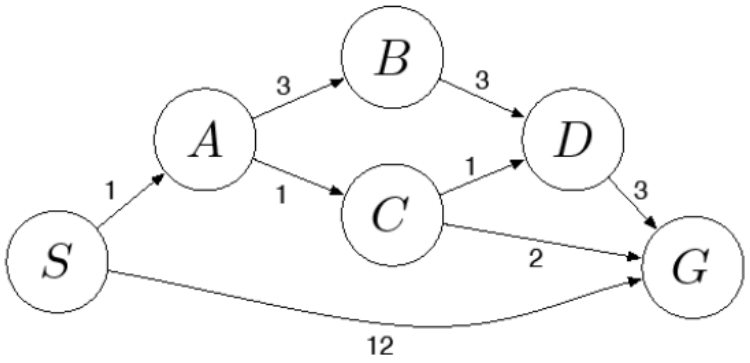
BIRZEIT UNIVERSITY
Computer Systems Engineering Department

ENCS 3340 Artificial Intelligence

Second Semester, 2020-2021 HW#1 Search: Global/Local/Adversarial
Due Date: Saturday, 3/4/2021

Question 0 (Global Search):

Given the following graph and table: S is start (initial) node and G is the goal node. Perform the search algorithms that were not part of your Project 1. For example if your project has **Greedy and Breadth First** then you need to do A*, Depth First, Uniform and Iterative Deepening. For each give the order of expansion and the path to the goal.



State	$h(n)$
S	4
A	2
B	6
C	1
D	3
G	0

Question 1 (Genetic Algorithms)

Given that chromosomes consist 5 genes each, each gene can hold one of the binary values 0 and 1.

The fitness value is calculated as the number of 1s present in the genome. If there are five 1s, then it is having maximum fitness. If there are no 1s, then it has the minimum fitness.

This genetic algorithm tries to maximize the fitness function to provide a population consisting of the fittest individual, i.e. individuals with five 1s.

Given a population of 5 chromosomes with the one values at (1,3,5), (2,4); (1,2,4), (3,4,5), (1,2,3). The next generation are produced using a crossover between the fittest chromosomes and a mutation from the mid-fitted chromosomes (ranked midway) by changing the middle gene to 1.

After crossover and mutation, the least fit individual is replaced from the new fittest offspring.

Show the fittest individual after 4 generations.

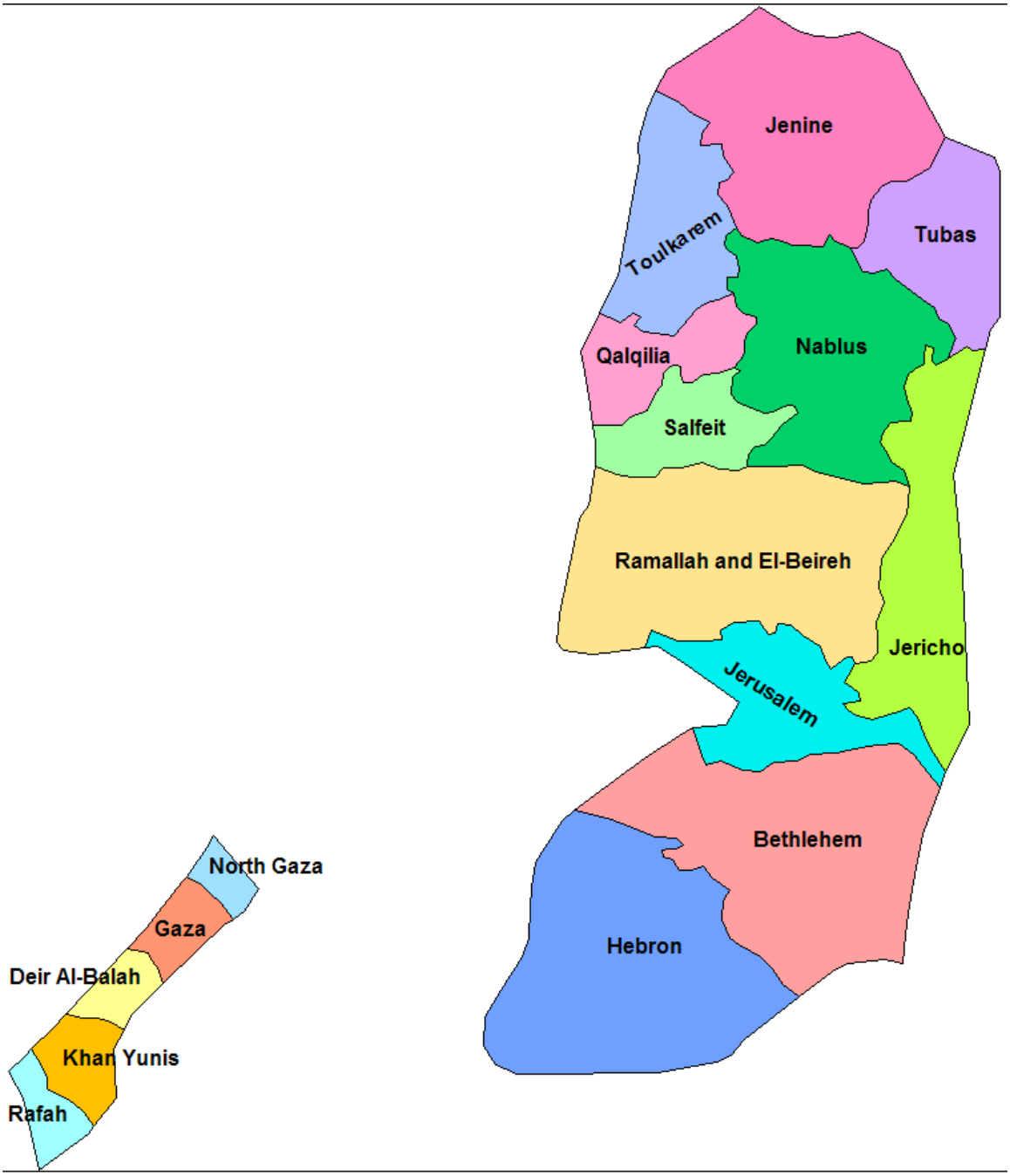
You can also play with an example implementation of a genetic algorithm in Java given at

https://towardsdatascience.com/introduction-to-genetic-algorithms-including-example-code-e396e98d8bf3

Question 2 (CSP)

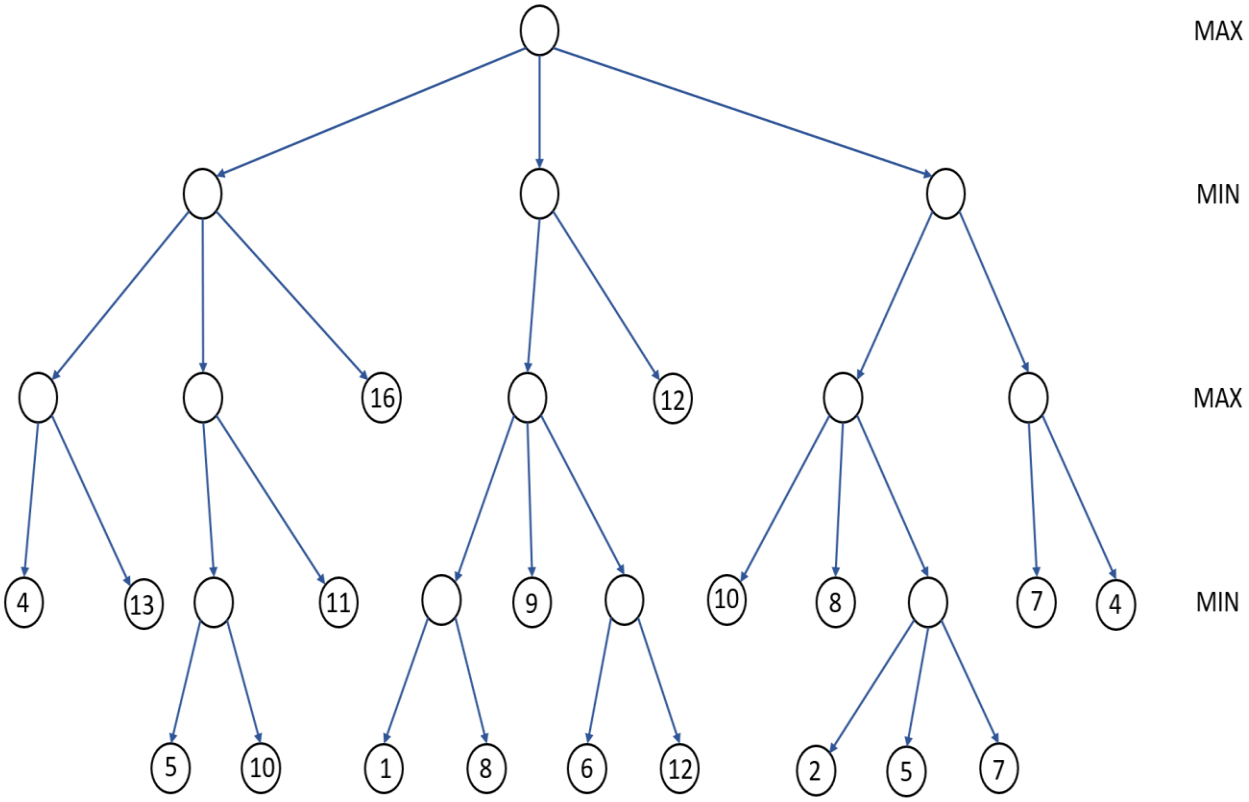
The map below shows the PNA districts.

- What is the minimum number of Colors needed to color the map such that no two neighboring districts have the same color? Justify your answer.
- Assuming the map has no colors, color the map using the **MRV + Least Constraining values** heuristics. Show the graph and show your solution step by step**. Note: Values are ordered alphabetically.**



Question 3 (Adversarial Search)

1. Perform MINMAX search algorithm on the following tree
2. On another copy of the tree, perform Alpha Beta search algorithm on the following tree, **Indicate** pruning by crossing the appropriate edges.


MAX
MIN
MAX
MIN
16
12
4
13
11
9
10
8
7
4
5
10
1
8
6
12
2
5
7