```
%% CHEN 320 - 202 Homework 3
% Problem: 1
% Author: Nathaniel Thomas
% Date: 09/23/2022
% Due:  09/25/2022

% [i] stages take solvent W, which contains X_in of A, and solvent S, which
% contains Y_in fraction of A. W and S are immiscible, and A is extraced
% from W.

% Equilibrium is reached in each stage. The equation is as follows;
S = 1000; % Right stream flow rate, kg/hr (Assume constant)
W = 2000; % Left stream flow rate, kg/hr (Assume constant)
X_in = 0.05; % Left stream composition
Y_in = 0.00; % Right stream composition
K = 10; % Equilibrium constant
N = 10; % Number of stages.

clc;

% Matrix for storing information on composition of the W and S streams.
% Rows are stages, columns are X values
X = zeros(N, N + 1);

for i = (2:N + 1)
    X(i - 1, i - 1) = 1;
    X(i - 1, i) = -(1 + K*S/W);
    X(i - 1, i + 1) = (K*S/W);
end
A = zeros(N, 1);
A(1, 1) = -0.05;
res = X\A;
res;

rec = 100*(X_in - res(10))/X_in;
fprintf("Final percent recovery: %.10f%% \n", rec);


Output:
Final percent recovery: 99.9999508480%
```

```
%% CHEN 320 - 202 Homework 3
% Problem: 2
% Author: Nathaniel Thomas
% Date: 09/23/2022
% Due:  09/25/2022

clc
A_init = 1.0; % Initial concentration of A in the reactor, gmol/litre

% Rate constants for all reactions, forward and backwards, 1/s
K_ab = 0.1; K_ba = 0.02; K_bc = 0.5; K_cb = 0.1; K_cd = 0.01; K_dc = 0.1;
K_da = 0.05; K_ad = 0.2; K_bd = 0.3; K_db = 0.1;

% Concentration generation of all components [C_A, C_B, C_C, C_D]
C = [-K_ab - K_ad, K_ba, 0, K_da;
    K_ab, -K_ba - K_bc - K_bd, K_cb, K_db;
    0, K_bc, -K_cb - K_cd, K_dc;
    K_ad, K_bd, K_cd, -K_da - K_dc - K_db;
    1, 1, 1, 1];
A = [0, 0, 0, 0, 1]';
res = C\A;

fprintf("The concentrations of A, B, C, and D are:\n %.5f, %.5f," + ...
    " %.5f, and %.5f gmol/litre.\n", ...
    res(1), res(2), res(3), res(4));


Output:
The concentrations of A, B, C, and D are:
 0.03856, 0.10870, 0.66487, and 0.18788 gmol/litre.
```