```matlab
clear
close all
clc

% Question 1.1

 DATA = LogisticMap(4, 0.5, 10000);
 find_bifurcation(DATA)

 function graph_values = LogisticMap(r, x0, N)
     graph_values=[];
     for r = linspace(0,r,N)
         xold = x0;

         % checking for the steady state
         for i=1:2000
             xnew=((xold-xold^2)*r);

             xold=xnew;
         end

         xss=xnew;
         for i=1:1000
             xnew=((xold-xold^2)*r);
             xold=xnew;

             % forming the matrix to create the plot with
             graph_values(1,length(graph_values)+1)=r;
             graph_values(2,length(graph_values))=xnew;

             if(abs(xnew-xss)<.0001)
                 break
             end
         end
     end

     % plot the values for a bifurcation plot and add details
     plot(graph_values(1,:),
 graph_values(2,:), '.', 'LineWidth', .1, 'MarkerSize',1.2,...
     'Color',[0 0 0])                    %the 1 1 1 vector represents white
 color
     set(gca, 'color', 'w', 'xcolor', 'k', 'ycolor', 'k')
     set(gcf, 'color', 'w')
     xlabel('r')
     ylabel('Steady-State (x*)')

     savefig('bifurcation.fig')

 end
```
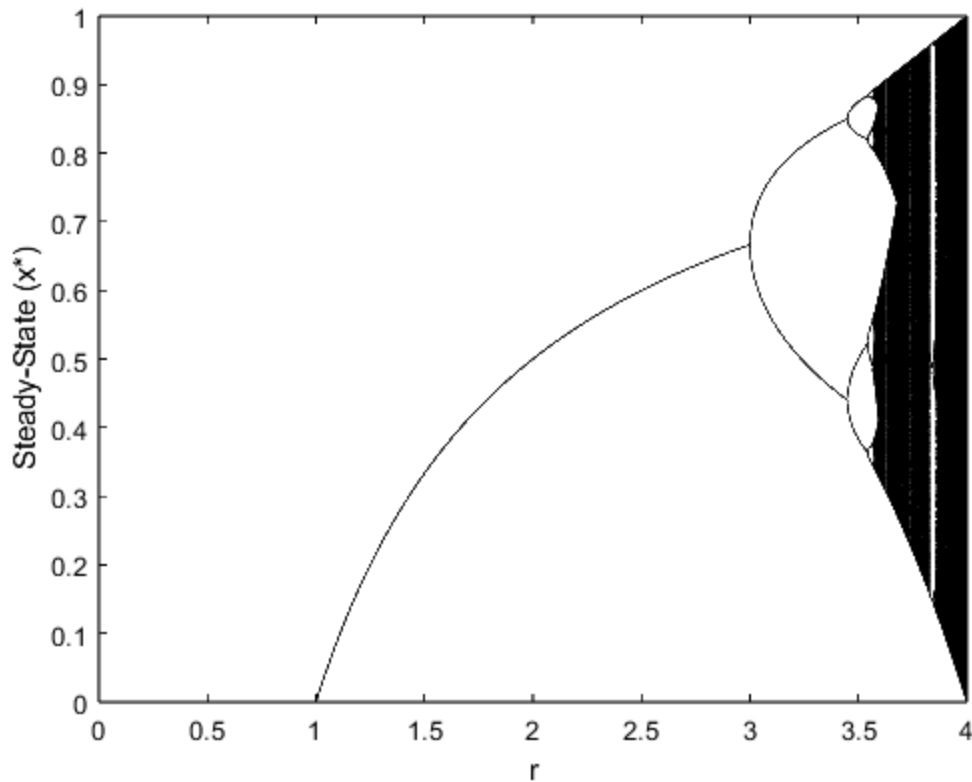
Question 1.2

```matlab
function bifurcation_list = find_bifurcation(data)
bifurcation_list = [];
i=1;
    for j=data(1,3:end) % start at 3 to avoid the first 1 columnds of 0
counting as a bifurcation
        if isempty(bifurcation_list)
            if abs(j - data(1,i+1)) == 0 % this if statement identifies the
bifurcation point, and the values where the branches emerge
                bifurcation_list = j;
            end
        elseif length(bifurcation_list) == 1
            if (abs(j - data(1,i+4)) == 0) % this if statement identifies the
2nd bifurcation point, and the values where 4 branches now emerge
                bifurcation_list = [bifurcation_list j];
            end
        else
            break
        end
        i = i+1;
    end


end
```

```
ans =

    2.9971    3.4487
```

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