Assignment Three

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Constraint Satisfaction (Problem Description)

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Let, $N =< X, D, C >$ is a constraint network where $X = \{ X_1,\ X_2,\ ....,\ X_n\}$ set of all variables, $D = \{ D_1,\ D_2,\ ....,\ D_n\}$ set of all domains, $C = \{ C_1,\ C_2,\ ....,\ C_{n-1}\}$ set of all constraints.
An arc (X_i, X_j) is arc consistent if and only for every value x in the current domain of X_i which satisfies the constraint of (X_i, X_j) such that there is some value y in X_j $(\ X_i = x\ and\ X_j = y\ )$ permitted by the constraints. A CSP is consistent if and only if every arc (X_i, X_j) in it's constraint graph is consistent.

To design this problem, first I generate a graph with 100 nodes, $G = \{ V_1,\ V_2,\ ....,\ V_{100}\}$. Then I assign the edges of the graph. Each edge of the graph is a constraint and can be called an arc. Each of the arc must be satisfied to solve this problem.
I define the constraints as below:

1. $C_{1-10} : \{ y = 2x \}$
2. $C_{11-20} : \{ y = 3x + 1 \}$
3. $C_{21-30} : \{ y = x^2 \}$
4. $C_{31-40} : \{ y = x^2 - 1 \}$
5. $C_{41-50} : \{ y = x - 1 \}$
6. $C_{51-60} : \{ y = x + 1 \}$
7. $C_{61-70} : \{ y = x \}$
8. $C_{71-80} : \{ y = x^3 \}$
9. $C_{81-90} : \{ y = 9x + 1 \}$
10. $C_{91-99} : \{ y = 4x - 1 \}$

I define the domains as below:

Let $i = \{ z_1,\ z_2,\ ....,\ z_{20}\}$ where z = any random integer.

1. $D_{1-10} : \{ i + 7 \}$
2. $D_{11-20} : \{ i^2 \}$
3. $D_{21-30} : \{ i + 5 \}$
4. $D_{31-40} : \{ i^2 + 2 \}$
5. $D_{41-50} : \{ 2i - 1 \}$
6. $D_{51-60} : \{ i^2 + i + 3 \}$
7. $D_{61-70} : \{ i^3 \}$
8. $D_{71-80} : \{ i^3 - i^2 + 5 \}$
9. $D_{81-90} : \{ 9i + 5 \}$
10. $D_{91-100} : \{ 2i^2 + 3 \}$

Finally using the arc consistency algorithms AC1, AC2, AC3 and AC4, I will measure their performances with respect to run-time and accuracy. I will also plot their performance with graph.