1 List Processing 6 pts

Write a Prolog program that enumerates all the subsets of a set (represented as a list) on backtracking.
Now write a query that generates the powerset of a set.

2 Using Operators 4 pts

Fully parenthesize the following terms based on the precedence and associativity information given below:
\[
\text{op}(1200, \text{xfx}, :-) \quad \text{op}(1100, \text{xfy}, ;) \quad \text{op}(1050, \text{xfy}, ->) \quad \text{op}(1000, \text{xfy}, ', ')
\]

\[
p :- q -> r, s ; t.
\]
\[
p :- q, r -> s ; t.
\]

To improve readability, display the result as an abstract syntax tree.

3 Procedural Meaning and Cuts 10 pts

\[
p(a,b).
p(X,Z) :- q(X,Y), !, r(X,Z).
p(c,d).
q(a,b).
q(b,c).
r(b,c).
r(b,d).
s(X,Y) :- q(X,Y).
s(X,Y) :- q(X,Z), s(Z,Y).
t(X,Y) :- q(X,Z), \neg t(Z,Y).
\]

Describe all the solutions output by the Prolog interpreter for the following queries:
1. \( p(X,Y) \).
2. \( p(b,Y) \).
3. \( s(X,Y) \).
4. \( t(a,b) \).

4 Programming Paradigms 5 pts

Motivate/explain the benefits of logic programming paradigm over other programming paradigms by providing an illustrative example/application.