Artificial Intelligence

CT-21003

Theory Assignment - CSP

Q1. Give precise formulations in Variable, Domain, Constraint and CSP Graph for each of the following as constraint satisfaction problems:

1. Rectilinear floor-planning: find non-overlapping places in a large rectangle for a number of smaller rectangles.
2. Class scheduling: There is a fixed number of professors and classrooms, a list of classes to be offered, and a list of possible time slots for classes. Each professor has a set of classes that he or she can teach.
3. Hamiltonian tour: given a network of cities connected by roads, choose an order to visit all cities in a country without repeating any.

Q2. Consider the problem of placing k knights on an $n \times n$ chessboard such that no two knights are attacking each other, where k is given and $k \leq n^2$.

1. Choose a CSP formulation. In your formulation, what are the variables?
2. What are the possible values of each variable?
3. What sets of variables are constrained, and how?

Q3. Consider the graph with 8 nodes A_1, A_2, A_3, A_4, H, T, F_1, F_2. A_i is connected to A_{i+1} for all i, each A_i is connected to H, H is connected to T, and T is connected to each F_i. Find a 3-coloring of this graph by hand using the following strategy: backtracking with conflict-directed backjumping, the variable order A1, H, A4, F1, A2, F2, A3, T, and the value order R, G, B.

Q4. Draw the CSP graph and give the step wise solution to find the resulting domain for variables after the CSP made ARC-Consistent for following CSP:

Variables V = {A, B, C, D}

Domain D = {1, 2, 3, 4, 5, 6}

Constraint C = {A<B, B<C, C<D, B+D=9}

Q5. Draw the CSP graph and give the step wise solution to find the resulting domain for variables after the CSP made ARC-Consistent for following CSP:

Variable: V = {V1, V2, V3, V4}

Domain: D_{V1} = {1,2,3,4}; D_{V2} = {3,4,5,8,9}; D_{V3} = {2,3,5,6,7,9}; D_{V4} = {3,5,7,8,9}

Constraint: C = {V1 ≥ V2; V2 > V3 or V3 – V2 = 2; V3 ≠ V4}