AI Foundations & Applications (AI61005)
Class Test 3
November 1, 2021

Question Paper has THREE Parts. This is PART A – First part

Time 20 Minutes

Answer All Questions

Write your name and roll number on every sheet.

Try to use answer the question in total of 2 pages only

Combine the sheets into a single pdf (Max size 10MB) and upload using the Google Form provided.

1. An $n \times n$ matrix is called a Euler square of order n if all its cells are filled up with integers $[1, \dots, n]$ such that each of these n integers appear at most once in a row and exactly once in each column. For example, following is a Euler square of order 5:

[2+3+(1+3+1)=10]

$$\begin{bmatrix} 1 & 2 & 3 & 4 & 5 \\ 2 & 3 & 4 & 5 & 1 \\ 3 & 4 & 5 & 1 & 2 \\ 4 & 5 & 1 & 2 & 3 \\ 5 & 1 & 2 & 3 & 4 \end{bmatrix}$$

   a. Find a CSP formulation (Variables, Domains, Constraints) for the problem of finding an Euler square of order n
   b. Draw the constraint graph for the CSP for finding an Euler square of order 3.
   c. Write down the SAT encoding of the same problem. In doing so, consider each of the n integers as n different colors and X_{ijk} to be the proposition that indicates the $(i,j)^{th}$ cell has color k. Clearly specify the following: Total number of propositions, SAT encoding (set of CNF formula with English statements), Total number of clauses in Big O notation.