NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES, KARACHI CAMPUS
SPRING 2021

Course: Artificial Intelligence **Sections: 6E, 6G, 9A**
Due Date: 25/04/2021 **Teacher Name: Dr. Fahad Sherwani**
Total Marks=5 Marks (1 each)

Assignment 1 & 2

Q1) You are in charge of scheduling for computer science classes that meet Mondays, Wednesdays and Fridays. There are 5 classes that meet on these days and 3 professors who will be teaching these classes. You are constrained by the fact that each professor can only teach one class at a time.

The classes are:

• Class 1 - Intro to Programming: meets from 8:00-9:00am

• Class 2 - Intro to Artificial Intelligence: meets from 8:30-9:30am

• Class 3 - Natural Language Processing: meets from 9:00-10:00am

• Class 4 - Computer Vision: meets from 9:00-10:00am

• Class 5 - Machine Learning: meets from 9:30-10:30am

The professors are:

• Professor A, who is available to teach Classes 3 and 4.

• Professor B, who is available to teach Classes 2, 3, 4, and 5.

• Professor C, who is available to teach Classes 1, 2, 3, 4, 5.

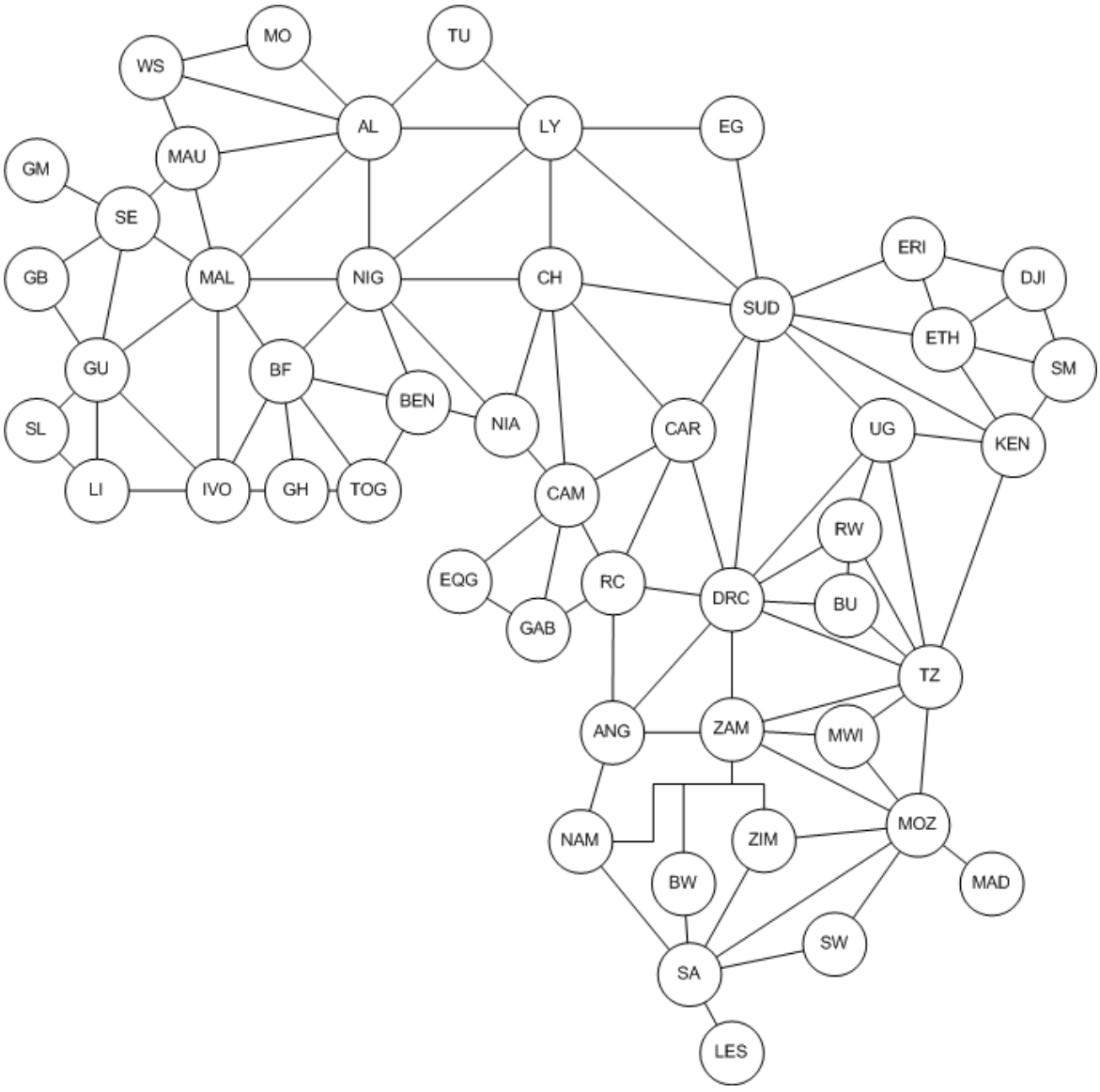
a) Formulate this problem as a CSP problem in which there is one variable per class, stating the domains, and constraints. Constraints should be specified formally and precisely but may be implicit rather than explicit.
b) Draw the constraint graph associated with your CSP.
c) Show the domains of the variables after running arc-consistency on this initial graph (after having already enforced any unary constraints).

NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES, KARACHI CAMPUS
SPRING 2021

Course: Artificial Intelligence **Sections: 6E, 6G, 9A**
Due Date: 25/04/2021 **Teacher Name: Dr. Fahad Sherwani**
Total Marks=5 Marks (1 each)

Q2) Consider the Map coloring problem for the map of Africa below. Use AC-3 algorithm to make the network consistent while following the constraints.

Variables: 49 Countries, Constraints: 107 - No adjacent state can have same color, Domain: Red, Green, Blue, Yellow.



NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES,
KARACHI CAMPUS
SPRING 2021

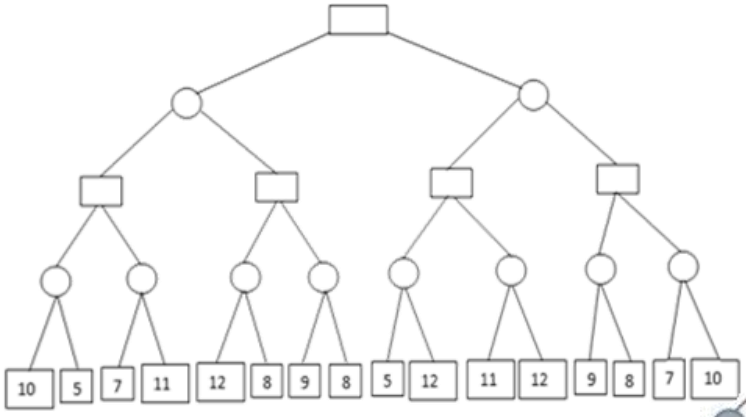
Course: Artificial Intelligence **Sections: 6E, 6G, 9A**
Due Date: 25/04/2021 **Teacher Name: Dr. Fahad Sherwani**
Total Marks=5 Marks (1 each)

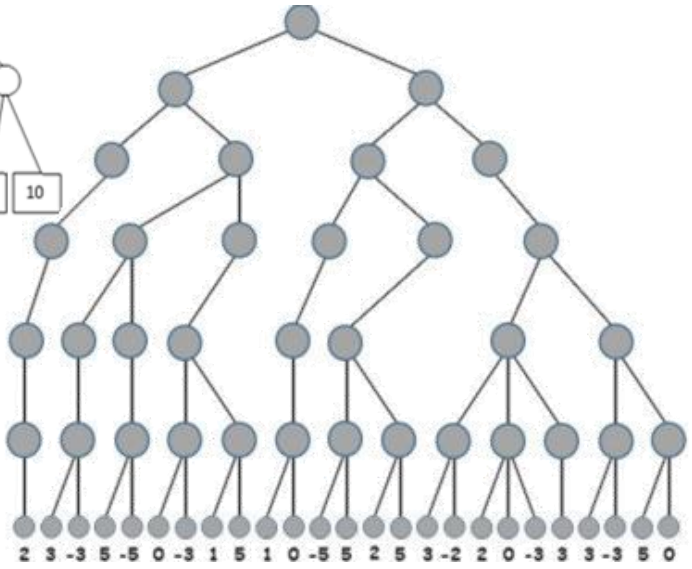
Q3) Solve the following Cryptarithmetic problem considering the following Constraints:

a) The arithmetic operations are in decimal; therefore, there must be maximum ten different letters in overall strings which are being used.
b) All of the same letters should be bound to a unique digit and no two different letters could be bounded to the same digit.
c) As the words will represent numbers, the first letter of them could not be assigned to zero.
d) The resulting numbers should satisfy the problem, meaning that the result of the two first numbers (operands) under the specified arithmetic operation (plus operator) should be the third number.

1. DAN+NAN=NORA
2. TWO+TWO=FOUR
3. CAT+RUN=AWAY
4. BASIC+LOGIC=PASCAL
5. BROWN+YELLOW=PURPLE

Q4) Use Min-Max algorithm on the following game trees to find the best possible path for Max player that ensures to maximize its score. Also, apply Alpha-Beta pruning to reduce the computational time required to implement these game trees.





NATIONAL UNIVERSITY OF COMPUTER AND EMERGING SCIENCES,
KARACHI CAMPUS
SPRING 2021

Course: Artificial Intelligence **Sections: 6E, 6G, 9A**
Due Date: 25/04/2021 **Teacher Name: Dr. Fahad Sherwani**
Total Marks=5 Marks (1 each)

Q5) Genetic algorithm can be represented as a sequence of procedural steps moving from one population of artificial chromosomes to a new population.

Suppose that the size of a chromosome's population, N, is 4 and the chromosomes are built in the form of X = abcdefgh. Assume that each gene takes only integer values ranging from 0-9. The initial population consists of the following chromosomes:

X1 = 65413532
X2 = 87126601
X3 = 23921285
X4 = 41852094

The fitness function used to measure the chromosome's performance is as follows:

$$f(x) = (a + b) - (c + d) + (e + f) – (g + h)$$

1) Calculate the fitness of each individual chromosome and arrange them in descending order of fitness.
2) Apply crossover on the three fittest chromosomes using a one-point crossover which is in the middle and swap the first half of the first chromosome with the second half of the second chromosome. 3) Perform 6 Iterations and Apply mutation for all chromosomes after every 3 iterations by swapping the first gene with the last gene.