

## Homework 4

## Problem 1

```
// New Rules:
```

```
sister(Sister,Sib) ←  
    parent(Parent,Sister),  
    parent(Parent,Sib),  
    female(Sister),  
    Sister /= Sib.
```

```
niece(Niece,Uncle) ←  
    uncle(Uncle,Niece),  
    female(Niece).
```

```
// Full Siblings only
```

```
sibling(Sib1,Sib2) ←  
    parent(Mother,Sib1),  
    parent(Mother,Sib2),  
    parent(Father,Sib1),  
    parent(Father,Sib2),  
    Mother /= Father,  
    Sib1 /= Sib2.
```

→  
could be an  
aunt

## Problem 2

```
// Facts:
```

```
left_of(pencil,hourglass).  
left_of(hourglass,butterfly).  
left_of(butterfly,fish).  
    above(bicycle,pencil).  
    above(camera,butterfly).
```

```
// Rules:
```

```
right_of(X,Y) ← left_of(Y,X).  
    below(X,Y) ← above(Y,X).
```

```
// Example Query
```

```
// right_of(butterfly,hourglass)?
```

```
// Yes because left_of(hourglass,butterfly).
```

### Problem 3

```
// Recursive Rules:

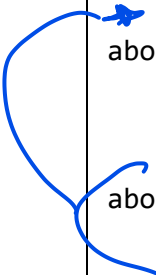
left_of(X,Z) ←
    left_of(X,Y),
    left_of(Y,Z).

above(X,Z) ←
    above(X,Y),
    above(Y,Z).

higher(X,Z) ←
    above(X,Y),
    left_of(Z,Y). // Will recur if not directly next to

higher(X,Z) ←
    above(X,Y),
    right_of(Z,Y). // Will recur if not directly next to
```

### Problem 4



```
// Rules:

above(X,Z) ←
    on(X,Y),
    above(Y,Z). // Recursive Case

above(X,Y) ←
    on(X,Y). // Base Case
```