

%% Q.2: Among the paths starting from each graph-node, how many times does each FP end a path?

% Function to find the graph-nodes ending in each FP

FPs = [20, 45, 54]; % All fixed points row vector

numStates = 64; % Number of possible initial states

function nodeFPsDictionary = findStartingNodes(FPs, numStates, G) % Function definition

FPgroup = cell(1, 3); % Initialize FP groups

startNodes = 1:numStates; % Initialize all path-start nodes

for inStartNodes = startNodes % Iterate through all initial states (path-start nodes)

    currentNode = startNodes(inStartNodes); % Extract current initial state

    for inFPs = 1:length(FPs) % Iterate through all FPs

        currentFP = FPs(inFPs); % Extract FP from vector of FPs

        FPindex = find(FPs == currentFP); % Extract index of current FP

        currentNodePaths = allpaths(G, currentNode, currentFP); % Extract all paths starting from current start graph-node and ending in current FP

        for inAllPaths = 1:length(currentNodePaths)

            if ~isempty(currentNodePaths) % For paths existing that start in current initial state and end in current FP

                if isempty(find(FPgroup{1, FPindex} == currentNode)) % For current start node not a part of current FP group cell

                    FPgroup{1, FPindex}(end + 1) = currentNode; % Add current start node to 'FP = 20' FP group cell

                end

            end

        end

    end

end

% Create dictionary to store information about graph-nodes ending in each FP

nodeFPsDictionary = dictionary(FPs, FPgroup);

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% Display created dictionary
disp('Graph-nodes with paths ending in 20, 45, and 54 respectively:');
disp(nodeFPsDictionary);

% Calculate how many initial states are present in each FP group cell
sumOfNodes = []; % Initialize row vector to store respective (20, 45, 54) sums
of initial states of FPs

for inFPs = 1:length(FPs) % Iterate through all FPs in FPs row vector

    FP = FPs(inFPs); % Extract FP

    FPgroupCell = nodeFPsDictionary(FP); % Extract all initial states of
current FP

    groupCellLength = length(FPgroupCell{:}); % Obtain number of initial states
of current FP

    sumOfNodes(inFPs) = sum(groupCellLength); % Obtain sum and store in row
vector for sums

end

% Display the numbers of initial states leading to respective FPs
disp(['Number of initial states ending in FP 20 are ', num2str(sumOfNodes(1)),
', those ending in FP 45 are ', ...
    num2str(sumOfNodes(2)), ', & those ending in FP 54 are ',
num2str(sumOfNodes(3)), '.']);

end

% Invoke function to get graph-nodes ending in each FP
nodeFPsDictionary = findStartingNodes(FPs, numStates, G);

```

## Output:

Graph-nodes with paths ending in 20, 45, and 54 respectively:

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20 → {[1 2 3 4 7 8 9 10 11 12 15 16 17 18 19 20 23 24 25 26 27 28 31 32 33 34 35 36 39
40 41 42 43 44 48 49 50 51 52 55 56 57 58 59 60 63 64]}

45 → {[1 3 5 7 9 10 11 12 13 14 15 16 17 21 23 25 26 29 30 31 32 33 35 37 39 41 42 43
44 45 46 47 48 49 53 55 57 58 61 62 63 64]}

54 → {[1 2 3 5 6 7 8 9 10 11 12 13 14 15 16 17 18 21 22 23 24 25 26 29 30 31 32 33 34
35 37 38 39 40 41 42 43 44 46 48 49 50 53 54 55 56 57 58 62 63 64]}

```

Number of initial states ending in FP 20 are 47, those ending in FP 45 are 42, & those ending in FP 54 are 51.