Assignment 1

Policy: **The assignment has to be submitted in writing**. Write neatly to avoid confusion during evaluation that may invite additional clarification from students. Write your name and roll number at the top of the assignment. ***If you do not write your name and roll number you lose 5 points.***

Late submission policy: You should submit by **30-1-2021 by 23:55 PM**.
The penalty of 5% will be given per day for submission after the deadline.

Collaboration Policy: You are to complete this assignment individually. However, you are encouraged to discuss the general algorithms and ideas in the class in order to help each other answer homework questions.You are also welcome to give each other examples that are not on the assignment in order to demonstrate how to solve problems. But we require you to:

- not explicitly tell each other the answers
- not to copy answers
- not to allow your answers to be copied

In those cases where you work with one or more other people on the general discussion of the assignment and surrounding topics, we ask that you specifically record on the assignment the names of the people you were in discussion with (or "none" if you did not talk with anyone else). **This is worth five points: for each problem, your solution should either contain the names of people you talked to about it, or "none." If you do not give references for each problem, you will lose five points.** This will help resolve the situation where a mistake in general discussion led to a replicated weird error among multiple solutions. This policy has been established in order to be fair to everyone in the class.

1. The missionaries and cannibals problem is as follows. Three missionaries and three cannibals are on one side of a river, along with a boat. The boat can hold one or two people (and obviously cannot be paddled to the other side of the river with zero people in it). The goal is to get everyone to the other side, without ever leaving a group of missionaries outnumbered by cannibals. Your task is to formulate this as a search problem. **(10 marks)**
    a. Define a state representation.
    b. Give the initial and goal states in this representation.
    c. Define the successor function in this representation.
    d. What is the cost function in your successor function?
    e. What is the total number of reachable states? Justify your answer.

2. Consider a state space where the start state is number 1 and the successor function for state n returns two states, numbers 2n and 2n + 1 **(10 marks)**
    a. Draw the portion of the state space for states 1 to 15.

b. Suppose the goal state is 13. List the order in which nodes will be visited for breadth first search, depth-limited search with limit 3, and iterative deepening search.

3. Choose a domain and describe search space for a case in which greedy best-first search performs worse than breadth-first search. How many nodes are visited by each strategy in your domain? **(10 marks)**

4. Given the SAT problem with 5 clauses:

$$(\neg a \vee d) \wedge (c \vee b) \wedge (\neg c \vee \dot{d}) \wedge (\neg d \vee \neg b) \wedge (a \vee \neg d)$$

assume that the heuristic function is the number of clauses satisfied. Let the solution vector be in the order (a,b,c,d) . Let the starting candidate be (0,0,0,0). Show 3 expansions of the Tabu search assuming tabu tenure tt = 2. Show the new candidates as well as the tabu moves at each of the three stages. Also draw a table showing which clauses are true for each candidate. **(10 marks)**