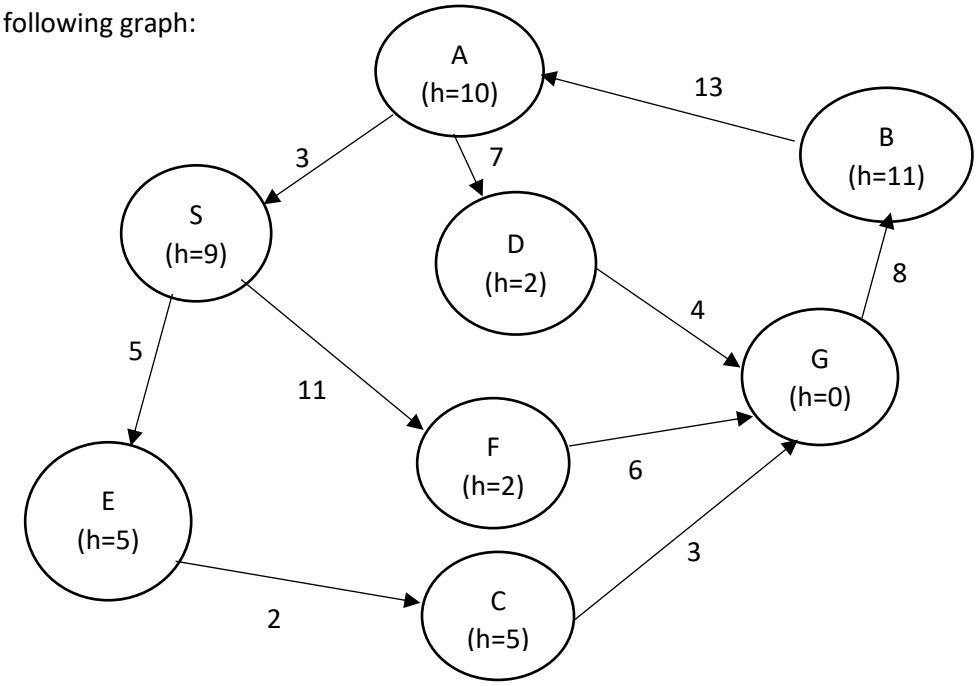
CSE 422 Section 7

Assignment 1

Submission Deadline (Before Midterm Examination)

1. Consider the following graph:



Here **S** is the starting node and **G** is the goal node. Now change only the heuristic values of **any two** nodes so that the heuristic values become both admissible and consistent. Mention the updated values and corresponding node names.

2. Suppose you have two heuristic functions **h1 and h2**, both of which are **admissible**. You have decided to create several new heuristic functions defined as follows:
    - h3(n) = 0
    - h4(n) = 2 × h1(n)
    - h5(n) = h2(n)/2
    - h6(n) = (h1(n)+h2(n))/2
    - h7(n) = max(h1(n), h2(n))
    - h8(n) = min(h1(n), h2(n))

    Now answer the following questions:

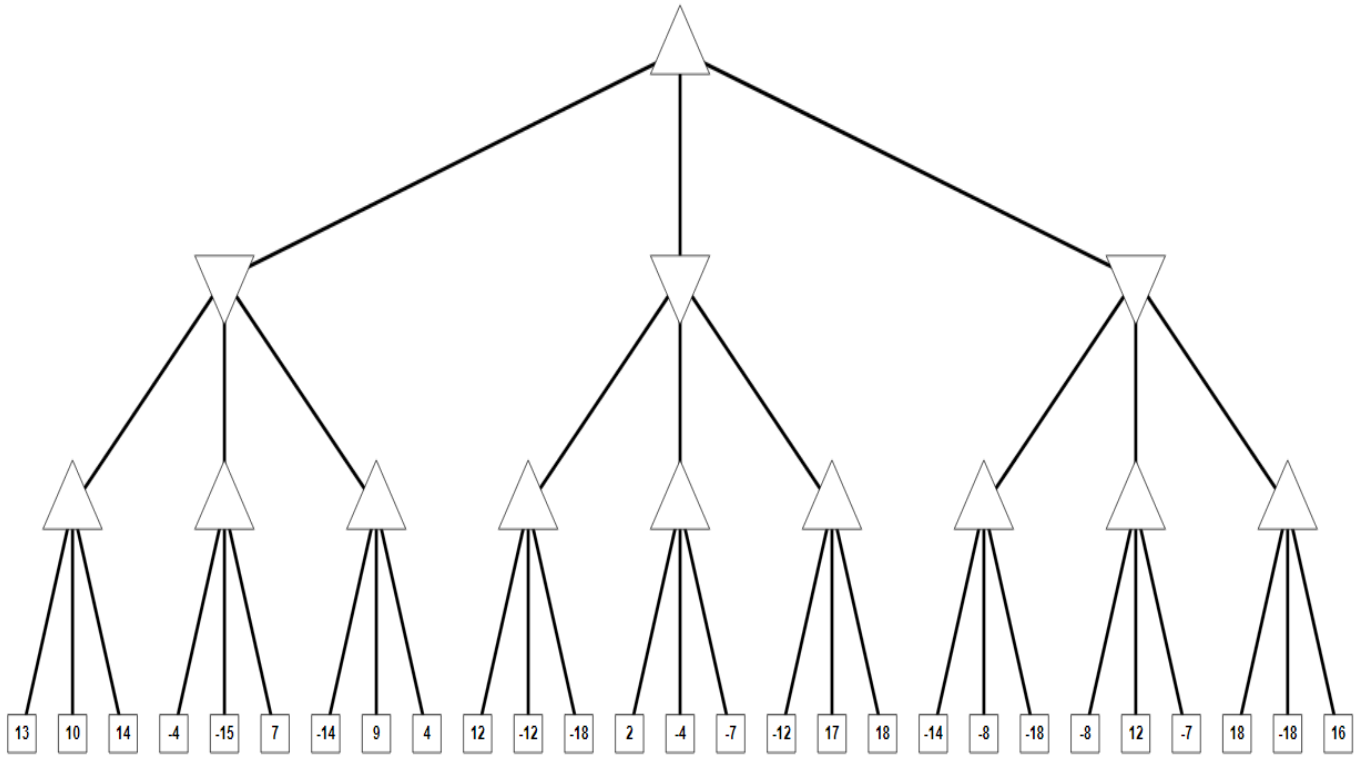
    i. Which heuristic is possibly inadmissible?
    ii. Among h5 and h6 which one is dominant?
    iii. Which heuristic will expand the maximum number of nodes?
    iv. In your opinion which heuristic is the best?

3. What is the role of the temperature T in Simulated Annealing? How do chances of taking bad moves change with the value of T? Show that as time passes by simulated annealing behaves like hill climbing search

4. Consider the following game tree.

△ Max ▽ Min

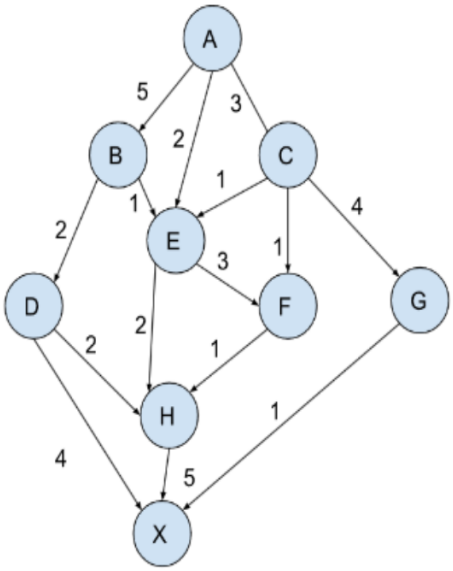
Apply minimax search and show which nodes will be pruned **if you use alpha-beta pruning**.



5. Consider the following map of Bangladesh where borders among the eight divisions have been marked. You need to color each of these divisions using three colors (Red/Green/Blue) such that two adjacent divisions do not receive the same color.
Now **formulate** the problem as CSP, Show the **Constraint Graph** and solve the problem **applying** both

Minimum Remaining Values(MRV) and Least Constraining Value(LCV) heuristics. [

6.



Node	h-Value
A	7
B	5
C	6
D	3
E	4
F	4
G	2
H	2
X	0

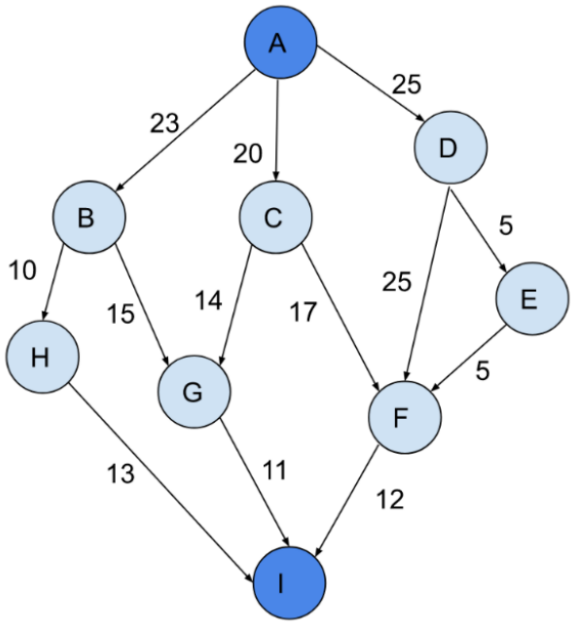
In the above graph, node A is the source, and node X is the destination. The arrows indicate directed edges. The table contains the heuristic values of each node. Now answer the following:

a. **Apply** A* algorithm to find the path from the source to the destination. Show the steps. In case, you end up with multiple nodes with f(n) = g(n) + h(n), then you can break the tie by choosing the lexicographically (alphabetically) smaller node. Suppose, node C and node D has the same f(n), in that case, choose C.

b. Is the heuristic consistent? Why or why not? **Explain** with appropriate calculation.

7.

In the following graph, A is the source and I is the destination. Each edge has a cost associated with it.



a. For each of the nodes from A to I in the graph above, **define** a random heuristic value that is consistent.

8.

Assume [X1, X2, X3, X4, X5, X6, X7, X8] represents a set of 8 numbers where each number can be anything from 1 to 100. Now your task is to find such a set with a combination of numbers where the difference between sum of the even numbers and sum of the odd numbers is 30. And you have to solve this problem using Genetic Algorithm. So, for e.g., if D1 represents sum of the

odd numbers and D2 represents sum of the even numbers then (D1 - D2) or (D2 - D1) will be equal to 30 for the solution.

a. Encode the problem and **deduce** two parent chromosomes, PC1 and PC2. But for PC1, the value of X1 should be 100, and for PC2 the value of X1 should be 1.

b. **Define** a suitable fitness function for the problem and calculate the fitness of PC1 and PC2.

c. **Illustrate** single point crossover after X4 between PC1 and PC2, and then perform mutation. You can mutate a number of your choosing. Finally, calculate fitness of the two newly formed child chromosomes and comment on which child is fitter.