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Artificial Intelligence / Data Visualization and Communication CA

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# Introduction

**Tasks for Artificial Intelligence**

Ciara is looking for employees for her new company, which develops and provides AI based logistic software for retailers. Ciara has determined that she needs: 2 Python Programmers, 2 AI Engineers, 1 Web Designer, 1 Database Admin, and 1 Systems Engineer. Assume that if a person has two abilities, he or she can take on two roles in the company.

Using any CSP (Constraint Satisfaction Problem) framework (using variables, value domains, and constraints), discover if the above problems can be solved and if so, detail who would be in hired**.**

Discuss in detail how using Constraint Satisfaction finds an answer or finds no solution to the problems in Tasks for Artificial Intelligence part 1. How does this differ from standard algorithmic solutions?

These problems be solved using several other algorithm’s we have studied in the module. Choose one of these algorithms and discuss your answer in detail including a proof of your hypothesis in code**.**

**Tasks for Data Visualisation**

Use appropriate visualisations to help communicate the CSP scenario and the corresponding solutions, if any, to the appropriate stakeholders.

Create interactive visualisation(s) to allow a user to explore alternate constraint scenarios.

Create GUI(s) to allow a user to explore alternate constraint scenarios.

Include in your report a section for a theoretical AI “team” you are part of, explaining the visualisation processes and rationalising your visualisation decisions (e.g., chart choice, colour, layout etc).

# Report

# **Artificial Intelligence**

*Scenario 1*

*Variables* The variables for this scenario are all the names involved. {Peter, Juan, Jim, Jane, Mary, Bruce, Anita}.

*Value Domain*

Value Domain for this scenario are the abilities each person has. {Python Programmer, AI Engineer, Web Designer, Database Admin and Systems Engineer}

*Constraints*

Constraints for this scenario are the numbers of hires they can have, 3, and the number of hires needed for each department, 2 Python Programmers, 2 AI Engineers, 1 Web Designer, 1 Database Admin, 1 Systems Engineer and that Ciara knows Python.

*Result* Jane, Juan and Jim. Jane and Ciara will act as a Python Programmers, Jane will take the other position as a Database Admin since she is the only one with this skill, Juan will be working as the only Web Designer and as one of the AI Engineers and Jim will take the second position as an AI Engineer and the only position as Systems Engineer.

Scenario 2

*Variables* The variables for this scenario are all the names involved. {Peter, Juan, Jim, Jane, Mary, Bruce, Anita}.

*Domain*

Value Domain for this scenario are the abilities each person has. {Python Programmer, AI Engineer, Web Designer, Database Admin and Systems Engineer}

*Constraints* Constraints for this scenario are the numbers of hires they can have, 2 Python Programmers, 3 AI Engineers, 1 Web Designer, 1 Database Admin, 1 Systems Engineer and that now they can hire 4 people with one extra person needed for AI Engineer.

# *Result*

Peter, Jane, Jim and Anita. Peter will act as one of the two Python Programmers and as a one of the three AI Engineers, Jane will act as a second Python Programmer and as the only Database Admin, Jim will act as the second of the three AI Engineers and as the only Systems Engineer and Anita will act as the third AI Engineer and as the only Web Designer.

# *CSP Framework for Solving Problems*

Constraint Satisfaction Problem is the method used to find a solution to a one or more constraints within a problem, finding values for a group of variables that will satisfy the requirements. CSP has three components: Variables, Domain and Constraints.

Variables: Values that need to be determined are known as variable, they need to be assigned to satisfy a set of constraints. In our case the variables were the name of each person.

Domain: The value that each variable can have or hold is known as value domain. In our case, each variable, name, hold one or two values, the abilities and those abilities were the Value Domain.

Constraints: Constraints are the specific requirements or rules that need to be satisfied in order to get a result. In our cases constraints where the number of hires they needed in each department and the number of hires they could do, per example.

After defining those three components within our problem, we can code, using python in our case per example, using the constraints library, and to come to an answer by using backtracking or forwardtracking algorithms to return our answer.

*How CSP finds an answer for both scenarios*

CSP uses a backtracking or forwardtracking algorithm to return the answer to our set of constraints. In our case, it checks possibilities of assigning combinations of variables and values, so it combines three different people and their respective roles to see if all the constraints are satisfied, if not, it deletes and will not try that combination again, if all constraints are satisfied then it returns that outcome. In the second case, it takes set of combinations between four people and their abilities until it finds a combination that satisfies all constraints. One of the possible solutions for scenario 1 is: Jane {Python and Database Admin}, Juan {Web Designer, AI Engineer} and Jim {Systems Manager and AI Engineer}. Ciara will take the second Python position available for this scenario. Scenario 2:

*CSP Vs Standard Algorithms*

CSP stands for Constraints Satisfaction Problem and those constraints have requirements that need to be met to be completed. Is very used to solve problems where it is needed to assign values to variables in a way where all restrictions are satisfied. To solve CSP all is needed is to define what are the variables, domain value and constraints of our problem, apply the algorithm and look for the optimal solution that satisfies all constraints. One of the algorithms used to solve it is known as backtracking algorithm used for search and optimization, it works by “building” candidates and checking is that is a viable and accept solution, if it is not the algorithm will not consider those candidates again, will move back and try with another set of candidates this way will check and get to all the possible solutions. In standard algorithm the approach is different as well as the application field, while CSP represents the term by variables, domain values and constraints meanwhile in the standard algorithm require a more step by step explanation of each phase of the process and involves a more logic and detailed code for problem-solving.

*Alternative Framework for Solving Problems*

# **Data Visualization and Communication**

# Constraint Satisfaction Problem is used when there are variables that need to be assigned to a value and must satisfy a set of rules, or constraints. It has three components:

Variables:

Domain:

Constraints

# 

# Rationale of the code

Interface gráfica do usuário, Texto, Aplicativo, Email

Descrição gerada automaticamente

Interface gráfica do usuário, Texto, Aplicativo

Descrição gerada automaticamente

# **Conclusion**

# References

<https://www.geeksforgeeks.org/constraint-satisfaction-problems-csp-in-artificial-intelligence/>

https://www.simplilearn.com/tutorials/data-structure-tutorial/backtracking-algorithm#:~:text=Backtracking%20is%20a%20general%20algorithm,completed%20to%20a%20reasonable%20solution.