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Lab Assignment 1

Problem

1-Service Placement Problem using intlinprog().

function spp\_using\_intlinprog()

totalFiles = 12;

maxCases = 0;

% Step 1: Read and store all results in a map

allResults = cell(totalFiles, 1);

for fileIndex = 1:totalFiles

fileName = sprintf('/MATLAB Drive/Assignments/Gap Dataset Files/gap%d.txt', fileIndex);

fileId = fopen(fileName, 'r');

if fileId == -1

error('Error opening file %s.', fileName);

end

totalCases = fscanf(fileId, '%d', 1);

fileResults = nan(totalCases, 1);

for caseIndex = 1:totalCases

serverCount = fscanf(fileId, '%d', 1);

userCount = fscanf(fileId, '%d', 1);

costMatrix = fscanf(fileId, '%d', [userCount, serverCount])';

resourceMatrix = fscanf(fileId, '%d', [userCount, serverCount])';

capacityVector = fscanf(fileId, '%d', [serverCount, 1]);

xMatrix = solveGapMax(serverCount, userCount, costMatrix, resourceMatrix, capacityVector);

totalCost = sum(sum(costMatrix .\* xMatrix));

fileResults(caseIndex) = round(totalCost);

end

fclose(fileId);

allResults{fileIndex} = fileResults;

maxCases = max(maxCases, numel(fileResults));

end

% Step 2: Build output table

outputData = nan(maxCases, totalFiles);

for fileIndex = 1:totalFiles

fileResults = allResults{fileIndex};

outputData(1:numel(fileResults), fileIndex) = fileResults;

end

% Step 3: Create table with headers

varNames = arrayfun(@(x) sprintf('gap%d', x), 1:totalFiles, 'UniformOutput', false);

caseLabels = (1:maxCases)';

resultTable = array2table(outputData, 'VariableNames', varNames);

resultTable = addvars(resultTable, caseLabels, 'Before', 1, 'NewVariableNames', 'CaseNumber');

% Step 4: Write to CSV

writetable(resultTable, '/MATLAB Drive/Assignments/Assignment 1/gap\_results.csv');

% Step 5: Plot Line Graph

figure;

hold on;

colors = lines(totalFiles); % Distinct color for each line

for fileIndex = 1:totalFiles

plot(caseLabels, outputData(:, fileIndex), ...

'-o', 'Color', colors(fileIndex,:), ...

'DisplayName', sprintf('gap%d', fileIndex));

end

xlabel('Test Case Number');

ylabel('Total Cost');

title('Total Cost per Test Case for Each GAP File');

legend('show', 'Location', 'bestoutside');

grid on;

hold off;

% Optionally save the figure

saveas(gcf, '/MATLAB Drive/Assignments/Assignment 1/gap\_results\_plot.png');

end

function xMatrix = solveGapMax(m, n, c, r, b)

f = -c(:);

AeqJobs = kron(eye(n), ones(1, m));

beqJobs = ones(n, 1);

AineqAgents = zeros(m, m \* n);

for i = 1:m

for j = 1:n

AineqAgents(i, (j-1)\*m + i) = r(i,j);

end

end

bineqAgents = b;

lb = zeros(m \* n, 1);

ub = ones(m \* n, 1);

intcon = 1:(m \* n);

options = optimoptions('intlinprog', 'Display', 'off');

x = intlinprog(f, intcon, AineqAgents, bineqAgents, AeqJobs, beqJobs, lb, ub, options);

xMatrix = reshape(x, [m, n]);

end

