SYDE 533 Conflict Resolution

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Tutorial 1: Two Decision-Makers Conflict Resolution

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Conflict Resolution

Conflict Resolution Procedure

Conflict Resolution consists of two modules:

1. Modeling.
2. Analysis.

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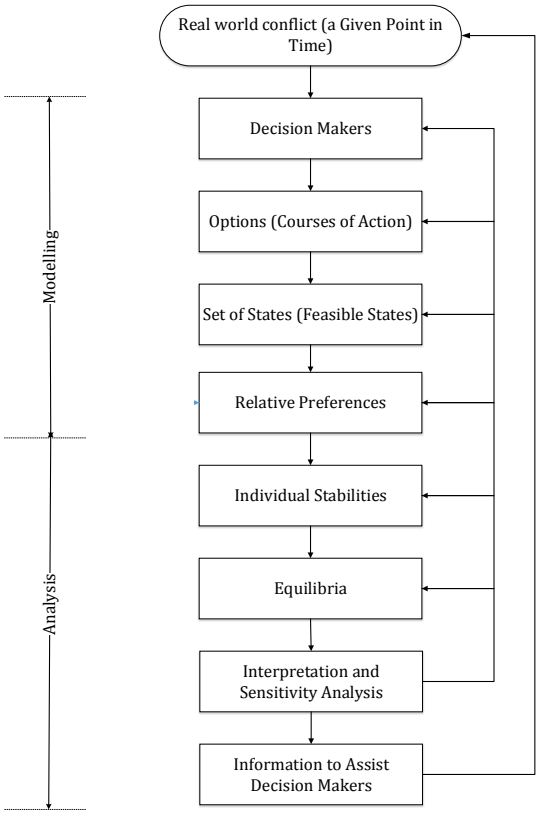
Conflict Resolution Procedure

Conflict Resolution consists of two modules:

1. Modeling.
2. Analysis.



Stability Analysis I

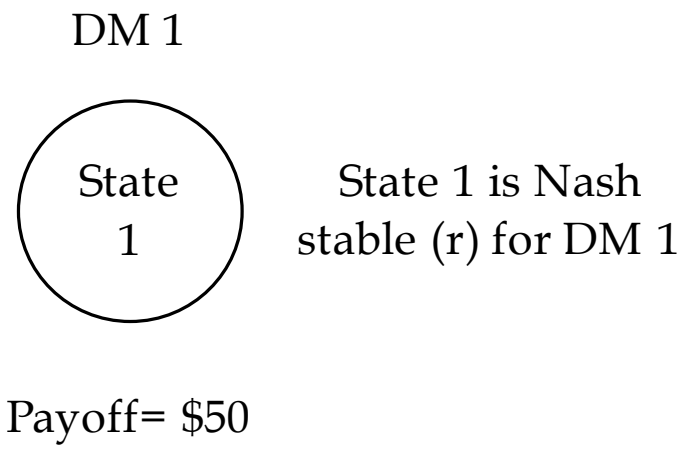
The solution concepts of human behavior under conflicts are explained as follows:

Solution Concept	Stability Description	Foresight	Risk
Nash Stability (r)	DM cannot move unilaterally to a more preferred state.	Low	Ignores risks.
Sequential Stability (S)	DM's unilateral improvements (UI's) are sanctioned by other DMs UI's.	Medium	Takes some risks.

Stability Analysis II

Nash Stability:

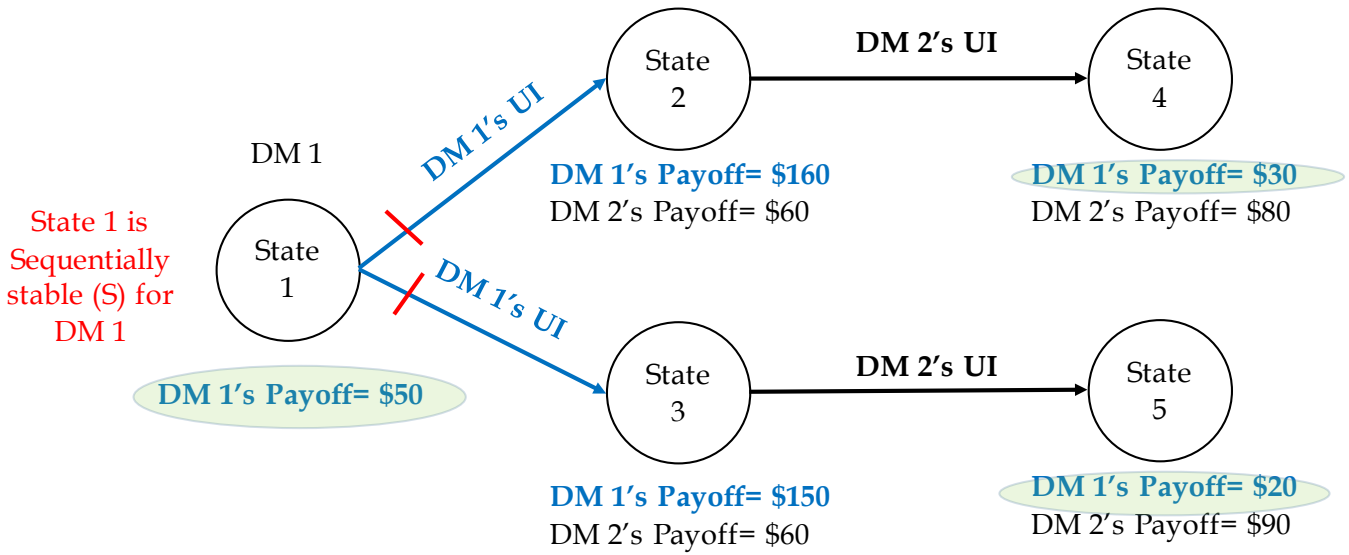
A state s_1 is considered as a Nash stable for *DM 1* if and only if (iff) *DM 1* has no Unilateral improvement (UI) from s_1.



Stability Analysis III

Sequential Stability:

A state s_1 is considered sequentially stable for *DM 1* iff there is a credible sanctioning move by *DM 2* for every UI's *DM 1* has from state s_1.



Stability Analysis IV

Unstable (u):

A state s_1 is unstable (u) for *DM 1* if *DM 1* has at least one UI from s_1 for which *DM 2* has no credible deterrent.

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Equilibrium

Definition (Equilibrium)

A state is considered as an equilibrium for the conflict iff it is stable for every DM under either Nash or sequential stability.

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The 1975 Conflict between Syria and Iraq over Sharing the Euphrates River Water

Choose Players and Options

Decision Makers and Options

DM	Options		
Syria	1. Release Water	N	Syrian
	2. Escalate	N	Strategy
Iraq	3. Attack	N	Iraq Strategy

What is the total number of mathematical states?

Choose Players and Options

What is the total number of mathematical states?

- Total number of mathematical states $= 2^h$, where h is the total number of options in the dispute.
- In this conflict we only have three options.
- Therefore, the total number of possible states $= 2^3 = 8$.

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Remove Infeasible States

- One infeasible situation in which Syria and releases the water and escalates the situation at the same time (mutually exclusive options).
- Taking this into account resulted in the removal of two states from the model.

Infeasible States

DM	Options			
Syria	1. Release Water	Y	Y	Y
	2. Escalate	Y	Y	Y
Iraq	3. Attack	-	Y	N

Feasible States

After removing the two infeasible states, we are left with six feasible states as shown below.

Feasible States

DM	Options	States					
Syria	1. Release Water	N	Y	N	N	Y	N
	2. Escalate	N	N	Y	N	N	Y
Iraq	3. Attack	N	N	N	Y	Y	Y
Label		1	2	3	4	5	6

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Preference Vector

Preference Vector for Syria

DM	Options	States						
Syria	1. Release Water	N	N	N	Y	N	Y	
	2. Escalate	N	Y	Y	N	N	N	
Iraq	3. Attack	N	N	Y	N	Y	Y	Fix Iraq's Strategy
		1	3	6	2	4	5	

Preference Vector for Iraq

		States						
Syria	1. Release Water	Y	N	N	N	Y	N	Fix Syrian
	2. Escalate	N	N	Y	N	N	Y	Strategy
Iraq	3. Attack	N	Y	Y	N	Y	N	
Label		2	4	6	1	5	3	

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Stability Analysis and Equilibria I

Stability Analysis Tableau

Syria						
Overall stability						
Syrian Stability						
Preference Vector	1	3	6	2	4	5
UIs						
Iraq						
Iraq Stability						
Iraq Preference Vector	2	4	6	1	5	3
UIs						

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Stability Analysis and Equilibria II

Stability Analysis Tableau

Syria						
Overall stability						
Syrian Stability						
Preference Vector	1	3	6	2	4	5
UIs		**1**		**1**	**6**	**6**
				3		**4**

Iraq						
Iraq Stability						
Iraq Preference Vector	2	4	6	1	5	3
UIs				**4**	**2**	**6**

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Stability Analysis and Equilibria III

Stability Analysis Tableau

Syria						
Overall stability			**E**			
Syrian Stability	**r**	**s**	**r**	**u**	**u**	**u**
Preference Vector	1	3	6	2	4	5
UIs		**1**		**1**	**6**	**6**
				3		**4**

Iraq						
Iraq Stability	**r**	**r**	**r**	**u**	**s**	**u**
Iraq Preference Vector	2	4	6	1	5	3
UIs				**4**	**2**	**6**

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In Class Exercise 2

Problem Description

In the Table below, indicate rational states using an “r”, sequentially stable states having unilateral improvements using an “s”, unstable states using a “u”, equilibrium state using “E”, and with “x” the states that are not equilibrium for the game.

Stability Analysis Tableau

DM A														
Overall stability														
DM A Stability														
Preference Vector	10	5	32	33	0	1	4	8	9	20	24	25	26	21
UIs				**5**	**32**	**5**	**32**	**23**	**5**	**32**	**32**	**5**	**10**	**5**
						33	**0**	**0**	**33**	**0**	**0**	**33**		**33**
								4	**1**	**4**	**4**	**1**		**1**
										8	**8**	**9**		**9**
											20			**25**

DM B														
DM B Stability														
Preference Vector	21	20	24	25	0	1	4	8	9	5	26	32	33	10
UIs		**21**		**24**		**0**			**8**	**4**	**24**		**32**	**8**
											25			**9**

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Stability Analysis and Equilibria

Stability Analysis

DM A														
Overall stability	X	E	**E**	X	X	X	X	X	X	X	X	X	X	X
DM A Stability	**r**	**r**	**r**	**s**	**u**	**u**	u	u	u	u	u	u	u	u
Preference Vector	10	5	32	33	0	1	4	8	9	20	24	25	26	21
UIs				**5**	**32**	**5**	**32**	**23**	**5**	**32**	**32**	**5**	**10**	**5**
						33	**0**	**0**	**33**	**0**	**0**	**33**		**33**
								4	**1**	**4**	**4**	**1**		**1**
										8	**8**	**9**		**9**
											20			**25**

DM B														
DM B Stability	**r**	**s**	**r**	**s**	**r**	**s**	r	r	s	s	s	r	u	u
Preference Vector	21	20	24	25	0	1	4	8	9	5	26	32	33	10
UIs		**21**		**24**		**0**			**8**	**4**	**24**		**32**	**8**
											25			**9**

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Summary

- The procedure of conflict resolution.
- Stability analysis concepts.
- Illustrative examples of the stability analysis concepts.
- Two in-class exercises.

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Thank You

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