

# Assignment 1

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1. To model the scenario described in the assignment we create 10 states:

- $X_1$ : Jenny entering door
- $X_2$ : Mark becomes happy
- $X_3$ : Jenny liking mark
- $X_4$ : Jenny being nervous
- $X_5$ : Jenny breaking vase
- $X_6$ : Mark becomes angry
- $X_7$ : Jenny being sad
- $X_8$ : Mark gives jenny hug
- $X_9$ : Dion becoming jealous
- $X_{10}$ : Dion breaking vase

In Figure 1 we visualize these states as a graph with their connections representing the casual relations between states. In the figure we can see that  $X_6$  “Mark becomes angry” is influenced in a positive way by  $X_5$  “Jenny breaks vase” and negatively impacted by  $X_7$  (denoted by a red line). The positive influence results in a rise of the value while the negative impact causes the value to drop.  $X_6$  and  $X_7$  also form a loop.

The weights between the connections and the speed of each state are described in the role matrices in Figure 3, 4 and 2.

For the states with multiple incoming connections ( $X_4$  and  $X_6$ ) we select the advanced logistic sum function while the other states will have the identity function as their combination function.

2. In Figure 2 the square connection matrix for the scenario is shown, with in every position the weight of the connection if any. In Figure 3 the role matrices for the connectivity is shown. In Figure ?? we see the aggregation role matrices and in Figure 5 the role matrix for the timing (speed) is shown.
3.     • State  $X_1$  (Jenny enters door) is a constant value which is 1 during the whole process, thus being a nonzero state from the beginning.

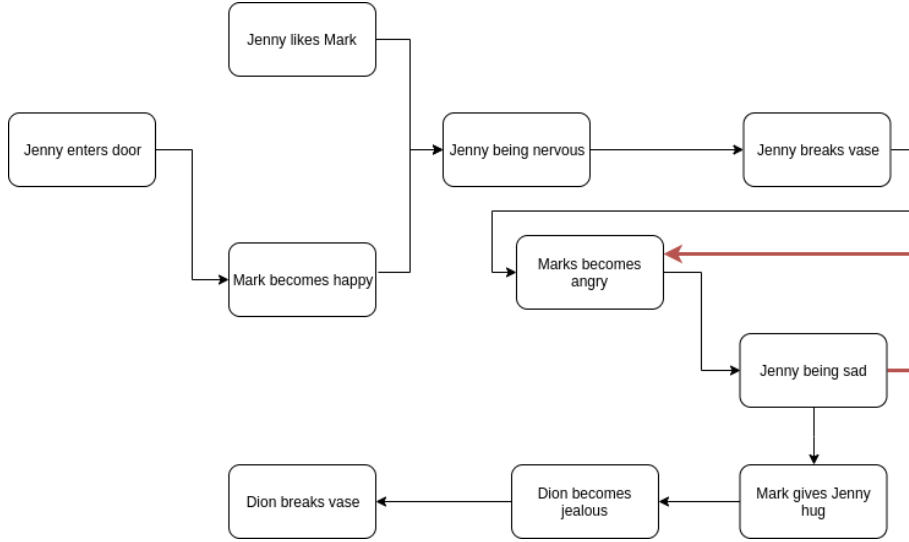


Figure 1: Graph representation for the scenario.

- State  $X_2$  (Mark is happy) starts low but becomes high after Jenny enters door.
- State  $X_3$  (Jenny liking Mark) has a constant value of 1 during the whole simulating just like  $X_1$ .
- State  $X_4$  (Jenny being nervous) starts low but increases fast because of the combination of Jenny liking Mark and Mark becoming happy. Thus,  $X_4$  should have low values in the beginning, high value after  $X_2$  and  $X_3$ .
- State  $X_5$  (Jenny breaks vase) starts from 0 and becomes 1 after Jenny is nervous.
- State  $X_6$  (Mark becomes angry) starts low but becomes high after breaking the first vase; moreover, Mark's anger becomes low again after Jenny's sadness is high and before Mark's hugging of Jenny becomes high.
- State  $X_7$  (Jenny being sad) starts low but becomes high after Mark becomes angry; moreover, when Mark's anger becomes low again Jenny's sadness becomes low, before Mark gives Jenny a hug.
- State  $X_8$  (Mark gives Jenny hug) starts in 0 and becomes 1 after Jenny's being sad and Mark becoming angry are low; moreover, it becomes 0 once Dion breaks vase.
- State  $X_9$  (Dion becomes jealous) starts low but becomes high after Mark gives Jenny a hug. The values are high at the end of the process.

	$X_1$	$X_2$	$X_3$	$X_4$	$X_5$	$X_6$	$X_7$	$X_8$	$X_9$	$X_{10}$
$X_1$		1								
$X_2$				0.25						
$X_3$				0.75						
$X_4$					1					
$X_5$						1				
$X_6$							0.9			
$X_7$						-1		0.7		
$X_8$									0.7	
$X_9$										1
$X_{10}$										

Figure 2: Square connection matrix.

- State  $X_{10}$  (Dion breaks vase) starts low but becomes 1 after Dion becomes jealous.

The above statements result in initial values described in Figure 6.

4. If we put the information of the role matrices in the framework, we end up with the results shown in Figure REF.

$m_b$	<b>base connectivity</b>	<b>1</b>	<b>2</b>
$X_1$	Jenny entering door		
$X_2$	Mark becomes happy	$X_1$	
$X_3$	Jenny liking mark		
$X_4$	Jenny being nervous	$X_2$	$X_3$
$X_5$	Jenny breaking vase	$X_4$	
$X_6$	Mark becomes angry	$X_5$	$X_7$
$X_7$	Jenny being sad	$X_6$	
$X_8$	Mark gives jenny hug	$X_7$	
$X_9$	Dion becoming jealous	$X_8$	
$X_{10}$	Dion breaking vase	$X_9$	

(a) Base connectivity matrix  $m_b$ .

$m_{cuv}$	<b>connection weights</b>	<b>1</b>	<b>2</b>
$X_1$	Jenny entering door		
$X_2$	Mark becomes happy	1	
$X_3$	Jenny liking mark		
$X_4$	Jenny being nervous	0.2	0.8
$X_5$	Jenny breaking vase	1	
$X_6$	Mark becomes angry	1	-1
$X_7$	Jenny being sad	0.9	
$X_8$	Mark gives jenny hug	0.7	
$X_9$	Dion becoming jealous	0.7	
$X_{10}$	Dion breaking vase	1	

(b) Connection weight matrix  $m_{cuv}$ .

Figure 3: Connectivity role matrices.

$m_{cfwv}$	combination function weights	id	alogistic
$X_1$	Jenny entering door		
$X_2$	Mark becomes happy	1	
$X_3$	Jenny liking mark		
$X_4$	Jenny being nervous		1
$X_5$	Jenny breaking vase	1	
$X_6$	Mark becomes angry		1
$X_7$	Jenny being sad	1	
$X_8$	Mark gives jenny hug	1	
$X_9$	Dion becoming jealous	1	
$X_{10}$	Dion breaking vase	1	

(a) Combination function weights matrix  $m_{cfw}$ .

$m_{cfpv}$	combination function parameters	id	alogistic
$X_1$	Jenny entering door		
$X_2$	Mark becomes happy		
$X_3$	Jenny liking mark		
$X_4$	Jenny being nervous		5 0.8
$X_5$	Jenny breaking vase		
$X_6$	Mark becomes angry		5 0.8
$X_7$	Jenny being sad		
$X_8$	Mark gives jenny hug		
$X_9$	Dion becoming jealous		
$X_{10}$	Dion breaking vase		

(b) Combination function parameters matrix  $m_{cfpv}$ .

Figure 4: Aggregation role matrices.

$m_s$	speed factors	1
$X_1$	Jenny entering door	
$X_2$	Mark becomes happy	0.7
$X_3$	Jenny liking mark	
$X_4$	Jenny being nervous	1.0
$X_5$	Jenny breaking vase	0.9
$X_6$	Mark becomes angry	0.5
$X_7$	Jenny being sad	0.5
$X_8$	Mark gives jenny hug	1
$X_9$	Dion becoming jealous	1
$X_{10}$	Dion breaking vase	0.3

Figure 5: Speed role matrices

$iv$	initial values	<b>1</b>
$X_1$	Jenny entering door	1
$X_2$	Mark becomes happy	0
$X_3$	Jenny liking mark	1
$X_4$	Jenny being nervous	0
$X_5$	Jenny breaking vase	0
$X_6$	Mark becomes angry	0
$X_7$	Jenny being sad	0
$X_8$	Mark gives jenny hug	0
$X_9$	Dion becoming jealous	0
$X_{10}$	Dion breaking vase	0

Figure 6: Initial values

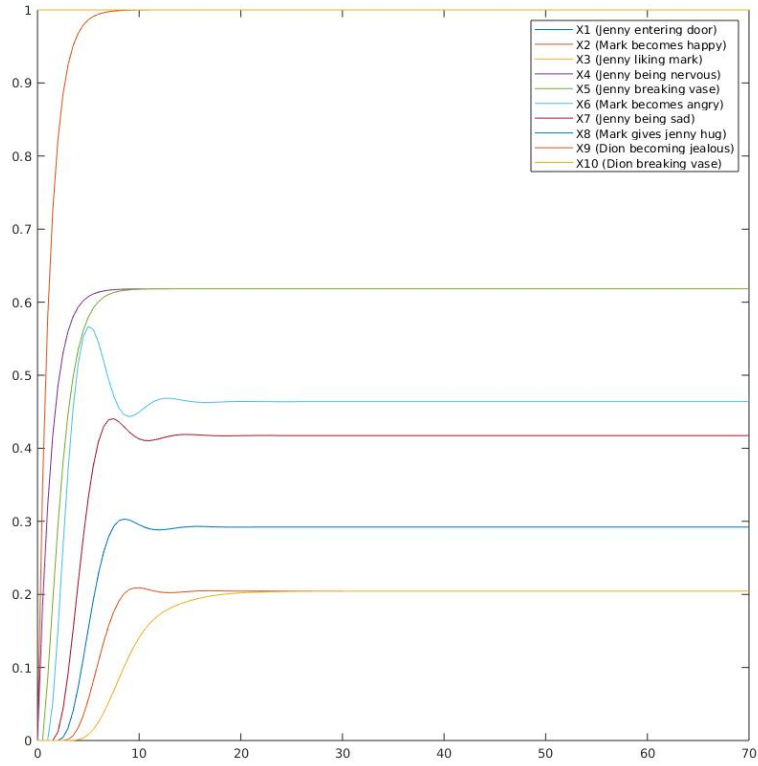


Figure 7: Responses the scenario using the role matrices described.