**Gillespie Algorithm:**

- Consider $N$ molecular types that undergo $M$ reactions, governed by reaction rates $r_i$ ($i = 1, M$).
- Want to stochastically simulate the number of molecules of each type, $C_j(t)$, as a function of time $t$.

**Idea:** one of the $M$ reactions will occur randomly and take a time $dt$. The number of molecules change according to this reaction and the time elapsed goes from $t \rightarrow t+dt$.

- For a chemical reaction the distribution of reaction times follows:

\[ P(T) = re^{-rT} dt \]

- Want to randomly sample times from this distribution: generate a random number $u \in [0, 1]$ then

\[ T = -\frac{1}{r} \ln(u) \quad (1) \]
Algorithm:

Do $i = 1, N_{\text{steps}}$ some large $\#$

1. generate $M$ $T_i$ from $M$ random numbers using Eqn(1)

2. reaction with smallest $T_i$ occurs $= T_i$

3. update particle #’s based on the reaction in 2.

4. update time: $t = t + T_i$

5. output: $t, \sum \mathcal{C}_i(t)$

end do