

### P3: Backtracking in Prolog

1. Write a predicate to generate the list of all subsets with all elements of a given list.  
Eg: [2, 3, 4] N=2 => [[2,3],[2,4],[3,4]]
2. Are given n points in a plan (represented using its coordinates). Write a predicate to determine all subsets of collinear points.
3. Write a predicate to determine all decomposition of n (n given, positive), as sum of consecutive natural numbers.
4. The list a1... an is given. Write a predicate to determine all sublists strictly ascending of this list a.
5. Two integers, n and m are given. Write a predicate to determine all possible sequences of numbers from 1 to n, such that between any two numbers from consecutive positions, the absolute difference to be  $\geq m$ .
6. Generate the list of all arrangements of K elements of a given list.  
Eg: [2, 3, 4] K=2 => [[2,3], [3,2], [2,4], [4,2], [3,4], [4,3]] (not necessary in this order)
7. A player wants to choose the predictions for 4 games. The predictions can be 1, X, 2. Write a predicate to generate all possible variants considering that: last prediction can't be 2 and no more than two possible predictions X.
8. Generate all strings of n parenthesis correctly closed.  
Eg: n=4 => (()) and () ()
9. Generate all permutation of N (N - given) respecting the property: for every  $2 \leq i \leq n$  exists an  $1 \leq j \leq i$ , so  $|v(i)-v(j)|=1$ .
10. For a list a1... an with integer and distinct numbers, define a predicate to determine all subsets with sum of elements divisible with n.
11. "Colouring" a map. n countries are given; write a predicate to determine all possibilities of colouring n countries with m colours, such that two adjacent countries not having the same colour.
12. Generate all sub-strings of a length  $2*n+1$ , formed from values of 0, 1 or -1, so  $a_1 = \dots, a_{2n+1} = 0$  and  $|a_{i+1} - a_i| = 1$  or 2, for every  $1 \leq i \leq 2n$ .
13. The list a1, ..., an is given and it consists of distinct integers. Write a predicate to determine all subsets with aspect of "mountain" (a set has a "mountain" aspect if the elements increase to a certain point and then decrease).
14. Write a program to generate the list of all subsets of sum S with the elements of a list (S - given).  
Eg: [1,2,3,4,5,6,10] si S=10 => [[1,2,3,4], [1,4,5], [2,3,5], [4,6], [10]] (not necessary in this order)
15. For a given n, positive, determine all decomposition of n as a sum of consecutive natural numbers.