CSC640
Assignment 2

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Q3) a) Formulation for K knights on NxN chessboard without attacking:
Variables: $\mathbf{X_{ij}}$ $\mathbf{1 \leq i, j \leq n}$

b) Possible Values: {0, 1}
0 indicating square has no knight
1 indicating the square contains a knight

c) Constraints:
$\Sigma X_{ij} = K$
$K \leq n^2$
$1 \leq i, j \leq n$
$(X_{ij}) \neq (X_{i \pm 2}, X_{j \pm 1})$ 4 constraints here
$(X_{ij}) \neq (X_{i \pm 1}, X_{j \pm 2})$ 4 constraints here
The top 8 constraints are used to maintain that no 2 knights are attacking on the board according to their movement rules.

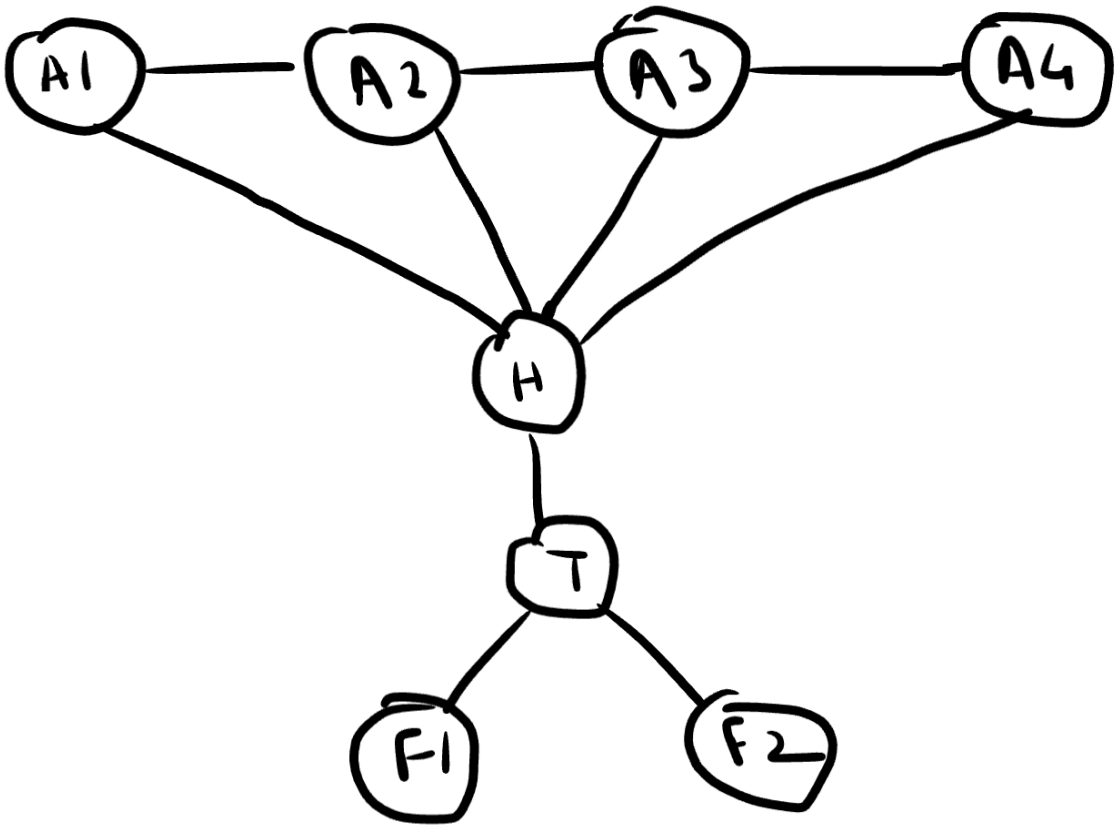
d) We start off the problem with an initial state using a binary 2D array S of size $n \times n$, where S_{ij} = 1 if there is a knight at that position, 0 otherwise. We can start off with K knights placed randomly on this 2D array S. Iteratively we apply actions to move the knights to new valid positions, aiming to minimize the number of attacking pairs and thus maximizing the utility. We stop the search when no better states are found or the max number of iterations have been reached.

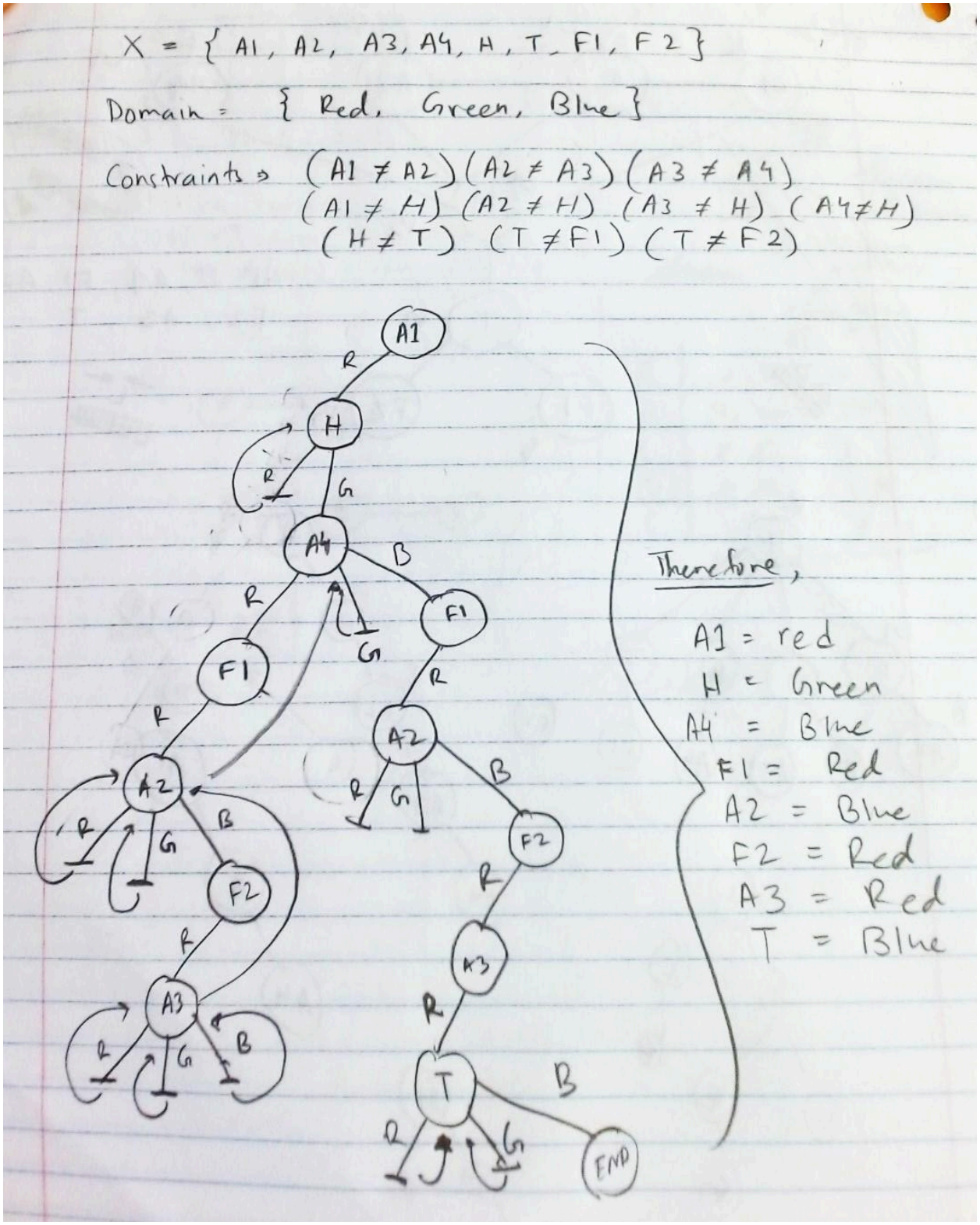
Objective function: Here we evaluate the quality of each state. The evaluation metrics will be the number of knights attacking each other. The next best state will be chosen based on this metric. Where the minimum is best.

Action function: This function will move a knight to an empty square such that the constraints are satisfied and create a set of new states from which we have to evaluate and choose the best one.

Result function: Here we chose the next best state from the set of actions and current state and evaluate the utility of each state.

Q4) a)

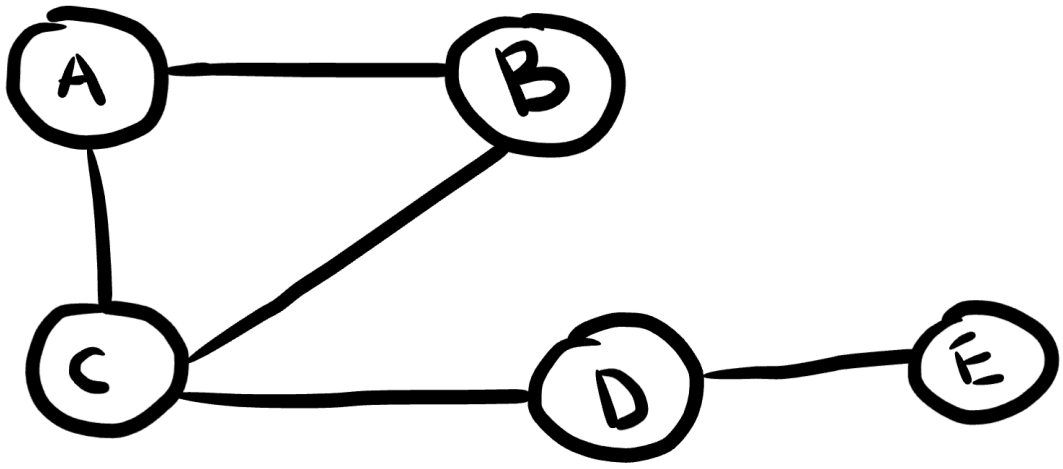




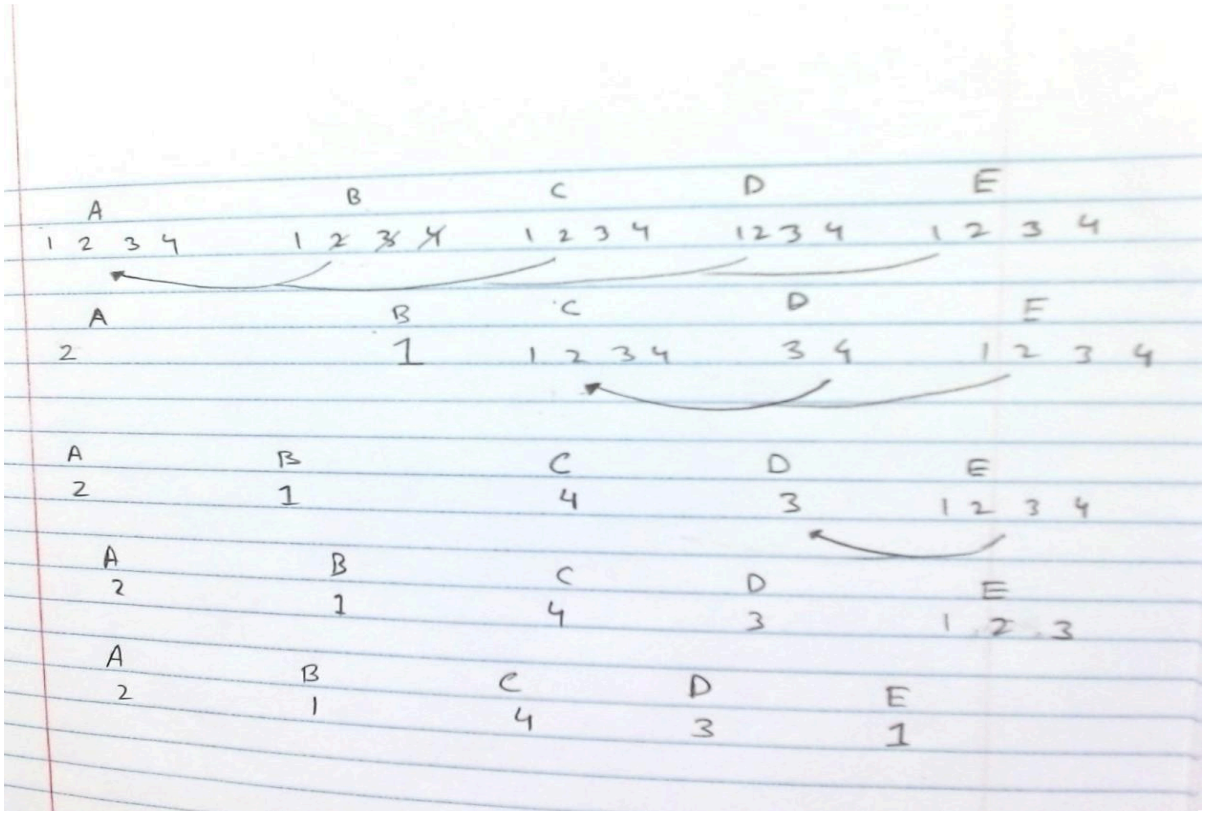
4) b, c, d done in python file the graph node colors are shown in the code.

Q5) a)
Variables: A, B, C, D, E
Domain: (r, t) Where r ∈ {International, Domestic} and t ∈ {1, 2, 3, 4}
Constraints:
B[t] = 1
D[t] ≥ 3
A[t] ≤ 2
D[t] < C[t]

b) i)
Variables: A, B, C, D, E
Domain: Time Slots: {1,2,3,4}
Same constraints as above just add:
A[r] = International
B[r] = International
C[r] = International
D[r] = Domestic
E[r] = Domestic



b) ii)



A	~~1~~	2	~~3~~	~~4~~
B	1	~~2~~	~~3~~	~~4~~
C	~~1~~	~~2~~	~~3~~	4
D	~~1~~	~~2~~	3	~~4~~
E	1	2	~~3~~	4

b) iii) (B, 1), (A, 2), (C, 3), (C, 4), (D, 3), (E, 1)

c) $O(n^3)$