

### Task 3: Heuristic Search Algorithms

**Domain:** Uniform Random-4-SAT is a family of SAT problems distributions obtained by randomly generating 3-CNF formulae in the following way: For an instance with  $n=4$  variables and  $k=5$  clauses, each of the  $k$  clauses is constructed from 3 literals which are randomly drawn from the  $2n$  possible literals (the  $n$  variables and their negations) such that each possible literal is selected with the same probability of  $1/2n$ . Clauses are not accepted for the construction of the problem instance if they contain multiple copies of the same literal or if they are tautological (i.e., they contain a variable and its negation as a literal). Each choice of  $n$  and  $k$  thus induces a distribution of Random-4-SAT instances. Uniform Random-4-SAT is the union of these distributions over all  $n$  and  $k$ .

Firstly generate your formula for  $N = 4$  and  $k = 5$ . Please write your clauses in the text file and each clause should be written in a different line of the text file. Then input the formula to three algorithms.

#### Implement:

1. Variable neighborhood descent : Modify Hill-Climbing Search to switch to a denser neighborhood function when stuck at a local optimum.
2. Beam Search : Code for different beam lengths
3. Tabu Search : Implement tabu search and find an optimum tabu tenure value for the domain.

**Report Format :**

1. Brief description about the domain:

1. State space
2. Start node and goal node
3. MOVEGEN and GOALTEST algorithm

%2. Heuristic functions considered

%2. Beam search analysis for different beam lengths

%2. Tabu search for different values of tabu tenure

%2. Comparison of Variable neighborhood descent, Beam Search, Tabu Search: Nodes explored by each

**Evaluation Criteria:**

Correctness: 15

Report: 10

Code Quality: 5

**Deadline:** 11:59 PM 5th Feb 2021

**Note :** *Penalty of 10% will be issues per day if the deadline is not met  
If found copied, 0% score will be awarded*

**For Reference :**

Heuristic search and Hill Climbing:

[https://drive.google.com/file/d/1rNpKGSBK\\_bd9lhs5suOH8VYaVxqO4dgy/view?usp=sharing](https://drive.google.com/file/d/1rNpKGSBK_bd9lhs5suOH8VYaVxqO4dgy/view?usp=sharing)

Beam Search Tabu Search:

[https://drive.google.com/file/d/1gbWgDeCurYZN35yd7fov\\_2U5wqZ1HIQT/view?usp=sharing](https://drive.google.com/file/d/1gbWgDeCurYZN35yd7fov_2U5wqZ1HIQT/view?usp=sharing)

Tabu Search

<https://drive.google.com/file/d/14nmG0OkkGJVxEPfu0VhbHRcOrlB9g95O/view?usp=sharing>

<https://drive.google.com/file/d/1-FiLcQxGuaurwzX8985xth0l42HjNYK-/view?usp=sharing>