UNIVERSITY OF KARACHI
(UOK)

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DEPARTMENT OF COMPUTER SCIENCE

MORNING PROGRAMME

MCS (FINAL)- 4th SEMESTER

COURSE TITLE: *"ARTIFICIAL INTELLIGENCE"*
COURSE CODE: CS-616

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ASSIGNMENT # "01"

1) THE 8-PUZZLE PROBLEM :-

7	2	4
5	—	6
8	3	1

Start State

—	1	2
3	4	5
6	7	8

Goal State

Solution :-

- **States :-** a State description specifies the location of each of the eight tiles and blank in one of the nine squares.

- **Initial State :-** Any state in State space.

- **Successor function :-** the blank moves Left, Right, Up or Down.

- **Goal test :-** current State matches the goal configuration.

- **Path cost :-** each step costs 1, so the path cost is just the length of the path

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

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

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

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

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

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

2	–	5
1	3	4
6	7	8

–	2	5
1	3	4
6	7	8

1	2	5
–	3	4
6	7	8

1	2	5
3	–	4
6	7	8

1	2	5
3	4	–
6	7	8

1	2	–
3	4	5
6	7	8

1	–	2
3	4	5
6	7	8

–	1	2
3	4	5
6	7	8

Goal State.

4- QUEEN PROBLEM:-

Solution -

- **States :-** Any arrangement of 0 to 4 queens on the board is a state.

- **Initial State :-** No queens on the board.

- **Successor Function :-** Add a queen to any empty square.

- **Goal test :-** 4 Queens are on the board, none attacked.

(4x4) Board.

There are 4 possibilities to place Q_1

Q_1 Q_1 Q_1 Q_1

There are 2 possibilities to place Q_2.

Q_2 Q_2

Stop going move further.

There is 1 Possibility to place Q_2

Q_2

There is 1 Possible way to place Q_2

Q_2

There are 2 possible ways to place Q_2

Q_2 Q_2

There are 1 Possibility to place Q_3

There is 1 Possibility to place Q_3

There is 1 Possible way to place Q_3.

There is no possible way to place Q_3. So stop here.

way to place Q_3

Q_3 Q_3 Q_3 Q_3

Stop going more further because there are no possibility to place any Queen.

There is 1 possibility to place Q_4

There is 1 Possible way to place Q_4

There is no possible way to move further for Q_3 so stop here.

Q_4 Q_4

Q_1 Q_1
    Q_2 Q_2
Q_3 Q_3
    Q_4 Q_4

These two are our goal state.

(4×4) Board.

There are 4 possibilities to place Q_1

Q_1 Q_1 Q_1 Q_1

There are 2 possibilities to place Q_2.

There are 2 possible ways to place Q_2

Q_2 Q_2

There is 1 possibility to place Q_2

There is 1 possible way to place Q_2

Q_2 Q_2

Q_2 Q_2

Stop going move further.

There are 1 Possibility to place Q_3

There is 1 Possibility to place Q_3.

There is 1 possible way to place Q_3.

There is no possible way to place Q_3. so stop...

Stop going move further.

There are 1 Possibility to place Q3

There is 1 Possibility to place Q3.

There is 1 possible way to place Q3.

There is no possible way to place Q3. So Stop here.

Q3

Q3

Q3

Q3 way to place Q3.

Stop going more further because there are no possibility to place any Queen.

There is 1 possibility to place Q4

There is 1 possible way to place Q4

Q4

Q4

There is no possible way to move further for Q3 so stop here.

These two are an goal state.

THE 8-QUEEN PROBLEM:-

Solution :-

- **State Representation:-** Any arrangement of 0 to 8 queens on the board is a state.

- **Initial State :-** No queens on the board.

- **Operators :-** Add a queen to any empty space.

- **Successor Function:-** Board with a queen added to the specified square.

- **Goal :-** 8 Queens on board in non-attacking position.

(8×8) Board.

Q_1 ↓ There are 8 possible ways to place Q_1 but we explore only 1 path.

Q_1	X	X	X	X	X	X	X
X	X						
X		X					
X			X				
X				X			
X					X		
X						X	
X							X

Q_2 ↓ There are 6 possible ways to place Q_2 but we explore only 1 path.

Q_1	X	X	X	X	X	X	X
X	X	X	X	Q_2	X	X	X
X		X	X	X	X		
X		X	X	X		X	
X	X			X			X
X				X	X		
X				X		X	
X				X			X

Q_3 ↓

There are 3 possible ways to place Q_3 but we explore only 1 path.

Q_1	X	X	X	X	X	X	X
X	X	X		X	Q_2	X	X	X
X	X	X	X	X	X	X	Q_3
X		X	X	X		X	X
X	X			X	X		X
X				X	X		X
X			X	X		X	X
X		X		X			X

Q_4 ↓

There are **2** possible ways to place Q_4 but we explore only 1 path.

Q_1	X	X	X	X	X	X	X
X	X	X		X	Q_2	X	X	X
X	X	X	X	X	X	X	Q_3
X	X	X	X	X	Q_4	X	X
X	X			X	X	X	X
X			X	X	X		X
X		X		X	X	X	X
X	X			X	X	X

Q_5 ↓

There are 2 possible ways to place Q_5 but we explore only 1 path.

Q_1	X	X	X	X	X	X	X
X	X	X	X	Q_2	X	X	X
X	X	X	X	X	X	X	Q_3
X		X	X	X	Q_4	X	X
X	X	Q_5	X	X	X	X	X
X	X	X	X	X	explore	X
X		X	X	X	X	X
X	X	X	X	X	X

Q_6

There is only 1 path to place Q_6.

Q_1	×	×	×	×	×	×	×
×	×	×	×	Q_2	×	×	×
×	×	×	×	×	×	×	Q_3
×	×	×	×	×	Q_4	×	×
×	×	Q_5	×	×	×	×	×
×	×	×	×	×	Q_6	×	
×		×	×	×	×	×	×
×	×	×		×	×	×	×

Q_7

There is only path to place Q_7.

Q_1	×	×	×	×	×	×	×
×	×	×	×	Q_2	×	×	×
×	×	×	×	×	×	×	Q_3
×	×	×	×	×	Q_4	×	×
×	×	Q_5	×	×	×	×	×
×	×	×	×	×	×	Q_6	×
×	Q_7	×	×	×	×	×	×
×	×	×	×	×	×	×	×

Q_8

There is only 1 path to place Q_8.

Q_1							
×				Q_2			
×							Q_3
					Q_4		
		Q_5					
						Q_6	
	Q_7						
		Q_8					

This is our final solution or Goal State.

Solved!! ⭐