

# CSCI 4560/6560 Evolutionary Computation

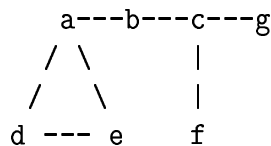
## Assignment Number 1: Due 9/3/2009 (in class)

1. [10 points] Solve Problem 3 Page 35 of the text book.
2. [10 points] Solve Problem 4 Page 35 of the text book.
3. [20 points] The  $subset_{21}$  problem is stated as follows. Given a set of  $N$  positive integers  $X = \{x_1, x_2, \dots, x_n\}$ . Find a subset  $P$  of the set  $X$  such that the sum of the elements of  $P$  is equal to 21. For example, if  $N=5$  and the set  $X = \{12, 17, 3, 24, 6\}$ , the set  $P = \{12, 3, 6\}$  is a valid solution for the  $subset_{21}$  problem in this example.

Formulate the  $subset_{21}$  problem as a Genetic Algorithm optimization. You may use binary representation, OR any representation that you think is more appropriate. you should specify:

- A fitness function. Give 3 examples of individuals and their fitness values if you are solving the above example (i.e.  $X = \{12, 17, 3, 24, 6\}$ ).
  - A set of mutation and/or crossover and/or repair operators. Intelligent operators that are suitable for this particular domain will earn more credit.
  - A termination criterion for the Genetic Algorithm optimization which insures that you terminate with a valid solution for the  $subset_{21}$  problem if a solution exists.
4. [20 points] The **graph k-coloring** problem is stated as follows: Given an undirected graph  $G = (V, E)$  with  $N$  vertices and  $M$  edges and an integer  $k$ . Assign to each vertex  $v$  in  $V$  a color  $c(v)$  such that  $1 \leq c(v) \leq k$  and  $c(u) \neq c(v)$  for every edge  $(u, v)$  in  $E$ . In other words you want to color each vertex with one of the  $k$  colors you have and no two adjacent vertices can have the same color.

For example, the following graph can be 3-colored using the following color assignments:  $a=1, b=2, c=1, d=2, e=3, f=2, g=3$



Formulate the **graph k-coloring** problem as an evolutionary optimization. You may use a vector of integer representation, OR any representation that you think is more appropriate. you should specify:

- A representation.

- A fitness function. Give 3 examples of individuals and their fitness values if you are solving the above example.
- A set of mutation and/or crossover and/or repair operators. Intelligent operators that are suitable for this particular domain will earn more credit.
- A termination criterion for the Genetic Algorithm optimization which insures that you terminate with a valid solution for the **graph k-coloring** problem if a solution exists.