

1 Problem 1

Farabi(F), Zahid(Z), Ishrak(I) and Nafisa(N) went to Chini-Come, a restaurant close to their campus. Our task was to create CSP based on the given constraints and come up with a solution.

1.1 Problem Analysis

1.1.1 Variable

There were four variables - F,N,Z,I.

1.1.2 Domain

Each of the variable had four values in their domain - Special Rice (S), Biryani Rice (B), Kashmiri Naan (K), and Paratha (P).

1.1.3 Constraint

As given, Z does not like Paratha. So Z can not take the value P. So I created a unary constraint named $Z \neq P$ and in the truth table I unchecked the value of P and thus set it to False.

Ishrak and Farabi want to order different dishes. So I created a binary constraint $I \neq F$ and set all the entries of the table to false where the entry had same value for F and I.

Farabi will either take Special Rice or Biryani Rice. So in the truth table I set only the values of R and S to true.

Zahid will order the same dish as Ishrak. So I created a binary constraint $Z = I$ and set all the entries of the table to true where the entry had same value for Z and I.

Also, Zahid will order a unique dish. So I created binary constraint of Z with F and N, and set all the entries of the table to false where the entry had same value for the variables.

As Nafisa will not order K, I created a unary constraint and set the value of K for N false.

1.2 Solution

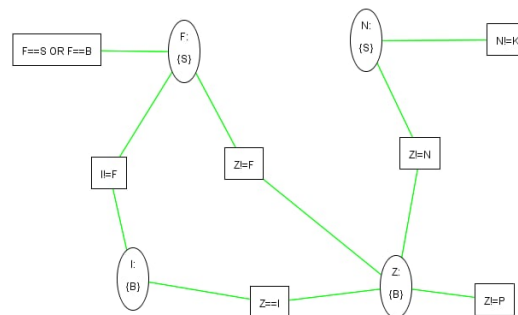


Figure 1.1: CSP of Problem 1

1.3 Findings

Solution found: $Z = B$, $F = S$, $I = B$, $N = S$

1.4 Challenges

At first I was not sure how to set the constraints for Z as he wanted unique dishes but also would copy I. Later our instructor explained that Z will only copy I. So the binary constraint between Z and I would be different than that of between Z and others.

2 Problem 2

Ali (A), Sristy (S), Maliha (M), and Rafid (R) are looking to for an apartment. There are three floors in the building: 1, 2, and 3. More than one person can live on a single floor, but each person must be assigned to some floor. Our task was to create CSP and find a solution.

2.1 Problem Analysis

2.1.1 Variable

There were four variables - A,S,M and R.

2.1.2 Domain

Each of the variable had three values in their domain - 1,2 and 3 which represents floor number(Integer).

2.1.3 Constraint

As Ali and Sristy must not live on the same floor, I took the complement of $A==S$ using the built in constraint type Equal.

If Ali and Maliha live on the same floor, they must both be living on floor 2. But if they live on different floors, one of them must be living on floor 3. So I set the values of $\{1,3\}$, $\{2,2\}$, $\{3,1\}$, $\{2,3\}$, and $\{3,2\}$ to true.

Rafid can not live on the same floor as anyone else. So I created 3 binary constraints and took the complement of $R==A$, $R==S$ and $R==M$.

As Rafid must live on a higher floor than Maliha, I used the Greater Than constraint between R and M set $R > M$

2.2 Solution

2.3 Findings

Solution found: $A = 2$, $S = 1$, $M = 2$, $R = 3$

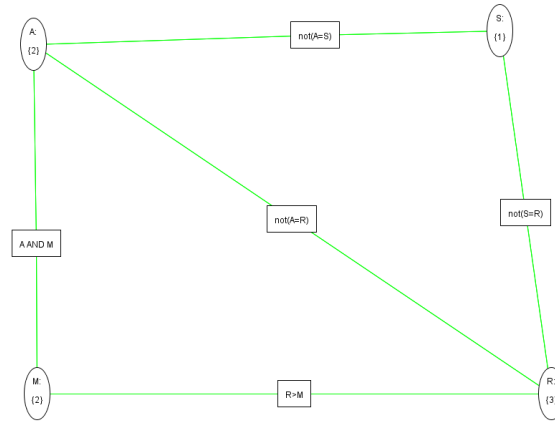


Figure 2.1: CSP of Problem 2

2.4 Challenges

Setting up the constraint for Ali and Maliha was a challenge. At first I thought only to set the entries true with a value of 3. But it did not meet the condition that they both must live on floor 2 if they lived on the same floor. To ensure that, later I set the value of 2,2 to true as well.

3 Problem 3

The six friends are in a line: Tabassum (T), Sabrina (S), Ishmam (I), Farhan (F), Atiq (A), and Rifat (R). Each friend has a distinct location among the six spots, which are labeled 1 through 6.

3.1 Problem Analysis

3.1.1 Variable

R,A,F,I,T,S are the variables.

3.1.2 Domain

Each variable could take values from 1 to 6(Integer).

3.1.3 Constraint

Farhan is standing in between Atiq and Ishmam. So I created two binary constraints $|F-A| = 1$ and $|F-I| = 1$. I set the values of the entries true where the difference between the pair of values were 1 such as $\{1,2\}, \{2,1\}, \{3,2\}, \{2,3\}$ etc.

Sabrina and Rifat are standing next to each other. So I created a binary constraint $|S-R| = 1$. This was similar to the previous 2 constraints.

Tabassum is either at the front of the line or the back of the line. So I set created a unary constraint and set only the values of 1 and 6 to true.

Sabrina has one person behind her. So I created a unary constraint and set only the value of 5 to true.

Now each of them were standing in unique location. So I took the complement of Equal constraint for each pair of values such as T and R, T and A, T and F, T and I, T and S and so on for other five variables.

3.2 Findings

Solution found: $R = 4$, $A = 1$, $F = 2$, $I = 3$, $T = 6$, $S = 5$

3.3 Solution

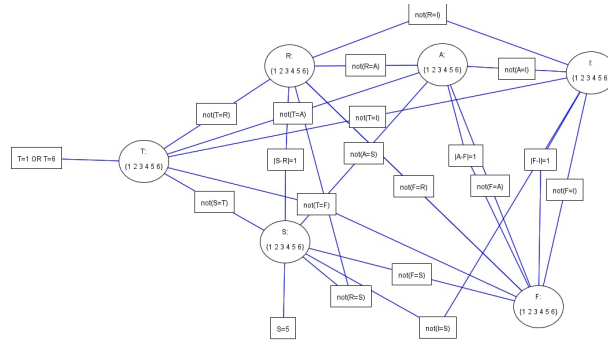


Figure 3.1: CSP of Problem 3

3.4 Challenges

In this task the most difficult constraint to satisfy was that each of them were to take unique spot. At first I tried to create ternary constraint. But I failed. As much I could understand, it is not possible to create so. It may be possible to do so but as I am not familiar with the tool I could not do so. That is why I created binary constraints for each pair. The resulting CSP contained too many constraints and it was huge.

4 Problem 4

The problem is designing a schedule for two faculty members who will fulfill the assigned work (G) Gather contents for Database Management Systems (DBMS) Lab, (Q) Check quiz scripts, (C) Take Artificial Intelligence class, (D) Conduct DBMS Lab, (L) Take AI lab within certain limits.

4.1 Problem Analysis

4.1.1 Variable

The variables were G,Q,C,D and L.

4.1.2 Domain

Each of the variable could take 8 eight values x8 (8 am - 9 am) , x9 (9 am - 10 am) , x10 (10 am - 11 am) , x11 (11 am - 12 pm) , y8 (8 am - 9 am) , y9 (9 am - 10 am) , y10 (10 am - 11 am) , y11 (11 am - 12 pm)

4.1.3 Constraint

At any given time, each faculty member can do at most one task (G, Q, C, D, L). I satisfied this constraint by creating binary constraint between each pair such as $D \neq L$, $D \neq G$, $D \neq Q$, $D \neq C$ and so on and setting false the entries of the truth table where the pair contained same values. For example $\{x_8, x_8\}$, $\{x_9, x_9\}$, $\{x_{10}, x_{10}\}$, $\{x_{11}, x_{11}\}$, $\{y_8, y_8\}$, $\{y_9, y_9\}$, $\{y_{10}, y_{10}\}$ and $\{y_{11}, y_{11}\}$.

The AI class (C) must happen before AI lab (L). I created a binary constraint between C and L, and set the pair of values false where the values of C were greater than L.

The contents (G) should be gathered before taking the DBMS Lab (D). I created a binary constraint between G and D, and set the pair of values false where the values of G were greater than D.

The DBMS Lab (D) should be finished by 10 am. As DBMS lab only take 1 hour, I set the values true where the starting time was 8 and 9 for both X and Y.

X is going to gather contents for DBMS (G) since s/he's good at browsing contents. I created a unary constraint and set the values true only for X.

The other faculty member not conducting DBMS lab (D) should attend the lab, and hence cannot do anything else at that time. I created binary constraints $D=X, Y$ and ensured that the pair of values for X and Y where time is same are set to false. Such as $\{x8, y8\}$, $\{x9, y9\}$ etc are false.

The person taking DBMS Lab (D) does not take AI Lab (L). I created binary constraint between D and L and the entries where both values of a pair were x or y, were set to false.

The person taking AI Lab (L) must also take the AI class (C). I created binary constraint between C and L and the entries where both values of a pair were x or y, were set to true.

Checking quiz scripts (Q) takes 2 consecutive hours and hence should start at or before 10 am. I created a unary constraint and set the value true where time was 8,9 and 10.

Taking AI Lab (L) takes 2 consecutive hours and hence should start at or before 10 am. I created a unary constraint and set the value true where time was 8,9 and 10.

4.2 Solution

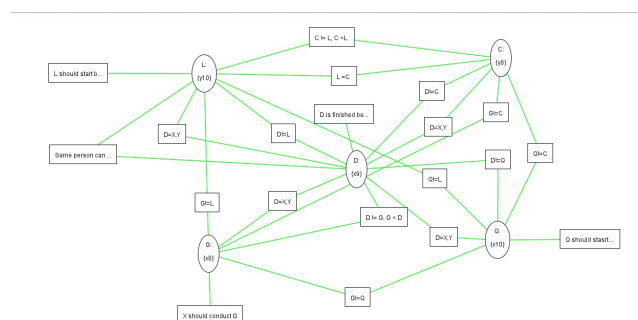


Figure 4.1: CSP of Problem 4

4.3 Findings

Solution found: $L = y_{10}$, $D = x_9$, $C = y_8$, $Q = x_{10}$, $G = x_8$

4.4 Challenges

Initially I was understanding how to set the variables and domain as the problem statement seemed a bit complex to me. I took help from others to understand thoroughly and determine the variables and domain. Another challenge I faced while solving this task was handling with the execution of the jar file. My CSP was not loading from file even though I saved it and was showing lots of error in command prompt and in XML file. I solved the problems almost 3 times because the file was not opening. Finally I created the CSP and took screenshot immediately.