MATLAB

NO1

matlab code:

```
function [x_opt, fval] = optimize_welded_beam (P, L, E, G, tau_max,
         sigma_max, delta_max, c1, c2, lb.)
% Primary fn. Optimizes welded beam.
% This uses a Genetic Algorithm.
% P: Applied load N.
% c1 : Unit cost of welding material
% c2 : Unit cost of bar stock ($/m^3
% lb : lower bounds for [h, l, t, b]
% ub : Upper bounds [h, l, t, b]
% x_opt : Optimal design variables [h, l, t, b]
% fval : Minimum fabrication cost.

% Defining the objective function Using a nested function
function cost = objective_function (x)
% x(1) = h, x(2) = L, x(3) = t, x(4) = b.

cost = ((1+c1)*x(1)^2 * x(2) + c2 * x(3) * x(4) * L + x(2))) ;
end

% Define non linear constraints:
R = sqrt(x(2)^2 + (x(1) + x(3))^2/4);
tau1 = P /sqrt(2) * x(1) * x(2));
M = P * (L + x(2)/2);
J = 2 * (x(1) * x(2)/sqrt(2) * x(2)^2/12 + ((x(1) + x(3)) /2]^2
tau = P * sqrt ( tau1 ^2 + tau2^2 + 2*tau1*tau2 *x(2) /2 *
sigma = (6 * P * L)/ (x(3)^2 * x(4) ));
delta = (4 * P * L^3) / E * x(3)^3 * x(4))) ;
Pc = 4.013 * E * sqrt( x(3)^2 * x(4)^6 /36)) / L^2 *
     (1 - (x(3)/6 * L) ) * sqrt ( E/(4*G)))
% Define inequality Constraints C.
C(1) tau - tau_max;
C(2) = sigma - sigma_max;
C(3) = delta - delta_max;
C(4) = P - Pc ;
C(5) = x(1) - x(4);
```

% Define problem for GA.
nVars = 4; %Number of design variables.

```
A = [].
b = [].
Aeq = [].
beq = [].
```

% call Genetic Alogorithm;

```
options = optimoptions('ga', 'Display' 'iter', ConstraintTolerance',
,1e-6);
[x_opt, fval] = ga(@objective_funtion, nVars, A, b, Aeq.
beq, lb, ub, @ nonliner_Contrains, options;
```

% Display Results;

```
fprintf('Optimal Design Variables:\n');
fprintf('Weld thickness (h): %.4f m\n', x opt(1));
fprintf('Weld Length l: %.4f m\n', x_opt(2));
fprintf('Beam Height (t): %.4f m\n', x opt(3));
fprintf('Beam Width (b): %.4f m\n', x opt 4).
fprintf Minimum Fabrication Cost: $%.2f\n', fval);
```

Pareto optimality. A solution is Pareto optimal if it is impossible to improve one objective without making another objective worse. There isn't a single solution but a set of best tradeoffs;

Pareto fronts; This is a set of all Pareto optimal solutions plotted in the objective space (eg; cost vs deflection

How to Impliment; -
Use maltab gamultiobj function.
multi-objective function;