CO541– ARTIFICIAL INTELLIGENCE

ASSIGNMENT 04

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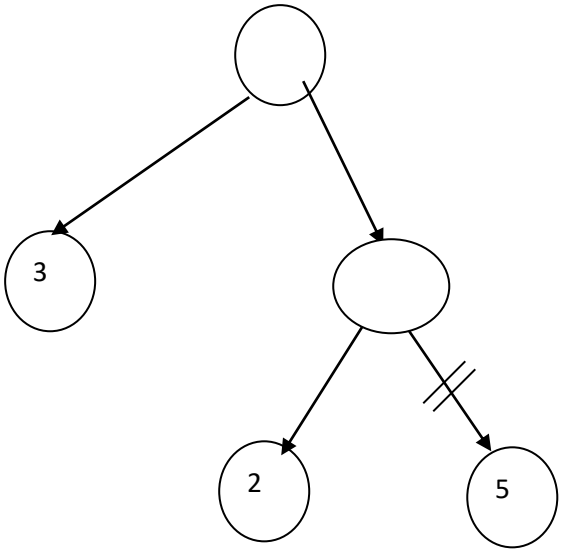
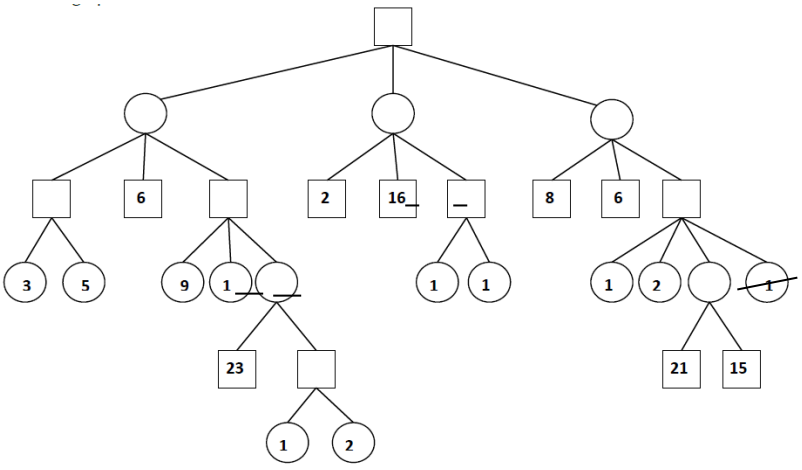
E/14/125

SEMESTER 08

1. Draw the smallest possible game tree on which alpha-beta will prune at least one leaf node. Make sure to label the leaves with values, and circle the leaf (or leaves) that will be pruned.



2.



3.

4. Define in your own words the terms constraint satisfaction problem, constraint, backtracking search, arc consistency and min-conflicts.
Constraint satisfaction problem – these are mathematical problems whose objects should satisfy a number of limitations.
Constraint – a kind of limitation
Backtracking search – DFS for CSPs with single variable assignment, Backtracking can be applied only for problems which admit the concept of a "partial candidate solution" and a relatively quick test of whether it can possibly be completed to a valid solution.

Arc consistency - A variable of a constraint satisfaction problem is arc-consistent with another one if each of its admissible values is consistent with some admissible value of the second variable. Formally, a variable x1 is arc-consistent with another variable x2 if,

for every value a in the domain of x1 there exists a value b in the domain of x2 such that (a, b) satisfies the binary constraint between x1 and x2. A problem is arc consistent if every variable is arc consistent with every other one.

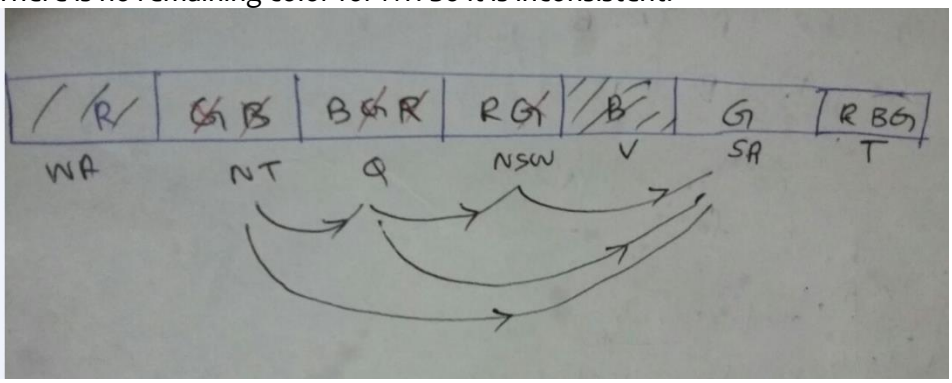
Min conflicts - an initial assignment of values to all the variables of a CSP, the algorithm randomly selects a variable from the set of variables with conflicts violating one or more constraints of the CSP. Then it assigns to this variable the value that minimizes the number of conflicts. If there is more than one value with a minimum number of conflicts, it chooses one randomly. This process of random variable selection and min-conflict value assignment is iterated until a solution is found or a pre-selected maximum number of iterations is reached.

5. How many solutions are there for the map-coloring problem discussed in the class (i.e., of Australia)?
   18

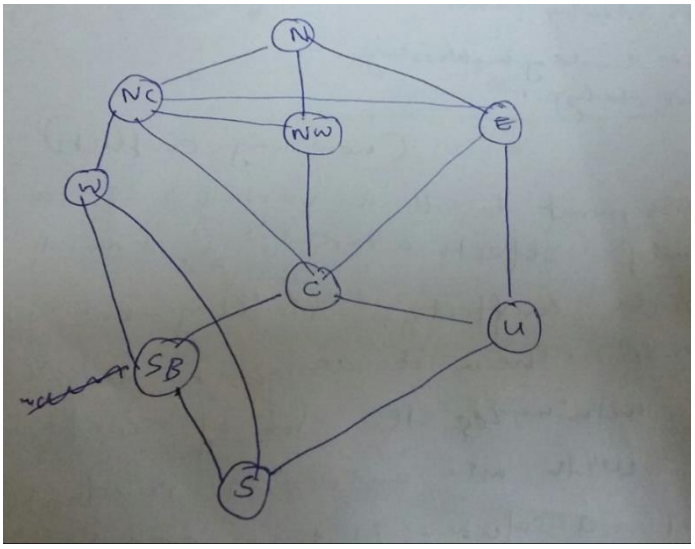
6. Explain why it is a good heuristic to choose the variable that is *most* constrained, but the value that is *least* constraining in a CSP search.
   Choosing the variable with the fewest legal values is called the minimum remaining values (MRV) heuristic. Once a variable has been selected, the algorithm must decide on the order in which to examine its values. For this, the least constraining value heuristic can be effective in some cases. It prefers the value that rules out the fewest choices for the neighboring variables in the constraint graph.

7. Use the AC-3 algorithm to show that arc consistency is able to detect the inconsistency of the partial assignment {WA = red, V = blue} for the map-coloring problem mentioned in Question 4.

   There is no remaining color for NT. So it is inconsistent.



9. (a)



(b)

N	NW	NC	E	W	SB	C	V	S
RGB	RGB	RGB	RGB	RGB	RGB	RGB	RGB	RGB
GB	R	GB	GB	GB	RGB	RGB	RGB	RGB
GB	R	B ⟺	B	GB	B	G	RB	RGB

inconsistent.