Programming languages (TC-2006)

Midterm Exam - Prolog

Date: December 1, 2020

This exam contains five problems. You are requested to solve all of them. Please note that this time, there is no template for the solution. This is on purpose since you should have the flexibility to solve these problems to best fit your needs. Please note that you must submit only working code. If your code does not run, your final grade will be zero. Then, comment out any piece of code that does not work. However, feel free to include comments to explain your rationale, particularly when the code is commented out because it does not work as requested.

1 `cows` (15%)

Four black cows and two brown cows give as much milk in five days as three black cows, and five brown cows give in four days. Assume that a regular cow produces between 22 and 32 liters of milk per day. Which kind of cow is the better milker, black or brown? Write a program in Prolog that solves this problem.

2 `ages` (15%)

The youngest of a group of friends is older than 34 years, and nobody is older than 50. In five years, Tom will be as old as Howard will be in 12 years. Jack is younger than Tom by at least eight years. Howard was born three years before Jack. Howards's age is a multiple of seven. What old are these friends? Write a program in Prolog that solves this problem.

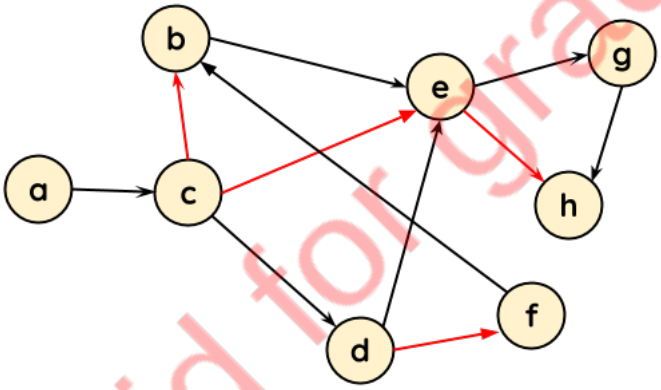
3 `sum` (20%)

Write a program in Prolog that solves the following cryptarithmetic puzzle:

As in other cryptarithmetic puzzles, each letter must be given a value between 0 and 9, and no repeated values are allowed for two or more different letters. Please have in mind that, for solving this problem, you must also consider the carriers of the sum.

4 `path` (20%)

Write a program in Prolog that checks if there is at least one path between two given nodes in the following directed graph.



This time, there is an additional constraint when traversing the graph: red edges are restricted. Then, a valid path can include, at most, one red edge. For example, when asking for a path between nodes `a` and `h`, the program must not return `a-c-d-h` since it goes through two red edges. However, there are other alternatives to get from node `a` to node `h`. For example, `a-c-d-e-g-h`, which includes no red edges.

5 `masters` (30%)

Write a program in Prolog that matches each of the following questions with its right answer (do not forget to use the hints provided).

Q1. He-man's twin sister. **Hint**: it ends with the string "RA".

Q2. Prince Adam's secret identity. **Hint**: It starts with the letter 'H'.

Q3. Skeletor's former name. **Hint**: it contains the letter 'E' but not the letter 'M'.

Q4. Skeletor's master and leader of the Horde. **Hint**: its third and fifth letters are 'R' and 'A', respectively.

The possible answers to these questions are 'HEMAN', 'HORDAK', 'KELDOR', and 'SHERA'.

Deliverables

Prepare a PL file that contains the functions requested and submit it to Canvas. **Please, do not submit other formats but PL**.

I promise to apply my knowledge, strive for its development, and not use unauthorized or illegal means to complete this activity, following the Tecnológico de Monterrey Student Code of Honor.