



Computação Evolucionária

2020/2021

Notes for the PL 6

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22 de Março de 2021

Set Covering

6.1 Introduction

In this assignment we are going to address a problem with a theoretical flavor, but still corresponding real world application. The idea is to devise an evolutionary model from the definition of the problem, to implement the corresponding algorithm and to test its performance. You should pay special attention to the problem of the representation, the variation operators and the fitness function. In the end, **you must submit trough the platform** a small document describing your solution and the analysis of the results. Moreover, the code must be sent by email after the end of the class. These are typical questions that may appear in the final exam!

6.2 Minimum Set Covering

Problema 6.1 M

Imagine that you have a set U , called **Universe**, whose elements are the first m natural numbers. Furthermore, you have different sub-sets of U , $S_i, i = 1, \dots, n$, that may have elements in common and whose union is equal to the universe. The problem to solve is to find the minimum number of subsets S_i whose union is equal to the universe U , i.e., those sets covers the universe and its number is minimal.

Below is an example with $m=10$ and $n=5$.

$U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

$S = \{S1, S2, S3, S4, S5\}$

$S1 = \{2, 3, 5, 6, 7, 10\}$

$S_2 = \{1, 2, 4, 6, 7, 9\}$
 $S_3 = \{3, 5, 6, 7, 9, 10\}$
 $S_4 = \{1, 2, 8\}$
 $S_5 = \{1, 2, 3, 4, 7, 8\}$

In this case, one possible solution is (S_3, S_5) .

Devise a solution, implement it and do some preliminary tests with a small dataset to come up with a reasonable set of parameters.

6.3 Empirical Study

In **InforEstudante** you will find four data sets with some instances of the problem, that you must download. The files with the data have a special format. First we have two numbers, one defining the number of subsets, and the other defining the universe. Then there are a number of ones equal to the size of the universe. After that we have the description of the subsets, each one defined by one number stating how elements there are in the subset followed by the elements of the subset. The figure 6.1 show an example.

```

10 10
1 1 1 1 1 1 1 1 1 1
2
1 8
2
5 6
4
1 2 3 4
1
1
4
1 2 5 8
2
6 10
1
9
4
1 2 3 5
1
8
1
7

```

Figura 6.1: One instance of a file for the set covering problem

Problema 6.2 **M**

Run your program using each of the different data sets, and analyze the evolution over generations. What conclusions can you made?