Assignment 7 (CHE331A)

1. A sample of the tracer hytane at 320 K was injected as a pulse input in to a reactor. The effluent concentration was measured as a function of time and reported in the following Table.

Time,t (min)	0	0.5	1	2	3	4	5	6	7	8	9	10	11	14
C (g/m^3)	0	1	2	5	8	10	8	6	4	3	2.5	1.5	0.8	0

   a. Construct a figure showing the tracer concentration C(t) as a function of time.
   b. Construct a figure showing E(t) as a function of time.
   c. Construct the F(t) curve.
   d. Calculate the mean residence time, t_m and variance
   e. Construct the E(Θ) vs Θ curve.

2. An RTD experiment was carried out in a non-ideal reactor that gave the following results

$E(t) = 0$ for $t < 1$ min
$E(t) = 1\ min^{-1}$ for $1 \leq t \leq 2$ min
$E(t) = 0$ for $t > 2$ min

   a. What is the mean residence time 't_m' and variance σ^2?
   b. What fraction of fluid spends time 2 min or less in the reactor?
   c. What fraction of fluid spends time between 1.5 and 2 min in the reactor?

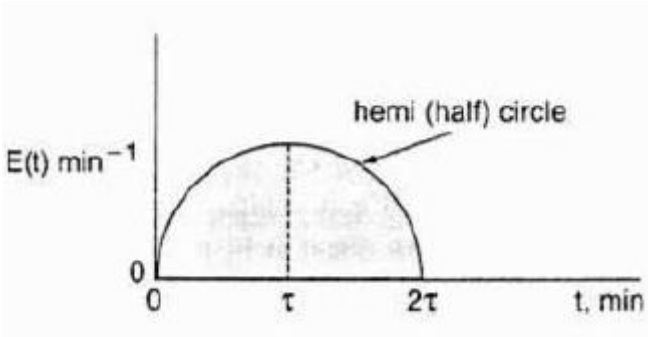
3. A reactor with several dividing baffles is to be used to carry out the reaction A → R with a rate law given by: $-r_A = 0.05C_A \frac{mol}{L.min}$. The results of a pulse tracer test are given below:

t (min)	0	10	20	30	40	50	60	70
C (mol/L)	35	38	40	40	39	37	36	35

   a. How many tanks in series would you suggest to model this reactor?
   b. Assuming the tanks in series model, find out the expected conversion.

4. The first-order reaction, $A \xrightarrow{k} B$, with k = 0.8 min^{-1} is carried out in a real reactor with the following RTD function

$E(t) = \sqrt{\tau^2 - (t-\tau)^2}\ min^{-1}$ for $2\tau \geq t \geq 0$
$E(t) = 0$ for $t > 2\tau$



   a. What is the mean residence time?
   b. What is the variance?
   c. What is the conversion predicted by the segregation model?
   d. What is the conversion predicted by the maximum mixedness model?

   NOTE: Please solve Q.4 (c) and (d) by using MATLAB /Python. Codes should be sent to che331a@gmail.com