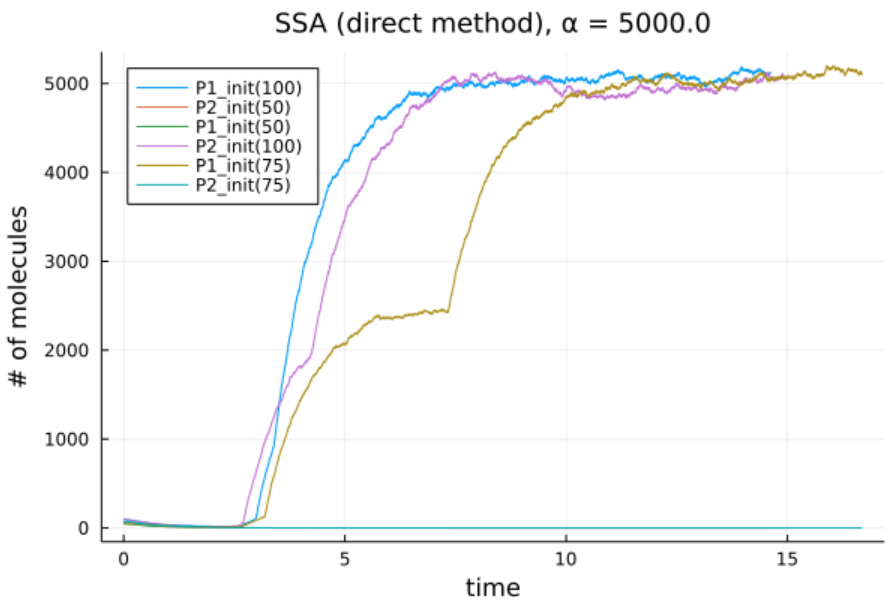
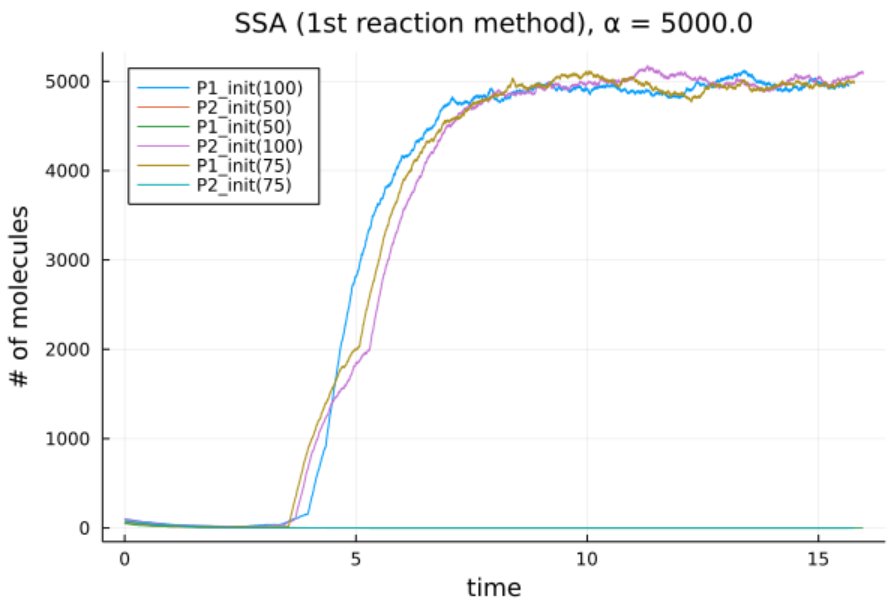
MMSB HW5 SSA report

Q1：

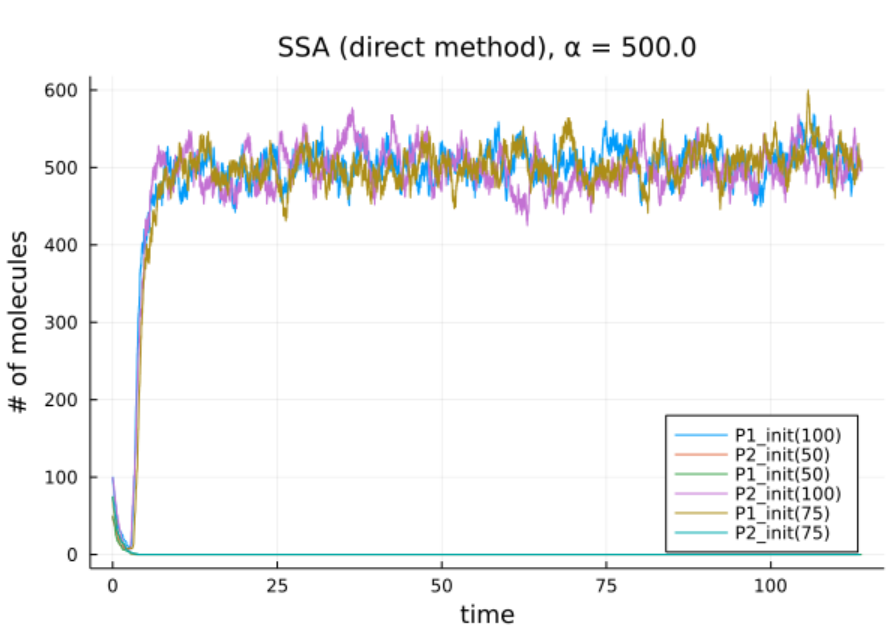
Please run simulations of the stochastic system for α = 5, 50, 500, and 5000, **both in the direct and first reaction methods** by your own. So there will be *eight* kinds of simulations in total.

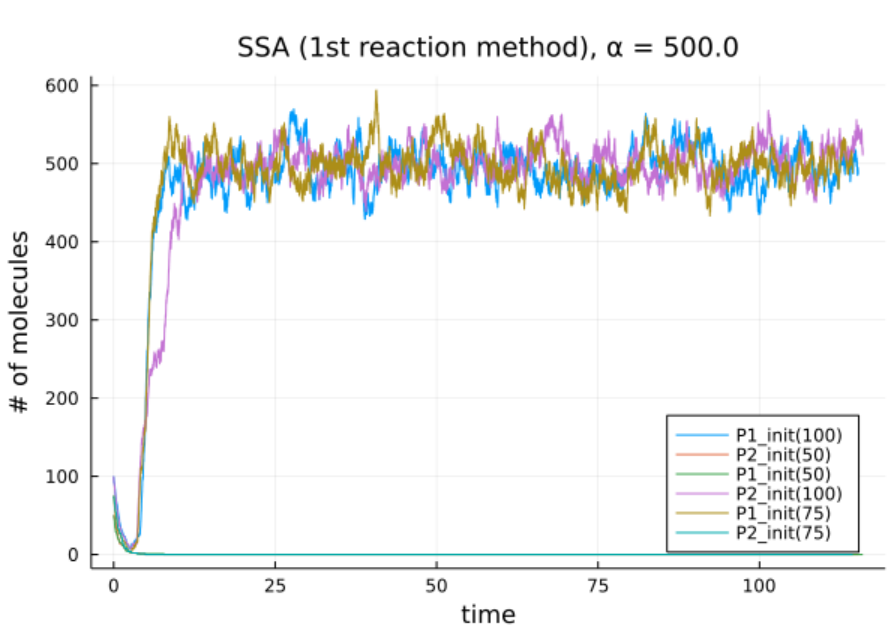
Result：α = 5000



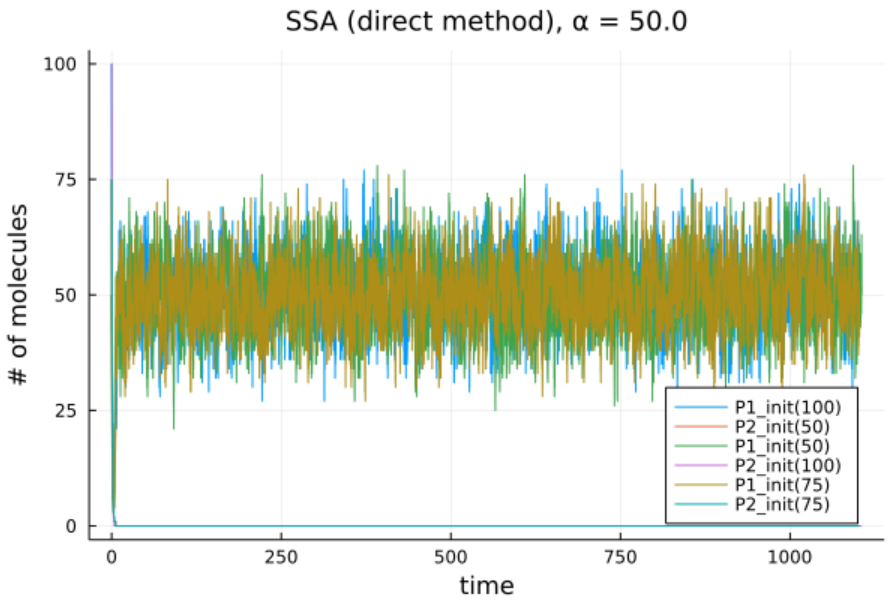


Result：α = 500

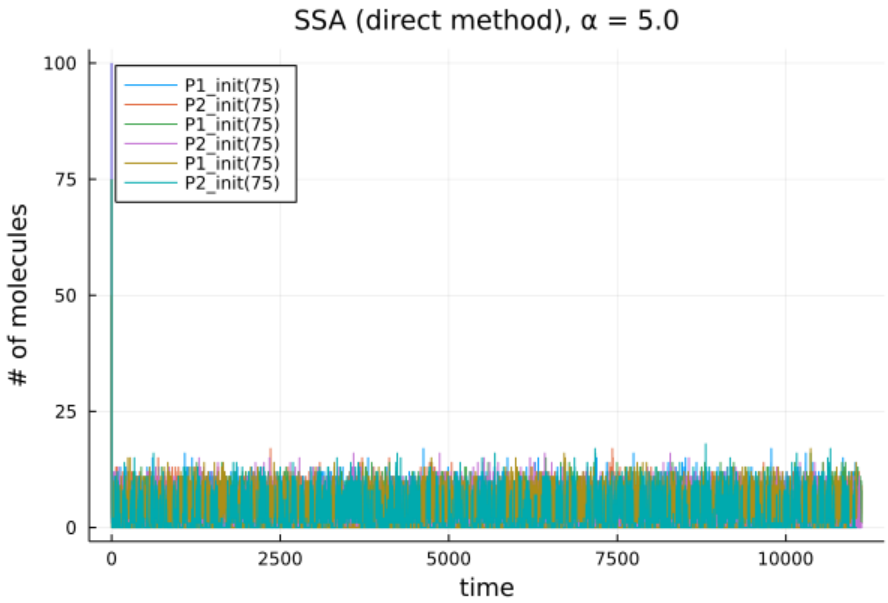




Result：α = 50



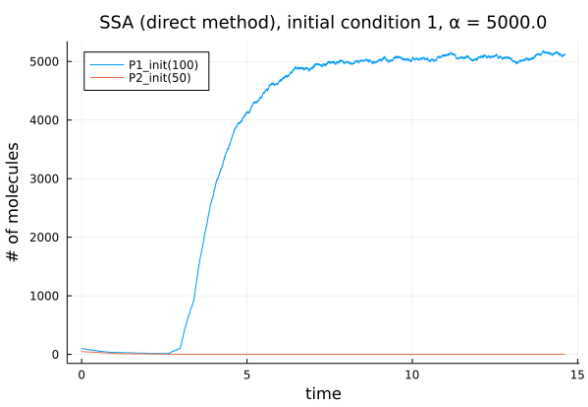
Result：α = 5

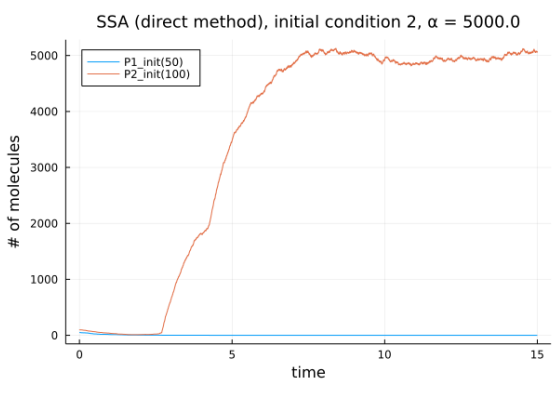


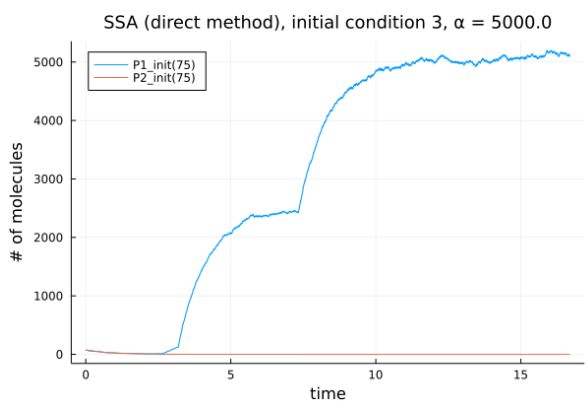
Q2：

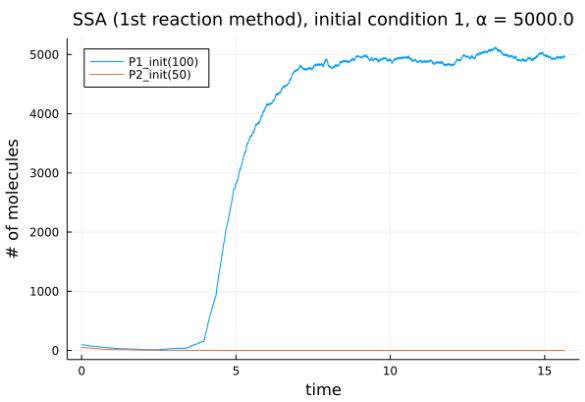
Please show that for α = 5000, the system exhibits bistability, and for α = 5, the system is noisy.

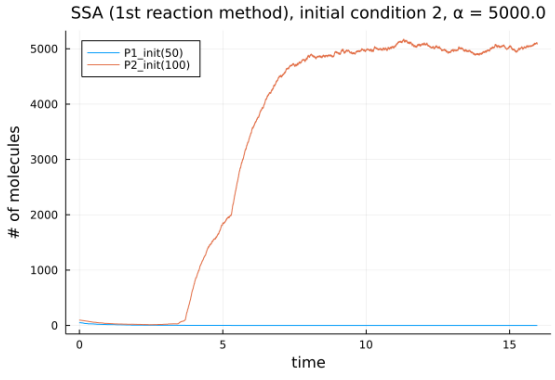
α = 5000 → bistability

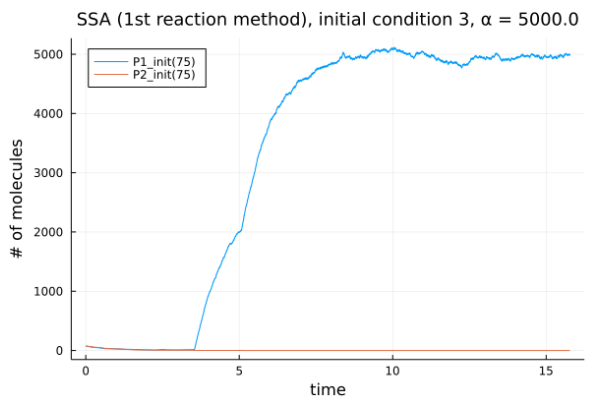






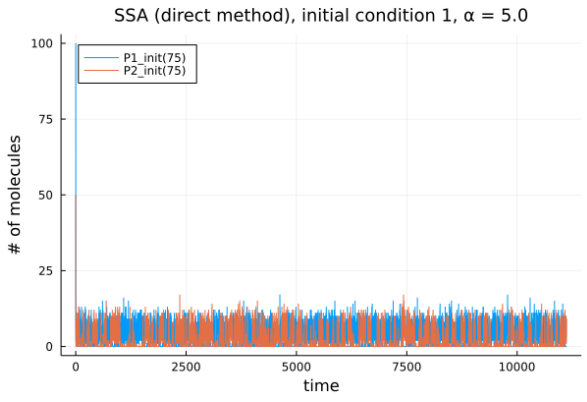


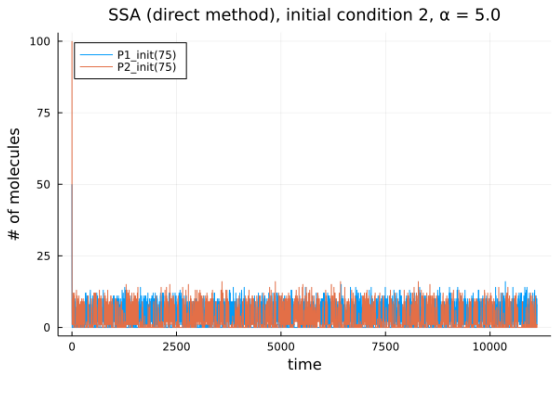


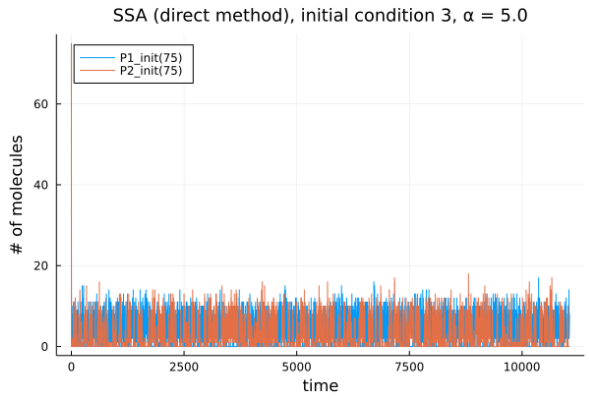


- 給定三種不同的起始條件，但可顯現兩種不同的 steady state，可推測其具有 bistable 的特性。

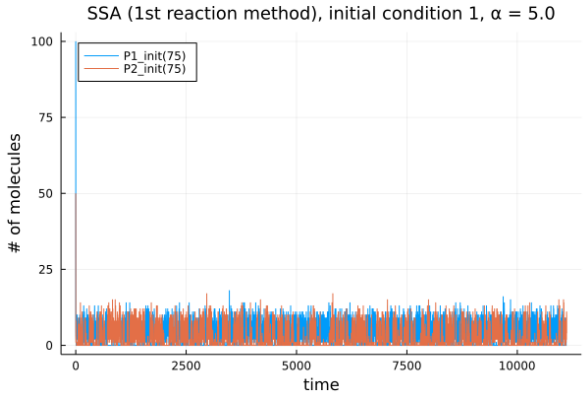
α = 5 → noisy



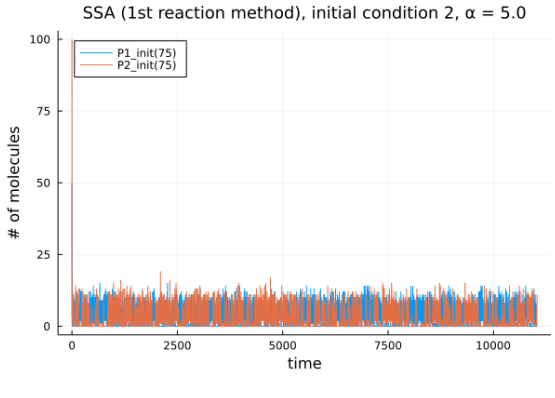




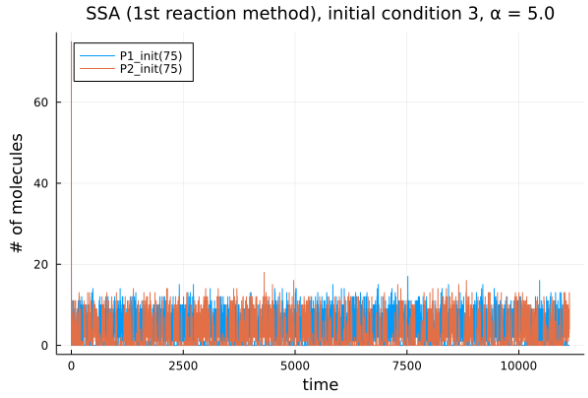
SSA (1st reaction method), initial condition 1, α = 5.0



SSA (1st reaction method), initial condition 2, α = 5.0



SSA (1st reaction method), initial condition 3, α = 5.0

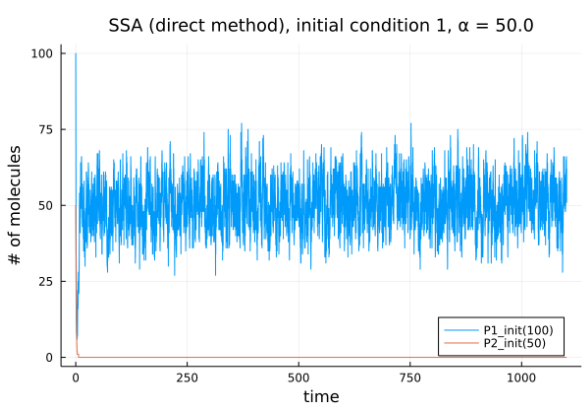


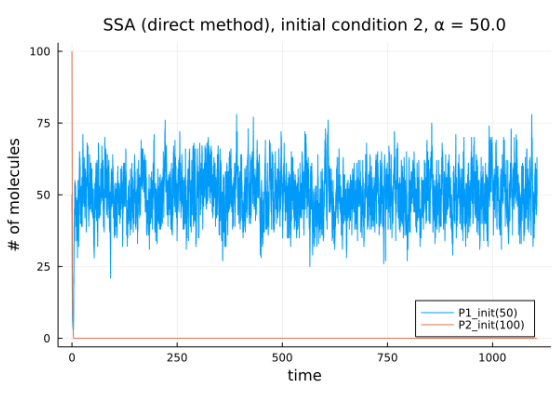
- 給定三種不同的起始條件，皆無法觀察到明顯的穩定狀態或趨勢，因此可歸類為 noisy。

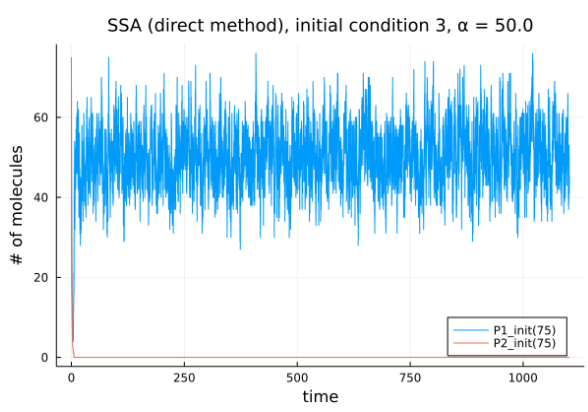
Q3：

Please explain the model behaviors when α = 50 and 500.

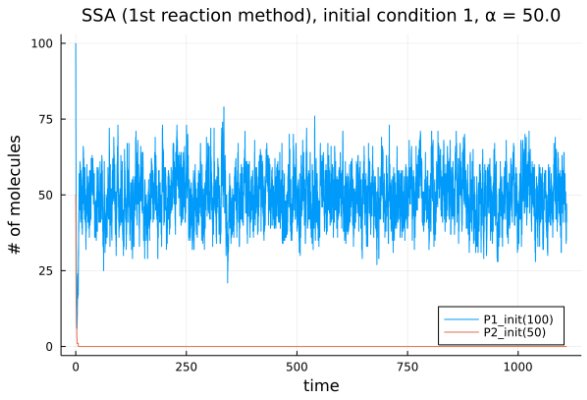
α = 50





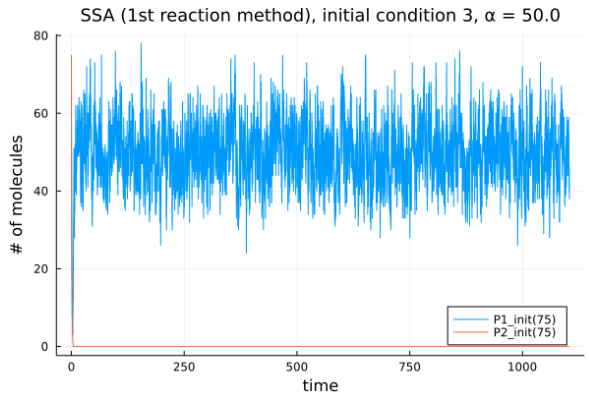


SSA (1st reaction method), initial condition 1, α = 50.0



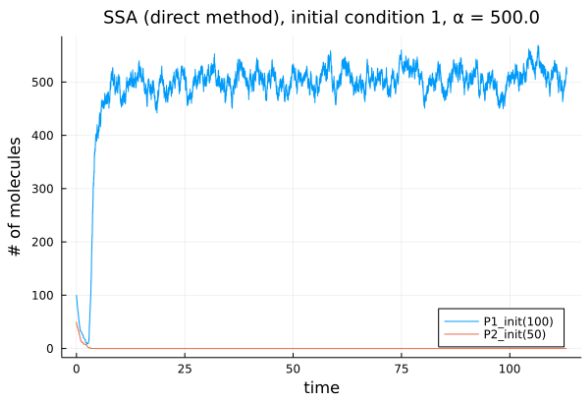
SSA (1st reaction method), initial condition 2, α = 50.0

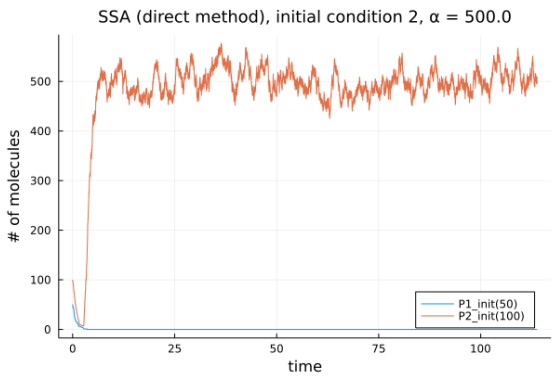
SSA (1st reaction method), initial condition 3, α = 50.0

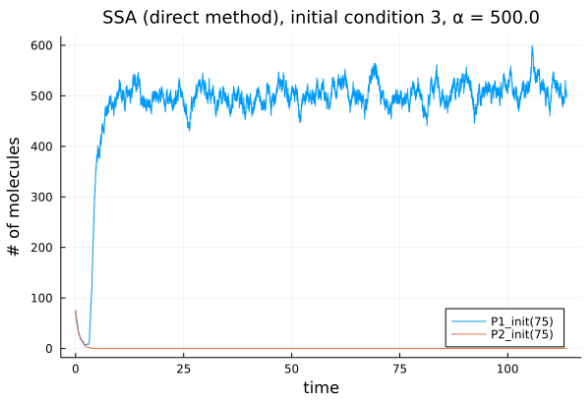


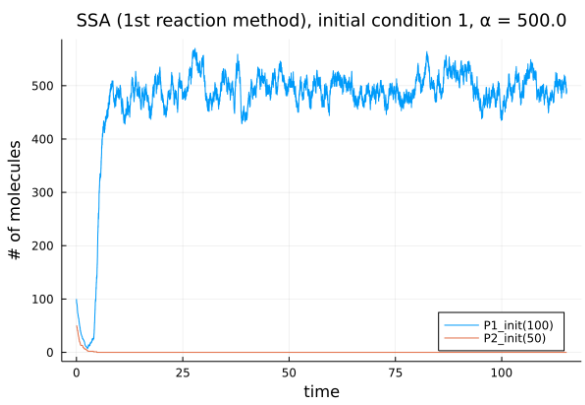
- α = 50，P1較容易壓制 P2，但因為 α = 50 生成速率較慢，因此被 P2 拉扯所產生的影響（震盪）較大，但不至於無法觀察系統狀況。
- fist reaction method 在 initial condition 為 P1 = 50, P2 = 100 的條件下，可能會出現 P2 贏過 P1 的現象。

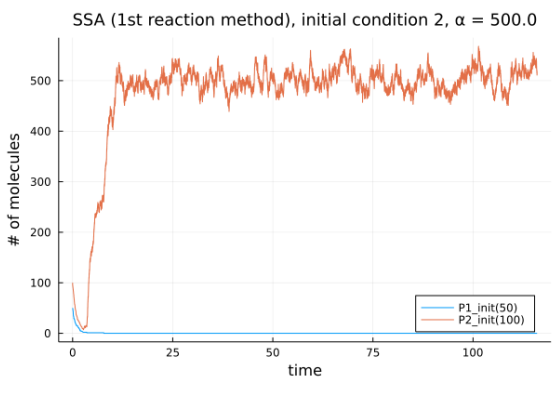
α = 500

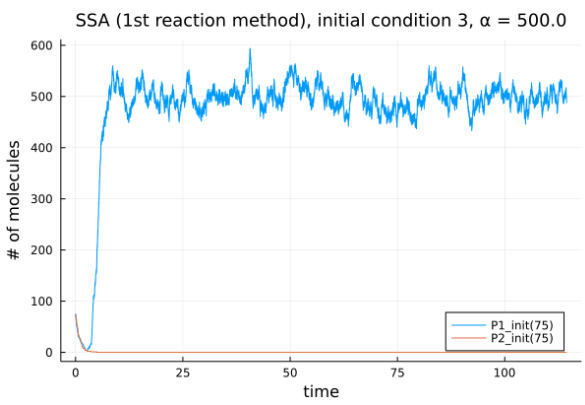












- 相較於 α = 50，在 α = 500 兩者受對方的拉扯程度變得更小，震盪情形有變好的趨勢，而且可以像 α = 5000 一樣看到 bistable 的結果。