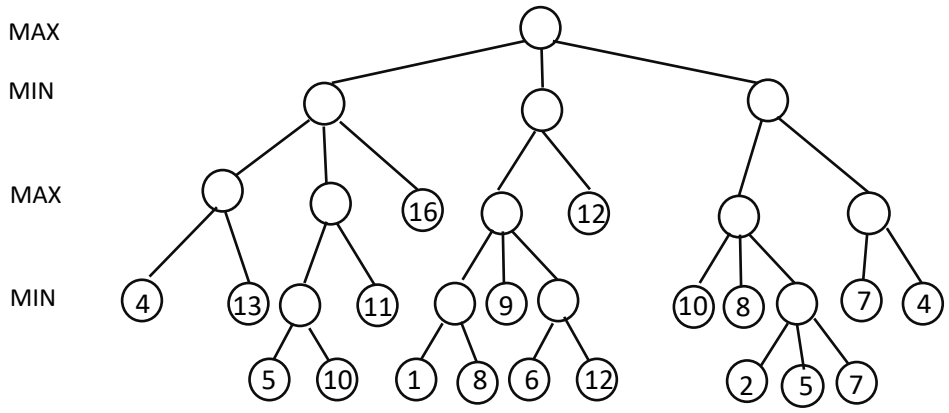
Comp 3710 Artificial Intelligence Concepts.

Assignment 3 (Points 10)

Due on 13/03/2021 Before 11:59pm

Part I Adversarial Search (Points 3)



a) Compute the minimax value at each node for the game tree above. Copy the above tree into your answer sheet and show the value of each node. (1 Point)

b) Use the Alpha-Beta pruning algorithm to prune the game tree above. You should draw an X through any pruning edge(s). Assume nodes are expanded left to right. Show all alpha and beta values computed at each node. Copy the above tree into your answer sheet and write down all alpha and beta value clearly. Submission should be well organized to clearly see each value. (2 Points)

NOTE: Use the minimax algorithm and the Alpha-Beta pruning algorithm that we discussed in the class to solve the above two problems respectively.

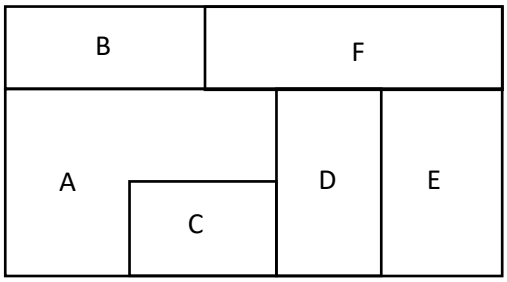
Part II Constraint satisfaction problem (CSP) (Points 7)

a) Solving the following cryptarithmetic problem on a paper, using the strategy of backtracking with forward checking and the Minimum Remaining Value Heuristic and least-constraining-value heuristic. (3 Points)

NOTE: The similar problem has been solved by showing all the required steps. You can find it under resources in BB. To solve the below cryptarithmetic problem, you should show all required steps to get full points. Submitting just a solution without showing the above strategies (Forward checking, backtracking, MRV, and LCV) in your writing will not acceptable for grading.

$$\begin{array}{r} C\ R\ A\ C\ K \\ +\ H\ A\ C\ K \\ \hline E\ R\ R\ O\ R \end{array}$$

b) We discussed a map-coloring problem as a constraint satisfaction problem in the class. This task considers the same problem for a different map as shown below. Each region must be colored in red, green or blue. There are two constraints. First, we need to color the map such that two adjacent regions always have different colors. Second, we are also required to color region C with blue.



a. **Formulate the above map-coloring problem** as a constraint satisfaction problem. (i.e., state variables, domain and constraints)
b. Given the map above, **draw the constraint graph** by adding edges between states. (0.5 point)
c. **Solve the above problem** using minimum remaining values (MRV) variable ordering. Break ties using alphanumerical ordering (A comes before Z). (1.5 points)
d. On the table below, **cross out values** that violate arc-consistency by running the algorithm AC-3. The unary constraint on C is already applied for you. **Show each required step** when you process AC-3 Algorithm (check the lectures to draw arc and remove values when it violates arc-consistency) (2 points)

	A	B	C	D	E	F
Red			-			
Green			-			
Blue						

Submission should include a PDF document which should satisfy the following:

- All answer must be typewritten
- All required steps must be given clearly.

*****