

Lab Assignment – 7

Maximum Marks: 10

Instructions:

1. Attempt **all Questions**.
2. All questions carry **equal** marks.
3. Assume any missing data suitably and state all your assumptions clearly.
4. You need to make this submission via **MS teams**.
5. The usage of **mobile phones** and **internet** during the lab hours is **strictly prohibited** unless specially instructed.
6. Write your name and roll number inside the file. Name your file as: Your Roll No_Name. For example, if your Roll No. is 10IM9999 and your name is Ravi, then you should name your file as: **10IM9999_Ravi**
7. Submission Deadline – The file must be submitted during the lab hours. **Assignments submitted after due date and time will NOT be evaluated.**
8. Do not submit multiple files for same assignment. In case of multiple files compress them in one “.zip” file and then submit.

Problem 1. The **N Queen** is the problem of placing N chess queens on an $N * N$ chessboard so that no two queens attack each other. For example, figure 1 represents a possible solution for the 8 Queen problem. Solve this problem using constraint programming on Cplex solver. Take N of your choice with N at least 10.

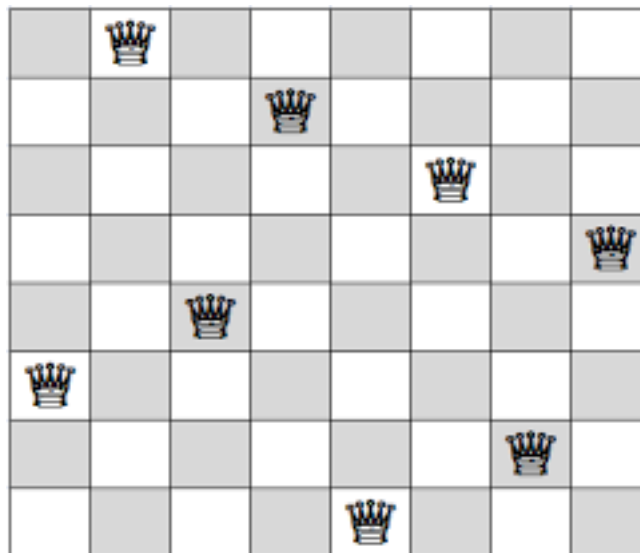


Figure 1. A possible solution for the 8 Queen problem

Problem 2. The **Knight's Tour** problem. Knight's tour is a problem in which we are provided with a $N * N$ chessboard and a knight. Moving according to the rules of chess, the knight moves two squares horizontally and one square vertically, or two squares vertically and one

square horizontally as shown in figure 2 below. Thus, one complete movement of a knight looks like the letter "L", which is 2 cells long.

According to the problem, we have to make the knight cover all the cells of the board and visit each square exactly once. For example, for a given 8 * 8 chess board with the Knight initially placed on 'Position 1', the possible solution is as shown in figure 3.

There can be two ways of finishing the knight move - the first in which the knight is one knight's move away from the cell from where it began, so it can go to the position from where it started and form a loop, this is called **closed tour**; the second in which the knight finishes anywhere else, this is called **open tour**. Solve this problem using constraint programming on Cplex solver. Take N of your choice with $N \geq 10$ and solve for closed or open tour.

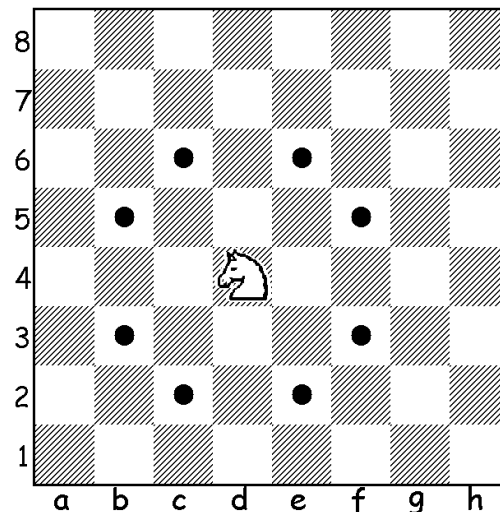


Figure 2. Valid moves of Knight

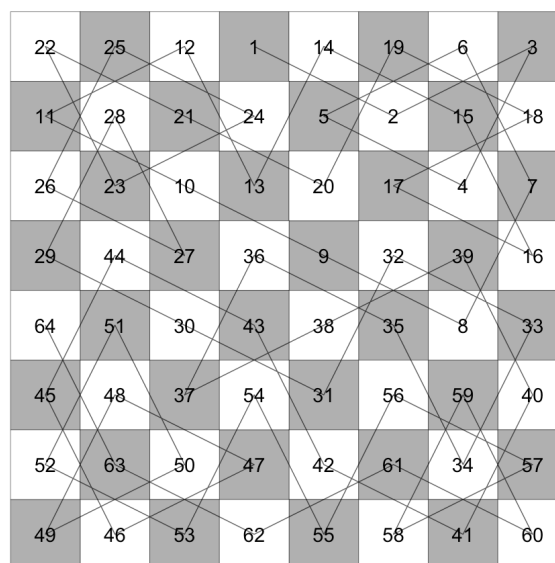


Figure 3. A possible solution for the Knight tour problem