general state of this problem by the following list: [A, B, C] where:

A: the number of pin that big disk has been put.

B: the number of pin that medium disk has been put.

C: the number of pin that small disk has been put.

Also:

pin (1) : no. of the pin 1.

pin (2) : no. of the pin 2.

pin (3) : no. of the pin 3.

2. Determine the start state and the goal state

The start state is [1, 1, 1]

The goal state is [3, 3, 3]

3. Calculate the total states (state space)

It can calculate the total states by the following equation:

$$total\ states = 3^3$$

$$= 27 \text{ states}$$

Here, all the states are legal if you take on your account the above conditions.

4. The operators

Here, we must write all the operators that can effect to the solution.

a. Moving the big disk form one pin to another one.

```
pin (1).
pin (2).
pin (3).
operator ([A, B, C], [A1, B, C]):- pin (A), pin (B), pin (C), pin(A1), A1<>A,
                                   A<>B, A<>C, A1<>B, A1<>C.
```

Moving big must no others put in the same pin

Putting big must no others found in the same pin

b. Moving the medium disk from one pin to another one

```
operator ([A, B, C], [A, B1, C]):- pin (A), pin (B), pin (C), pin(B1), B1<>B, B<>C, B1<>C.
```

c. Moving the small disk from one pin to another one

```
operator ([A, B, C], [A, B, C1]):- pin (A), pin (B), pin (C), pin(C1), C1<>C.
```