University of Dhaka

Department of Computer Science and Engineering

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Assignment No: 02

Assignment Topic:

Experimental Settings for arc consistency algorithm.

Submitted by:
Amit Roy, Roll: JH- 400

Submitted to:
Dr. Md. Mosaddek Khan, Lecturer
Md. Mofijul Islam, Lecturer
Department of Computer Science and Engineering,
University of Dhaka

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Problem Definition:

Constraint Satisfaction Problem:

A constraint satisfaction problem**(CSP)** consists of three components, **X**, **D**, and **C**:
X is a set of variables, **{X_1 , . . . , X_n }**.
D is a set of domains, **{D_1 , . . . , D_n }**, one for each variable.
C is a set of constraints that specify allowable combinations of values.

Each domain $\mathbf{D_i}$ consists of a set of allowable values, **{v_1 , . . . , v_k}** for variable $\mathbf{X_i}$. Each constraint $\mathbf{C_i}$ consists of a relation between two variables. This type of constraint is called binary constraint

An assignment that does not violate any constraints is called a consistent or legal assignment. A **complete assignment** is one in which every variable is assigned, and a solution to a **CSP** is a **consistent**, **complete assignment**.

A variable in a CSP is **arc-consistent** if every value in its domain satisfies the variable's binary constraints.

$\boldsymbol{X_i}$ is arc-consistent with respect to another variable $\boldsymbol{X_j}$ if for every value in the current domain $\boldsymbol{D_i}$ there is some value in the domain $\boldsymbol{D_j}$ that satisfies the binary constraint on the arc $\boldsymbol{(X, X_j)}$. A network is **arc-consistent** if every variable is arc-consistent with every other variable.

In this problem we need to implement the most popular algorithm for arc consistency named AC-1, AC-2, AC-3, AC4.

Experimental Setting(Plan):

1. A set of constraints which will contain some relations between two variables of the consistency graph. The relations could be,

x<=y
x>=y
$y=x^2$
gcd(x,y) = 1
y%x = 0

2. We will generate random graph using some python library named NetworkX for different number of nodes (e.g. 10,20,30,40,50)

3. For each node, we will consider it as a variable and randomly choose it's domain from a set of integers in a range(e.g.1~100) so that we can test the mathematical relational operator. For each pair of variable we will choose one or more binary constraint from our constraint list(1).

4. Now, we will run the AC-1, AC-2, AC-3,AC-4 algorithm on the randomly generated graphs. For the same number of nodes we will generate different random graphs and run the algorithms several times(10-20) and take the average value of running time.

5. We will plot a graph where the **X axis** will be the number of nodes and the **Y axis** will be the performance measure. We will get 4 different lines for four different algorithms and then compare amongst the graphs to infer some significant knowledge of the performance difference of the four arc consistency algorithms.