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% 1.A
% Write code for generating p-Erdos-Renyi random graphs and check their connectivity with one of the presented methods.
% You MUST produce a graph showing the probability of obtaining a connected graph as a function of the arc probability p, for p ranging from 0 to 1, and for n=100.
% You MUST find the value of p (say p99) that guarantees that the resulting graph is connected with probability 0.99, for n=100.
% You MAY optionally: (i) show graphs for other values of n; (ii) compare the processing speed of more connectivity check methods.

% p-Erdos-Renyi random graph
% edges included in the graph with probability p.
% n nodes
n = 100;
% 100 different p's from 0 to 1.
p = linspace(0,1,100);
% probability of obtaining a connected graph.
pr = zeros(1,length(p));
for i = 1:length(p)
    % 10 graphs each p
    c = zeros(1,10);
    for j = 1:length(c)
        A = zeros(n);
        % only for the upper triangular matrix
        for k = 1:n
            for l = k+1:n
                if rand<p(i)
                    A(k,l) = 1;
                    A(l,k) = 1;
                end
            end
        end
        D = diag(sum(A));
        L = D - A;
        if rank(L)== n-1
            c(j) = 1;
        end
    end
    pr(i) = mean(c);
end
% p99
stop = false;
pos = find(pr>=0.99);
i = 0;
while(stop==false)
    i = i+1;
    if sum(pr(pos(i):length(pr))~=1)==0
        stop = true;
    end
end
p99 = p(pos(i));
p99
% plot
plot(p,pr,'k-*','LineWidth',2,'MarkerSize',3)
hold on
line('XData',[p99 p99], 'YData',[0 1], 'LineStyle','-', ...
    'LineWidth', 1, 'Color',[0 0.5 0.6])
title('p-Erdos-Renyi probability of obtaining a connected graph', ...
    'fontSize', 15)
xlabel ('p', 'fontSize', 11)
ylabel ('probability', 'fontSize', 11)
text (p99-0.02,0.5,'p99','fontSize', 11)
hold off

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p99 =

    0.0808

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