National University of Computer and Emerging Sciences

Karachi Campus

Artificial Intelligence (AI2002)

Sessional-II Exam

Total Time (Hrs): 1

Total Marks: 15

Total Questions: 3

Date: April 4th 2024

Course Instructor(s)

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_____ Roll No

_____ Section

_____ Student Signature

Attempt all the questions.

CLO 3: To demonstrate understanding and ability to implement the major concepts, approaches and research in evolutionary algorithms, CSP.

Q1: **[Time: 20 Minutes] [1+4= 5 Marks]**

A. How does mutation enhance the genetic variation within a population?

Solution:

Mutation randomly modifies the genetic information (genotype) of individuals in a population. This modification can involve changing one or more genes or altering the structure of chromosomes.

B. Maximize the function $f(y) = x^2 + 2x - 1$ from [0-31] use genetic algorithm for finding the solution. Your solution must obey following conditions:

1. Initially you can select 4 chromosomes with the values 8, 13, 19, 23.
2. Perform single point cross over at point 2 and 4.
3. Perform mutation only on weakest chromosome at point 3.
4. Comment whether your answer is converging or diverging.

CLO 2: To identify and relate methods of search and practically apply the corresponding techniques.

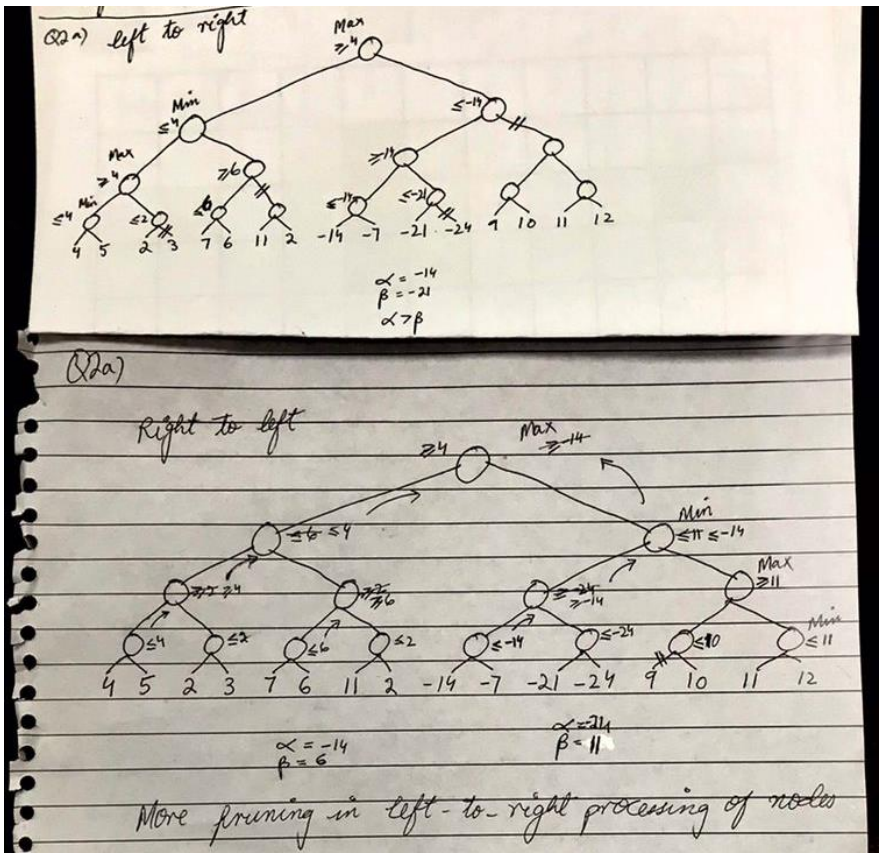
Q2: **[Time: 20 Minutes] [4+1 = 5 Marks]**

A. A game is played between max, and min. Draw a tree considering Max as a first player and the branching factor is 2. Given terminal values below, show backed-up values, the best decision available at the root, and branches that will get pruned (explain why they are getting pruned if any).

4, 5, 2, 3, 7, 6, 11, 2, -14, -7, -21, -24, 9, 10, 11, 12.

Explain which processing of nodes either left-to-right or right-to-left would lead to an increase, decrease or no change in the number of pruned branches?

Solution:



From left-to-right number of pruned branches will be increased.

B. How does the minimax algorithm improve decision-making within adversarial search scenarios?

Solution:

It improves decision-making by allowing an agent to anticipate and plan for the actions of its opponent, leading to more informed and strategic choices.

CLO 3: To demonstrate understanding and ability to implement the major concepts, approaches and research in evolutionary algorithms, CSP.

Q3: **[Time: 20 Minutes] [3+2 = 5 Marks]**

A. A group of three friends is planning their vacation itinerary for a week, and they have a list of five possible destinations to visit Each friend can only join one destination per morning. The destinations and their corresponding time slots are:

Hiking Trail : Opens from 1:00 pm-2:00 pm
Beach Resort : Opens from 1:30 pm-2:30 pm
Historical Museum : Opens from 2:00 pm-3:00 pm
Amusement Park : Opens from 2:00 pm-3:00 pm
Wildlife Safari : Opens from 2:30 pm-3:30 pm

The friends who will be joining the trip are:

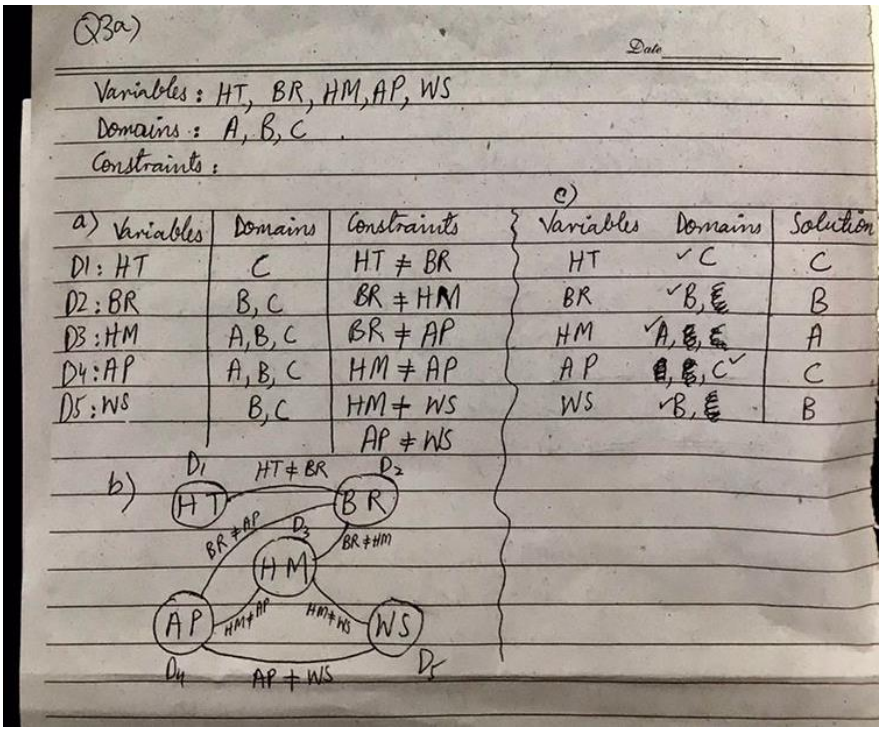
Friend Alice, who is available to visit Destinations 3 and 4.
Friend Bob, who is available to visit Destinations 2, 3, 4, and 5.

Friend Carol, who is available to visit Destinations 1, 2, 3, 4, 5.

Formulate this as a CSP problem by answering the following:

1. Identify variables, domains, and constraints of the problem.
2. Draw a constraint graph of the problem.
3. Show the domains of the variables after running arc consistency on this initial graph and give one solution to this CSP.

Solution:



B. You are solving the puzzle of cryptarithmetic that represents a different digit and none of the numbers use leading zeros. You have solved the puzzle of BLACK + GREEN = ORANGE and CROSS + ROADS = DANGER and got their numerical values.

A remover nearby fell on your answer and although you got the solution, some values of your answers were erased, _2 _7 _ 1 and 1 _ _ 6 _ 4. Now solve again to get the correct answer.

Solution:

BLACK	7	9	2	0	8	
GREEN	5	3	4	4	6	
ORANGE	1	3	2	6	5	4

CROSS	9	6	2	3	3	
ROADS	6	2	5	1	3	
DANGER	1	5	8	7	4	6