Exercise 1.1:
Consider the following program which specifies the descendant relation which is the relation of being a child of, or a child of a child of, or a child of a child of a child of, ...

```
descend(X,Y) :- child(X,Y).
descend(X,Y) :- child(X,Z), descend(Z,Y).
```

With the input database
```
child(anne, bridget).
child(bridget, caroline).
child(caroline, donna).
child(donna, emily).
```

Give the search tree for the query: `?- descend(anne, donna).`

Exercise 1.2:
Consider the program from Exercise 1.1. What happens if we change the order of the rules and goals. What is the result of the queries `?- descend(X,Y)`, `?- descend(anne, emily)`, and `?- descend(anne, bridget)`.

a) 

```
descend(X,Y) :- child(X,Z), descend(Z,Y).
descend(X,Y) :- child(X,Y).
```

b) 

```
descend(X,Y) :- descend(Z,Y), child(X,Z).
descend(X,Y) :- child(X,Y).
```


c) 

```
descend(X,Y) :- child(X,Y).
descend(X,Y) :- descend(Z,Y), child(X,Z).
```

Exercise 1.3:
Consider the following program for addition.

\[
\begin{align*}
\text{add}(0,Y,Y) . \\
\text{add}(\text{s}(X),Y,\text{s}(Z)) & :\text{-} \text{add}(X,Y,Z).
\end{align*}
\]

Give the search tree and instantiations for the query:

?- \text{add}(\text{s}(\text{s}(\text{s}(0))), \text{s}(\text{s}(0)), R).

Exercise 1.4:
Prolog can evaluate arithmetic expressions. What is the difference between

a) \?- \text{X}=3+2 and

b) \?- \text{X} \text{ is } 3+2 ?

c) What are restrictions for using the arithmetic expression \text{is } ?