



National University of Computer & Emerging Sciences, Karachi



Spring-2018 CS-Department

MidTerm 2

3rd April 2018, 11:00 am – 12:00 noon

Course Code: CS-401

Course Name: Artificial Intelligence

Instructor Names: Dr. Rauf Shams Malick, Syed Ali Naqvi, Farrukh Hasan

Student Roll No:

Section No:

- Return the question paper.
- Read each question completely before answering it. There are 3 questions and 2 pages.
- In case of any ambiguity, you may make assumption. But your assumption should not contradict any statement in the question paper.
- You can attempt questions in any order. But all parts of a question must be done in sequence.
- Conserve time, energy, paper, ink, and your marks. Irrelevant answers will result in penalty.

Time: 60 minutes.

Max Marks: 45 points

Question 1: Alpha-Beta pruning [10 points]

Draw a tree with 2 moves for Max and 1 move for Min and branching factor=2. Label the nodes alphabetically. That is, label the root A, the next B, and so on in a left to right breadth first fashion.

Given terminal values below, show backed up values, best decision available at the root, branch(es) that will get pruned and explain why they will get pruned.

8, 11, 8, -4, 7, -18, 3, 5

Question 2: CSP [20 points]

You are not happy with your timetable so you decide to offer your services as the new timetable coordinator. But before that, you think it wise to practice on a simpler timetable.

You try your hand at arranging computer science classes that meet on Mondays. There are 5 classes that meet on Monday 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
- Each class is taught by only one professor
- Each professor can only teach some of the classes.

The classes are:

- Class 1 – Introduction to Programming: meets from 8:00-8:55 am
- Class 2 - Intro to Artificial Intelligence: meets from 8:30-9:25 am
- Class 3 – NLP: meets from 9:00-9:55 am
- Class 4 – Robotic: meets from 9:00-9:55 am
- Class 5 – ML: meets from 9:30-10:25 pm

The professors are:

- Professor X, who is qualified to teach Classes C3 and C4.
- Professor Y, who is qualified to teach Classes C2, C3, C4 and C5.
- Professor Z, who is qualified to teach Classes C1, C2, C3, C4 and C5.

You have decided to formulate this problem as a CSP problem in which there is one variable per class (C1-C5) and professors are domain values (X, Y and Z). Answer the following questions:

- For each variable C1-C5 write down their domains. [5 points]
- Write all constraints, either implicitly or explicitly. [5 points]
- Draw a constraint graph for the problem. [10 points]

Question 3: Genetic Algorithm [15 points]

$\frac{15}{15}$

$\frac{7}{3}$

You are a skilled pilot, but the plane you were flying developed some problems and forced you to crash land in the wilderness. You must now go out on foot and try to reach a village or city. You have some equipment on the plane (list given below) from which you need to choose some items that can increase your chances of survival. But you can only carry 30 kg.

ITEM	WEIGHT	SURVIVAL POINTS
SLEEPING BAG	15	15
ROPE	3	7
POCKET KNIFE	2	10
TORCH	5	5
BOTTLE	9	8
GLUCOSE	20	17

- Choose an initial population of four. Then choose best three subsequently. (Encoding hint: 1 if item is chosen, 0 otherwise).
- Decide crossover point. (You can use different crossover points each generation if you want, but clearly mention it)
- Chance of mutation = 50 times in 100 generations (1 bit mutation only. Clearly show which bit is mutated)

Question. Explain your choice of fitness function. Then simulate a dry run of genetic algorithm running for initialization + 2 generations.