

# CSEN403: Concepts of Programming Languages

## Logic Programming V

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Spring Semester 2021

Implement a predicate `insert/3`. `insert(X,L1,L2)` is true if `L2` is contains all the elements in `L1` in addition to `X` i.e. `L2` is the result of inserting `X` into `L1`.

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insert(X, [], [X]).
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```
insert(X, [], [X]).
```

```
insert(X, [H|T], [X,H|T]).
```

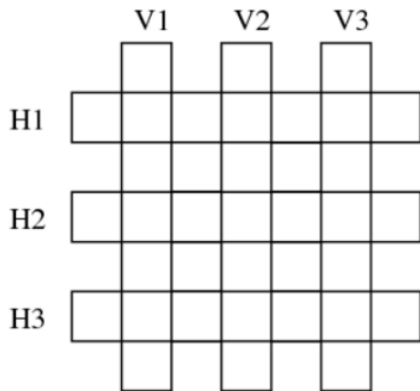
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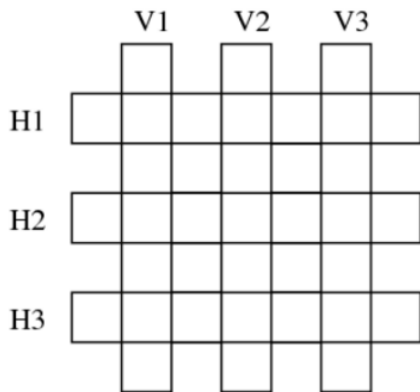
```
insert(X, [], [X]).  
insert(X, [H|T], [X,H|T]).  
insert(X, [H|T], [H|NT]):- insert(X,T,NT)
```

# Solving Puzzles Using Prolog

# Cross Words



# Cross Words



```
crossword(V1, V2, V3, H1, H2,  
H3) :-
```

```
word(V1, _, V1H1, _, V1H2, _,  
V1H3, _),
```

```
word(V2, _, V2H1, _, V2H2, _,  
V2H3, _),
```

```
word(V3, _, V3H1, _, V3H2, _,  
V3H3, _),
```

```
word(H1, _, V1H1, _, V2H1, _,  
V3H1, _),
```

```
word(H2, _, V1H2, _, V2H2, _,  
V3H2, _),
```

```
word(H3, _, V1H3, _, V2H3, _,  
V3H3, _),
```

```
H1\=V1, H2\=V2, H3\=V3.
```



# Sudoku

E0	E1	E2	E3
E4	E5	E6	E7
E8	E9	E10	E11
E12	E13	E14	E15

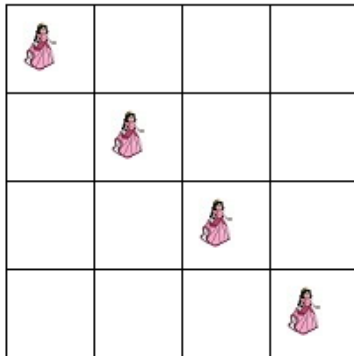
- Place  $N$  queens in an  $N \times N$  board.

# N-Queens

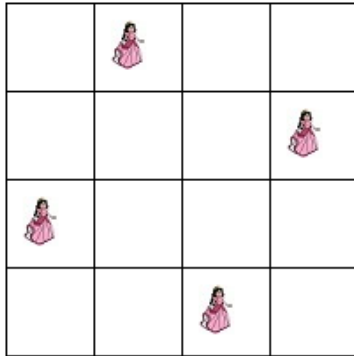
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- No two queens can attack each other
- Queens are able to move vertically horizontally and diagonally. Thus two queens would be able to attack each other if they are
  - ▶ In the same row
  - ▶ In the same column
  - ▶ In the same diagonal

# Wrong Solution



# Possible Solution



- A solution is a permutation of the list  $[1, 2, 3, 4]$ .

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- The permutation has to satisfy the needed properties '
- A possible solution  $[3, 1, 4, 2]$  encodes:
  - ▶ In the first row place a queen in column 3
  - ▶ In the second row place a queen in column 1
  - ▶ In the third row place a queen in column 4
  - ▶ In the third row place a queen in column 2
- Two or more queens lie on the same diagonal:
  - ▶ Same / diagonal if and only if the sum of the row and column is the same for each.
  - ▶ Two queens are on the same \ diagonal if and only if the difference of their row and column is the same number.

# Example

	1	2	3	4
1		Q		
2	Q			
3		Q		
4				Q

Thank you