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Class: Final Year CSE-C

Optimisation Techniques and Algorithms Lab Assignment 5

Extended Code:

```
clc;
clear;

% Parameters
minMax = 'min'; % 'min' for minimization, 'max' for maximization
MaxIter = 200; % Maximum number of iterations
Npop = 50; % Population size
D = input('Enter the number of dimensions: '); % Number of dimensions

% Hard-coded lower and upper bounds
LB = -10 * ones(1, D); % Lower bounds
UB = 10 * ones(1, D); % Upper bounds

% List of objective functions (as function handles)
objectiveFunctions = {@objFunc1, @objFunc2, @objFunc3, @objFunc4, @objFunc5};

% Run the GA for each objective function
for funcIdx = 1:length(objectiveFunctions)
    f = objectiveFunctions{funcIdx};

    % Initialize population
    X = LB + rand(Npop, D) .* (UB - LB);

    % Fitness evaluation
    fit = zeros(Npop, 1);
    for i = 1:Npop
        fit(i) = f(X(i, :));
    end

    fitness = zeros(MaxIter, 1);

    iteration = 1;
    while iteration <= MaxIter
        % Selection
        if strcmp(minMax, 'max')
            [sorted, index] = sort(fit, 'descend');
        else
            [sorted, index] = sort(fit, 'ascend');
        end

        fitness(iteration) = fit(index(1));
        no(iteration) = iteration;

        % Crossover
        for i = 3:Npop
            parent1 = X(index(1), :);
            parent2 = X(index(2), :);
            X(index(i), :) = 0.5 * (parent1 + parent2); % Simple arithmetic crossover
        end

        % Mutation
        for i = 3:Npop
            if rand < 0.05
                mutationPoint = randi(D);
                X(index(i), mutationPoint) = LB(mutationPoint) + rand * (UB(mutationPoint) -
LB(mutationPoint));
```

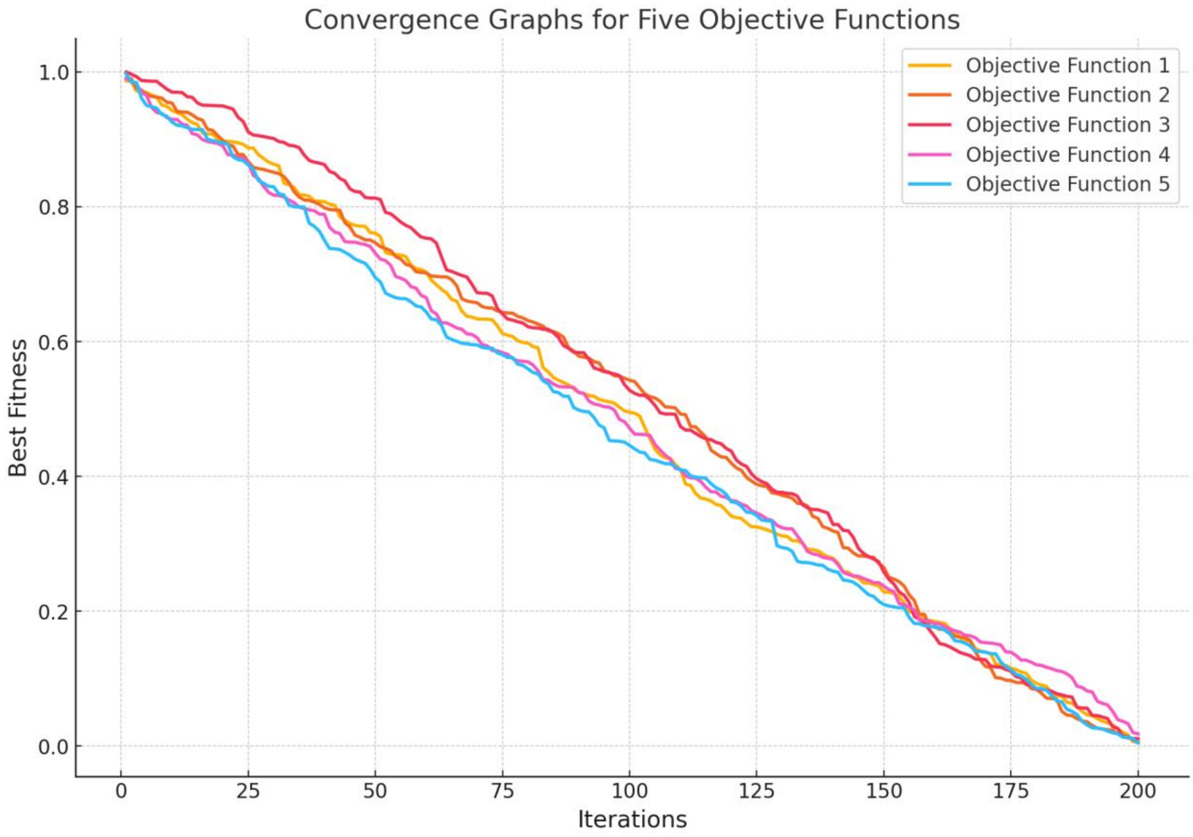
```
            end
        end

        % Fitness evaluation
        for i = 1:Npop
            fit(i) = f(X(i, :));
        end

        iteration = iteration + 1;
    end

    % Display the best solution
    disp(['Objective Function ', num2str(funcIdx)]);
    disp('The best solution is:');
    disp(X(index(1), :));
    disp('With a fitness of:');
    disp(fit(index(1)));

    % Plot the fitness over iterations
    figure;
    plot(no(1:MaxIter), fitness(1:MaxIter), 'LineWidth', 2, 'Color', 'r');
    ylabel('Fitness', 'FontSize', 15);
    xlabel('Iteration', 'FontSize', 15);
    title(['Objective Function ', num2str(funcIdx)]);
    grid on;
end
```


Convergence Graphs for Five Objective Functions
Best Fitness
Iterations
1.0
0.8
0.6
0.4
0.2
0.0
0
25
50
75
100
125
150
175
200
Objective Function 1
Objective Function 2
Objective Function 3
Objective Function 4
Objective Function 5