Artificial Intelligence (CCS-3880)

Assignment 1

Convener: Dr. Abdullah Alshanqiti

Important facts:

- Handed out: 26th Mar 2023.
- Deadline: 11th May 2023 at midnight.
- Mark Returned: 18th May 2023.
- This assignment is **a group of work** (maximum of two members in each group), which counts as **6%** of your final mark.
- The deadline is **strict**, and resubmission is **NOT** allowed.
- After the submission, you will be asked to demonstrate your work to the lab instructor.
- You can gain up to 3 extra marks for outstanding work, so try your best.

Task 1: Search Space Representation [2 marks]

The cops-robbers problem is as follows: three cops and three robbers are on one side of a high mountain connected by only a cable car transportation (i.e., cable transport in which cabins are hauled above the ground). The cabin can take one or two people at a time. The goal is to get everyone to the other side of the mountain without ever leaving a group of policemen outnumbered by criminals.

(a) Design a state space representation for this problem. Clearly specify the meaning of each component of the state representation.

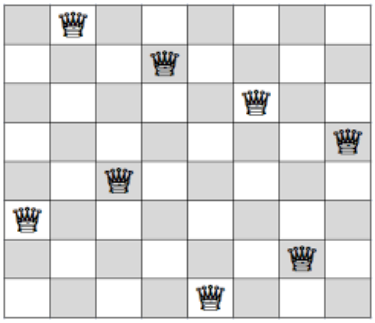
(b) Give the initial and goal states in this representation.

(c) Design a complete set of operators in this domain (successor function) based on your chosen state-representation.

(d) What is the cost function in your successor function?

Task 2: N-Queens Problem - Simulated Annealing [2 marks]

N - Queens problem is to place n - queens in such a manner on an n x n chessboard that no queens attack each other by being in the same row, column or diagonal. For n =1, the problem has a trivial solution, and no solution exists for n =2 and n =3. So first we will consider the 4 queens' problem and then generate it to (n>4) queens' problem.



(a) Write a Java/Python program that solves the above problem using the *Simulated Annealing* algorithm.

Make sure that your program is well-documented (i.e., writing enough comments that clearly explain your code) and executable with no syntax/compiling errors.

(b) Discuss in some details how your solution would improve the performance as compared to the classical search algorithm such as **DFS**?

Task 3: N-Queens Problem – Genetic Algorithm [2 marks]

(a) Write another Java/Python program that solves the same problem in (Task 2) but using a *Genetic Algorithm* instead.

Make sure that your program is well-documented (i.e., writing enough comments that clearly explain your code) and executable with no syntax/compiling errors.

(b) Discuss in some details the similarities and differences between your solutions in Task 2 vs. Task 3.

Penalties:

- Late submission: You will lose 20% of the total mark per day.
- Plagiarism: In case of plagiarism, zero tolerance policy will be applied. This means that the submitted files will be rejected and zero marks will be given.

Submission:

- Zip all the files of your answers in a single *.zip file (i.e., *.**rar** extension is NOT allowed)
- This zip file should contain one folder of source code for task 2 & 3 and one **pdf** document for answering the other questions.