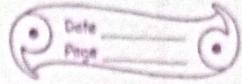


## PRACTICAL SESSION



1. Solve the 8 puzzle problem using following input and output

Initial state

1	2	3
8		4
7	6	5

Goal state

2	8	1
4		3
7	6	5

Ans:

	1 2 3		1 2 3		1 2 3
	8		4		
	7	6	5		

①.1	R	②.1	L	③.1	V	④.1
1 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3
8 2 4	8 4	8 6 4	8 6 4	8 6 4	8 6 4	8 6 4
7 6 5	7 6 5	7 5	7 5	7 5	7 5	7 5

①.2	R	②.2	L	③.2	
1 3	1 3	1 3	1 3	1 3	1 3
8 2 4	8 2 4	8 2 4	8 2 4	8 2 4	8 2 4
7 6 5	7 6 5	7 6 5	7 6 5	7 6 5	7 6 5

①.3	V	②.3			
8 1 3	1 3	1 3			
2 4	8 2 4	8 2 4			
7 6 5	7 6 5	7 6 5			

considering (2).2  
considering (1).1

8 1 3  
2 4  
7 6 5

considering ①.3

①.4	②.4	③.4
8 1 3	8 1 3	1 3
2 4	7 2 4	8 2 4
7 6 5	6 5	7 6 5

considering ①.4

①.5	②.5	③.5	④.5
8 1 3	8 3	8 1 3	8 1 3
2 4	2 1 4	2 4	2 6 4
7 6 5	7 6 5	7 6 5	7 5

considering ①.5

①.6	②.6	③.6
8 1	8 1 3	8 1 3
2 4 3	2 4 5	2 4
7 6 5	7 6	7 6 5

considering ①.6

①.7	②.7
8 1	8 1 3
2 4 3	2 4
7 6 5	7 6 5

①.8	②.8	③.8
8 1	8 1	8 4 1
2 4 3	2 4 3	2 3
7 6 5	7 6 5	7 6 5

①.8

	8	1
2	4	3
7	6	5

considering ①.8

①.9

2	8	1
4	3	
7	6	5

②.9

8	1
2	4
7	6

GOAL Reached.

Here, Total no. of moves = 9

Number : (D - R - U - L - L - D - R - R - U)

Space : (U - L - D - R - R - U - L - L - D)

2. Solve the 8-Queen problem using the following input and output.

start state.

	1	2	3	4	5	6	7	8
1	*							
2			*					
3	*							
4			*					
5	*							
6			*					
7	*							
8			*					

Goal state

	1	2	3	4	5	6	7	8
1					*			
2								*
3								*
4				*				
5							*	
6								*
7							*	
8					*			

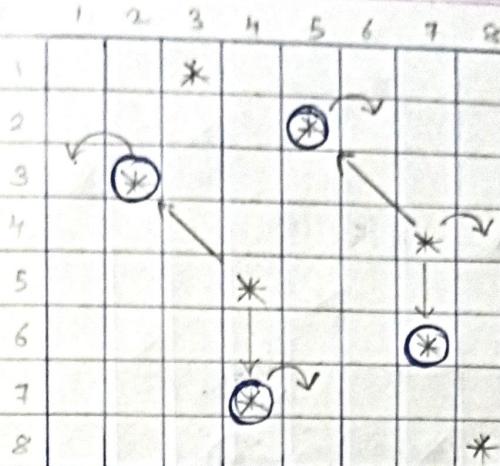
\* : 'position of the Queen'

\* Solving →

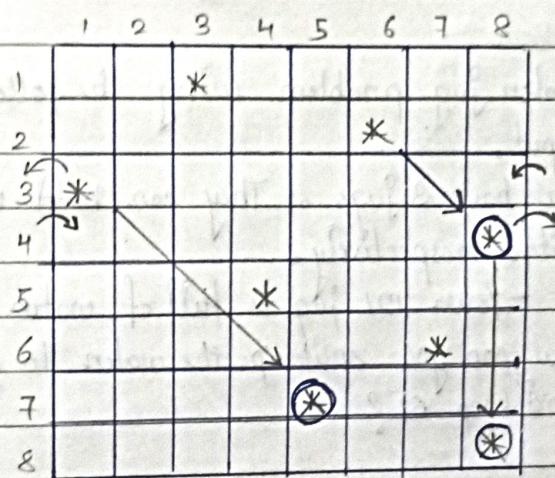
	1	2	3	4	5	6	7	8
1			*					
2					*			
3		*						
4						*		
5				*				
6						*		
7			*					
8							*	

(1)

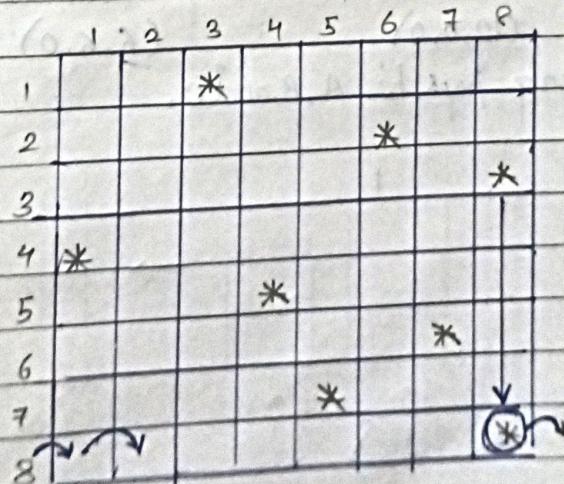
6



3



4



	1	2	3	4	5	6	7	8
1		*						
2			*			*		
3					*		*	
4	*							
5			*					
6						*		
7				*				
8		*						

(Goal State)

3. Solve the water jug problem using the following input and output.

→ You have 3 jugs. They can hold 12 litres, 8 litres and 5 litres respectively.

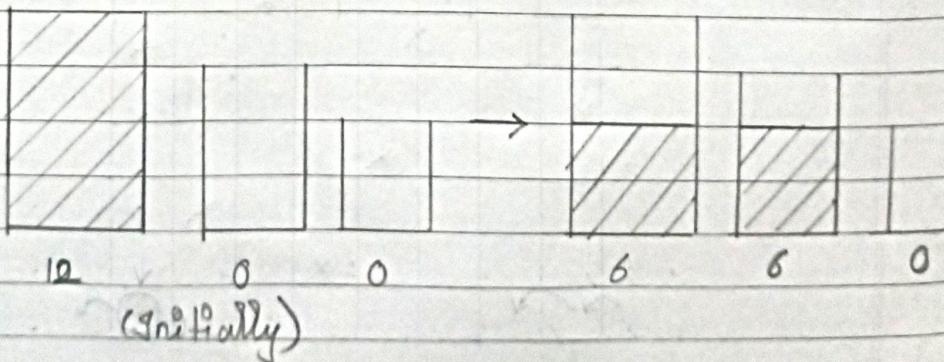
- Your 12L jug is full of water.

→ How can you split up the water to give away exactly 6L, and keep 6L?

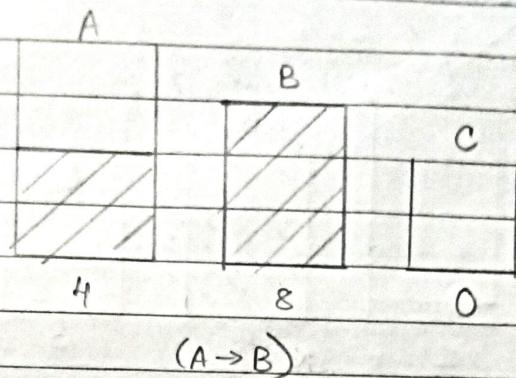
ANS:

Initial state  $\rightarrow$  Final state  
 $(12, 0, 0) \rightarrow (6, 6, 0)$

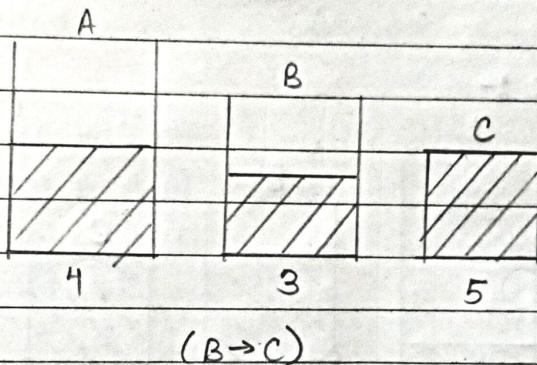
→ Let the three jugs be A, B and C.



STEP-1 :-



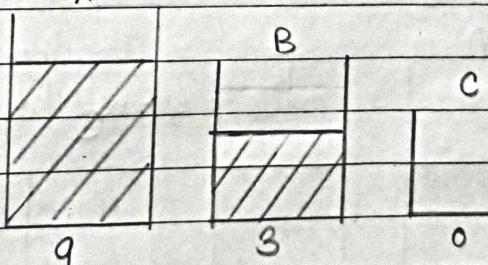
STEP-2 :-



STEP-3 :-

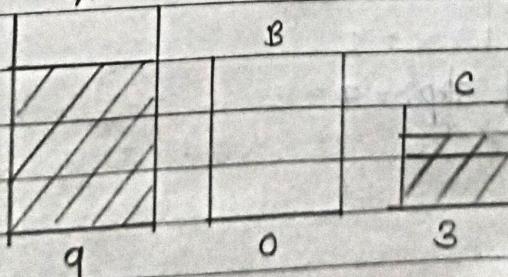
(C → A)

A

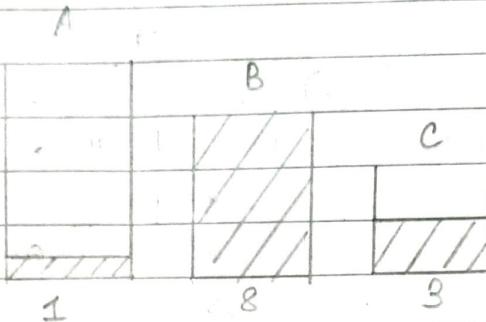


STEP-4 :-

A

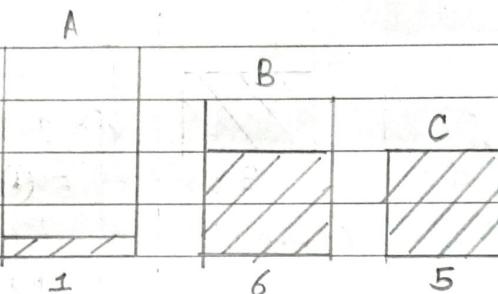


STEP-5 :-

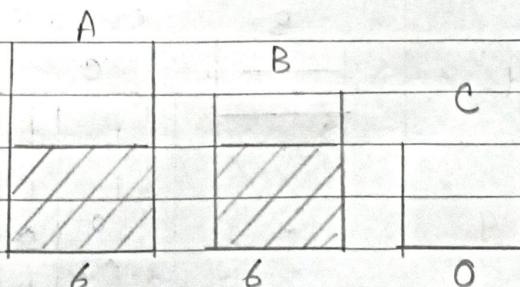


(A  $\rightarrow$  B)

STEP-6 :-



STEP-7 :-



(C  $\rightarrow$  A)

Total No. of steps = 7

4. Solve the Crypt Arithmetic problem using following input and output

$$\begin{array}{r} \text{KANSAS} \\ + \text{OHIO} \end{array}$$

OREGON

Then find the value of  $O+R+O+S+N$

1. 7      2. 8

3. 9

4. 10

ANS:

$$\text{KANSAS} + \text{OHIO} = \text{OREGON}$$

$$\begin{array}{r} \text{O H I O} \\ \text{K A N S A S} \\ \text{O R E G O N} \\ (\text{Given } O=5) \end{array}$$

$$\begin{array}{r} \cancel{1} \cancel{1} \\ \cancel{5} \ H \ I \ 5 \\ \text{K A N S A S} \\ 5 \ R \ F \ G \ 5 \ N \\ \rightarrow 1 + K = 5 \\ \therefore K = 4 \end{array}$$

$$\begin{array}{r} \cancel{1} \cancel{1} \\ \cancel{5} \ H \ I \ 5 \\ \text{A N S A S} \\ 5 \ R \ E \ G \ B \ N \end{array}$$

$$\begin{aligned} 1 + A &= 10 \quad (\because \text{Only then it can pass a carry to next value}) \\ \Rightarrow A &= 9 \\ \text{and } R &= 0 \end{aligned}$$

Now,

$$\begin{array}{r} \cancel{5} \ H \ \cancel{I} \ 5 \\ \cancel{4} \ 9 \ N \ \cancel{9} \ S \\ 5 \ 0 \ E \end{array}$$

$$\begin{array}{r} \cancel{5} \ H \ I \ 5 \\ \cancel{4} \ 9 \ N \ S \ \cancel{9} \ S \\ 5 \ 0 \ E \ G \ 5 \ N \end{array}$$

Here,

$$I + 9 = 5$$

$$\Rightarrow I = 6$$

Now,

$$\begin{array}{r} \cancel{5} \ H \ 6 \ 5 \\ \cancel{4} \ 9 \ N \ S \ 9 \ S \\ 5 \ 0 \ E \ G \ 5 \ N \end{array}$$

Here,  $5 + S = N$ ,

$S$  should be  $0, 1, 2, 3, 4$ ,  $\therefore$  If  $S > 4$ , it will generate a carry.

$S \neq 0$  and  $S \neq 4$  as they are already assigned.

Also,  $S \neq 1$ ,  $\because 5 + 1 = 6 = N$ , but  $I = 6$ .

$\therefore S$  must be either 2 or 3

Let  $S = 2$

$$\therefore 5 + 2 = 7 = N$$

$$\therefore N = 7$$

$$\text{and } 5 + N = E$$

$$\Rightarrow 5 + 7 = E \Rightarrow E = 2 \text{ and } 1 \text{ is carry}$$

This is not possible as  $S$  is assigned with 2 already (Assumption)

$\therefore$  we may assume that  $(5 + N)$  receives a carry

$$\Rightarrow 1 + 5 + N = E$$

$$\Rightarrow 1 + 5 + 7 = E \Rightarrow E = 3 \text{ and } 1 \text{ is carry}$$

Also,

$$1 + H + S = G_1$$

$$\Rightarrow 1 + H + 2 = G_1$$

The value of 'H' must be such that 'G' is greater than 9  
 $(\because \text{we know, a carry will be generated})$

$\therefore H$  must be either 7, 8 or 9.

$H \neq 7$ ,  $\therefore N$  is assigned with 7 (in assumption)

$H \neq 9$ ,  $\therefore A$  is assigned with 9

$\therefore H = 8$  and  $1 + H + 2 = G_1 \Rightarrow 1 + 8 + 2 = G_1 \Rightarrow G_1 = 1$  and carry-1

$\therefore H = 8, N = 7, S = 2$  and  $E = 3$  &  $G_1 = 1$

Conclusion :-

Digits	0	1	2	3	4	5	6	7	8	9
assignment	R	G <sub>1</sub>	S	E	K	O	I	N	H	A

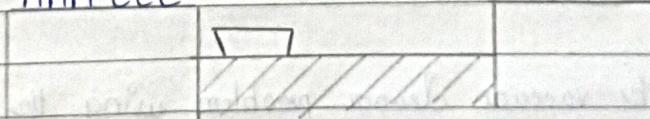
$$\therefore GROSS = 10522$$

$$\begin{aligned} \text{and } G_1 + R + O + S + S &= 1 + 0 + 5 + 2 + 2 \\ &= 10 \end{aligned}$$

5. Solve the missionaries- cannibal problem using the following input and output.

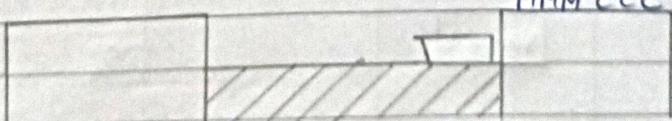
Ans: Initial state :-

MMMC CCCC



Goal state :-

MMMC CCCC

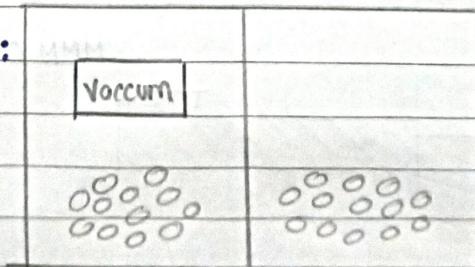


Constraints → Only 2 people can travel at the boat at a time  
 → The boat requires atleast 1 person to move it from one bank to another.  
 → no. of cannibals must be <sup>less or</sup> equal to the no. of missionaries - both in the boat as well at the banks.

Left Bank	Right Bank	OPERATION	BOAT
MMMC C C C	-	Initially	L
MM C C	MC	Move 1M & 1C to R	R
MMMC C C	C	Move 1M from R to L	L
MMM M	CCC	Move 2C from L to R	R
MMMC C	CC	Move 1C from R to L	L
M C	MM C C	Move 2M from L to R	R
MM C C	MC	Move 1M & 1C from R to L	L
M C	MM C C		
CC	MMMC C	Move 2M from L to R	R
CC C	MM M	Move 1C from R to L	L
C	MMMC C C	Move 2C from L to R	R
CC	MMMC C	Move 1C from R to L	L
Final State	-	MMMC C C C	Move 2C from L to R

6. Solve the vacuum cleaner problem using the following input and output.

Initial state:



ANS: Possible actions -

- 1) Move Left
- 2) Move Right
- 3) Clean Dint.

Solution →

