Assignment 8

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Part I

Q1. See Figure 1.

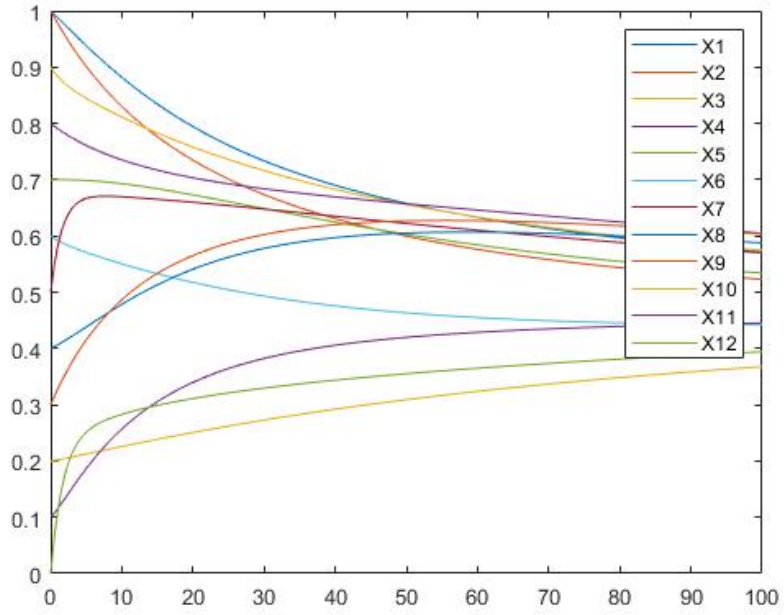


Figure 1: Visualization of simulation of run.

Q2. a) See b).

b) Values for $\eta X12$ (first value is X_{11}, second value corresponds to X_{13}):

- $\eta X12$=0 Average square residuals=0.105761359
- $\eta X12$=0.05 Average square residuals= 0.106122618

- $\eta X12$=0.1 Average square residuals= 0.080643816
- $\eta X12$=0.15 Average square residuals=0.065455519
- $\eta X12$=0.20 Average square residuals=0.057852398
- $\eta X12$=0.25 Average square residuals=0.054834022
- $\eta X12$=0.3 Average square residuals=0.057956277
- $\eta X12$=0.35 Average square residuals=0.049806877
- $\eta X12$=0.4 Average square residuals=0.161059962
- $\eta X12$=0.45 Average square residuals=0.05250719
- $\eta X12$=0.5 Average square residuals=0.051689699

c) The new best value of the speed factor nX_{12} is 0.35.

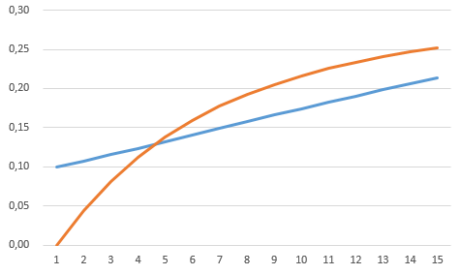


Figure 2: States X11 and X12 with $Nx12 = 0.35$

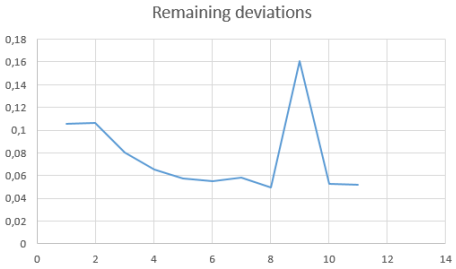


Figure 3: Remaining deviations for different $Nx12$

d) 51 values, as there are 51 points between 0 and 0.5 if each point is a = 0.1 increase starting from 0.

e) $dt = 0.1$ presents a smoother graph, as more points are calculated. However, it does not affect the result that $\eta X12 = 0.35$ is the most precise result.

Part II

Q3. a) See Table:

m_s^{tuning}	
X_1	1
X_2	2
X_3	3
X_4	4
X_5	5
X_6	6
X_7	7
X_8	8
X_9	9
X_{10}	10
X_{11}	11
X_{12}	12

b)
- $S_1 = 0.8872227907483419$
- $S_2 = 0.11851401889617294$
- $S_3 = 0.3922792803550513$
- $S_4 = 0.009228958845663807$
- $S_5 = 0.3528136642249054$
- $S_6 = 0.19146882553206565$
- $S_7 = 0.9840477022290043$
- $S_8 = 0.975840692726246$
- $S_9 = 0.04693090767555643$
- $S_{10} = 0.9999869084786855$
- $S_{11} = 0.003666540720424448$
- $S_{12} = 0.07723510802738674$
- RMSE = 0.017079936684310442

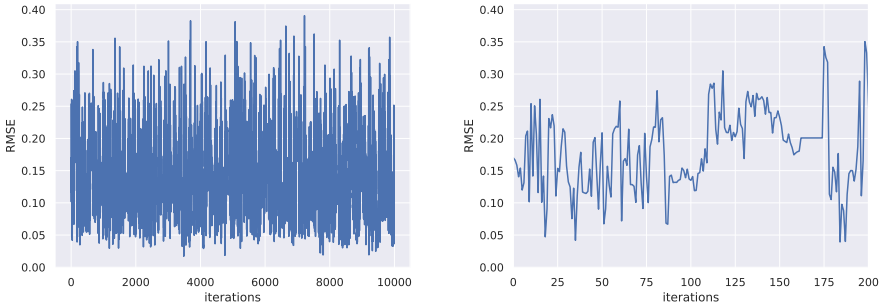
c) See Figure 4 for the RMSE as a function of the number of iterations.

d) See Figure 5.

e) Yes the RMSE is in accordance to the answer in B.

Q4. a) Same as above.

b)
- $S_1 = 0.9107343324367214$
- $S_2 = 0.0014907327786511176$
- $S_3 = 0.05582283573994806$
- $S_4 = 0.7708301498853044$
- $S_5 = 0.3207627960888332$
- $S_6 = 0.11497904154899773$
- $S_7 = 0.35071576587881603$



(a) Up to 10,000 iterations.

(b) Up to 200 iterations.

Figure 4: RMSE as a function of iterations.

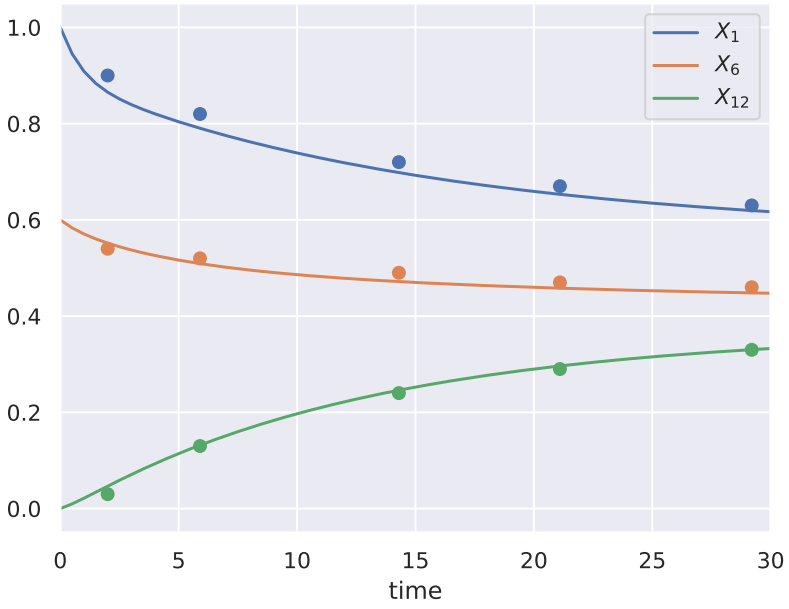
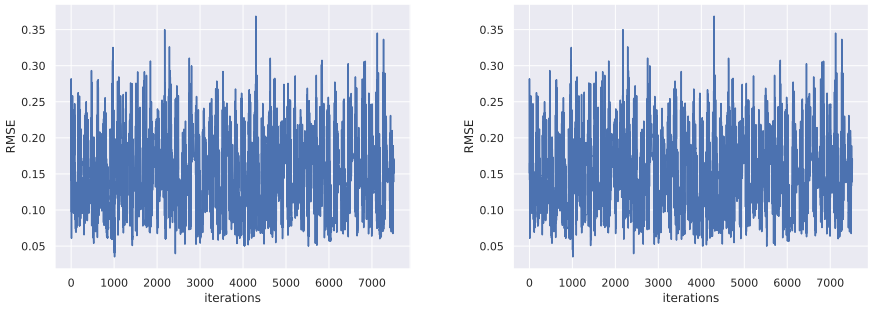


Figure 5: Result of simulation versus the empirical data points.

- $S_8 = 0.14290414025707876$
- $S_9 = 0.269149413866663$
- $S_{10} = 0.023806261402755383$
- $S_{11} = 0.447741696018896$
- $S_{12} = 0.2647859873414261$

- RMSE = 0.03508473072978626

c) See Figure 6.



(a) Up to 7,500 iterations.

(b) Up to 200 iterations.

Figure 6: RMSE as a function of iterations.

d) See Figure 7.

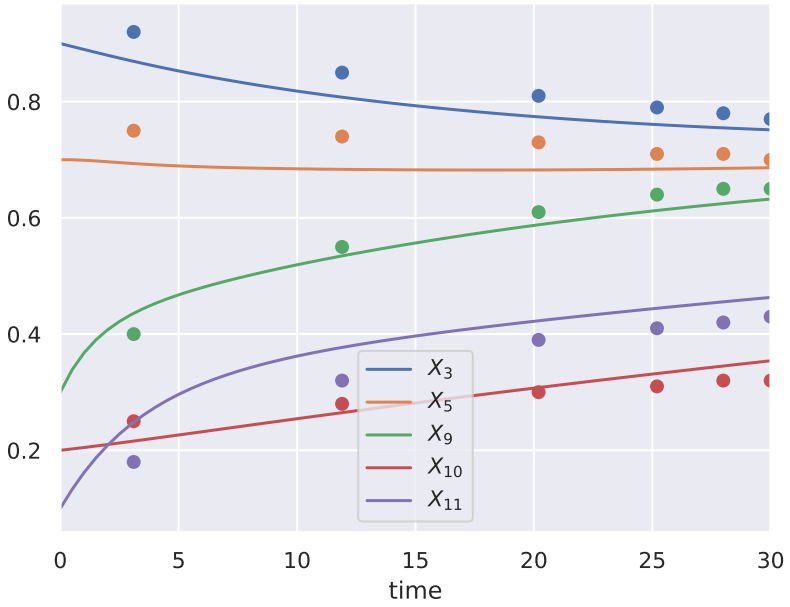


Figure 7: Result of simulation versus the empirical data points.

e) Yes the RSME is in accordance with the results found in b).

Q5. a) See tables below:

m_{cw}^{tuning}	1	2	3	4	5	6	7
X_1							
X_2							
X_3							
X_4							
X_5	1	2	3	4	5	6	7
X_6							
X_7							
X_8							
X_9							
X_{10}							
X_{11}							
X_{12}							

m_s^{tuning}	
X_1	
X_2	
X_3	
X_4	
X_5	8
X_6	
X_7	
X_8	
X_9	
X_{10}	
X_{11}	
X_{12}	

b) RMSE = 0.03724545435264507

c)
- $\omega_{1,5} = 0.9995965713393494$
- $\omega_{2,5} = 0.9998917260328566$
- $\omega_{3,5} = 0.9959614012303794$
- $\omega_{6,5} = 0.99970764007448$
- $\omega_{7,5} = 0.9958953340738674$
- $\omega_{10,5} = 0.9995795204425464$
- $\omega_{11,5} = 0.9956450658127269$
- $s_5 = 0.9997863960478829$

d) See Figure 8.

e)

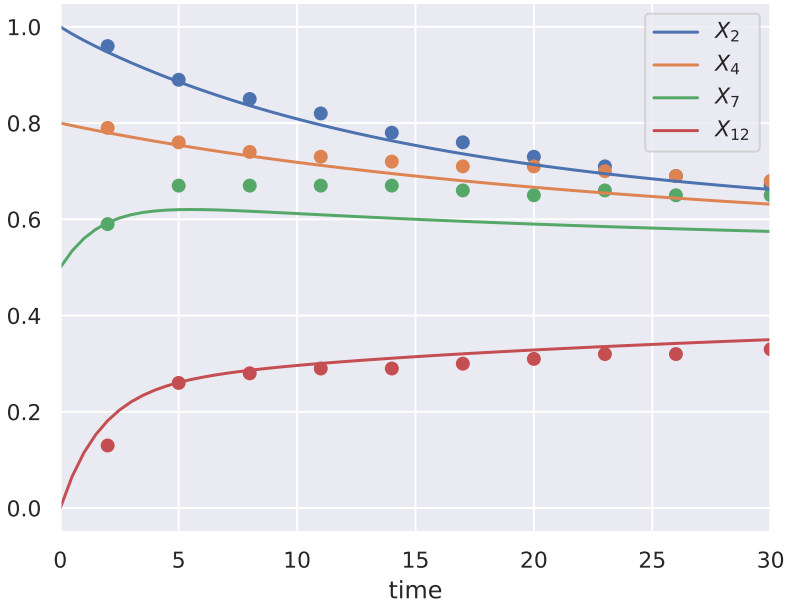
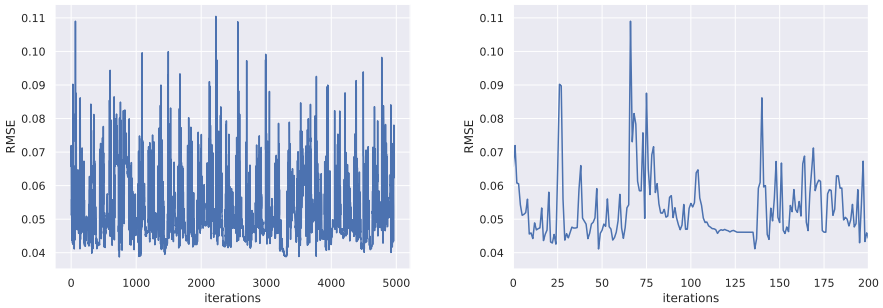


Figure 8: Result of simulation versus the empirical data points.



(a) Up to 5,000 iterations.

(b) Up to 200 iterations.

Figure 9: RMSE as a function of iterations.