

# A Methodology for Action-Selection using Value-Based Argumentation

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# Agenda

- Introduction
- Motivation
- Purpose
- Approach
- Example Application

# Introduction

- The work described is aimed at finding a methodology for decision making using argumentation that promotes the agent's *aims* and *aspirations*.
- The five steps in the methodology takes the complete cycle of decision making from identifying the agents goals, formulating the issue, building the plan of action to finally sequencing the actions.
- The main highlight is:
  - Decisions are being made depending on the agent's preferences.
  - The need to decide upon a sequence of actions.
  - Considerations of uncertainty

# Motivation

- A contribution to try and answer:  
“Why we cannot trust agents in sensitive /  
critical decision making? ”

In other words

“How can we raise the confidence level in  
agents to take over decision making?”

# Purpose

- To find a methodology for selecting an action that can address:
  - Options and their likely effects
  - Other agents' actions and how they effect ours
  - Short-term vs. long-term decisions
  - Emotions
  - Uncertainties
  - Side effects
  - Incomplete information

# APPROACH

A five-step approach that is based on the use of argumentation schemes as a presumptive justification of action.

# Approach

1. Formulating the Problem (AATS)<sup>[2]</sup>
2. Determining the Arguments (AATS and CQs)<sup>[3]</sup>
3. Building the Argumentation Framework (VAF)<sup>[4]</sup>
4. Evaluating the Argumentation Framework (VO and PE)<sup>[4]</sup>
5. Sequencing the Actions

**AATS** – Action-Based Alternating transition System

**CQs** – Critical Questions

**VAF** – Value-Based Argumentation Framework

**VO** – Value Ordering

**PE** – Preferred Extension

# EXAMPLE APPLICATION

## “HEAD OF THE DEPARTMENT DILEMMA”

The Head of the Department (HoD) has a budget of 3 points for conference attendance.

3 different students have submitted a request to attend.

Student	Cost	Attend	Paper	Previous
S1	1	0	0	0
S2	2	0	1	0
S3	1	0	0	1



# Step 1/5

## Formulating the Problem

- **Actions**

- Write S1,S2 or S3 (j0,j1,j2)
- Send S1,S2 or S3 (j3,j4,j5)

- **Propositions**

- Cost – Attendance – Paper – Previous
- X – XXX – XXX – XXX
- 3 – 000 – 010 – 001

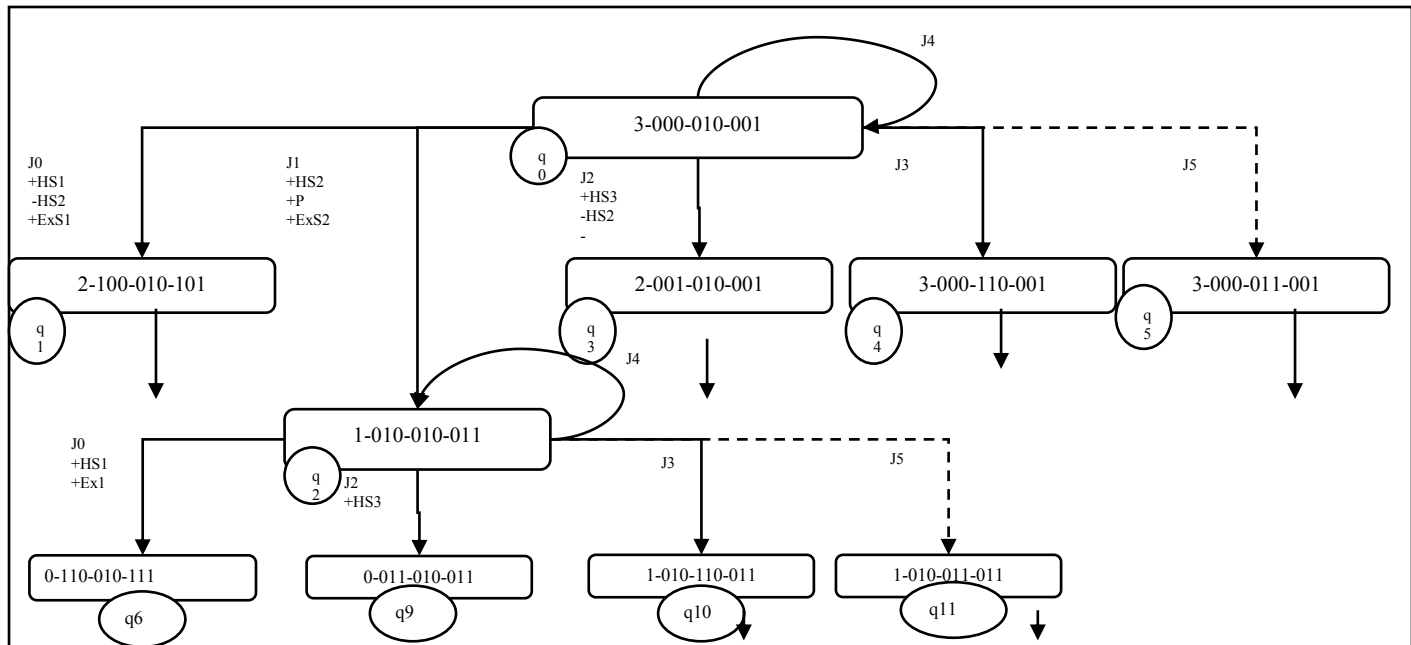
- **Values**

Value	Short	Promoted/Demoted if:
Happiness	H(Si)	Promoted if Si attends
Happiness	H(Si)	Demoted if Si has written a paper and does not attend
Publication	P	Promoted if Si attends having written a paper
Experience	E(Si)	Promoted if Si has not attended before, and attends
Esteem	Est	Promoted if Si has attended a previous conference, has a paper and attends

# Step 1/5

## Formulating the Problem

### States' Transitions



### Uncertainties

Joint Actions

Initial State

# Step 2/5

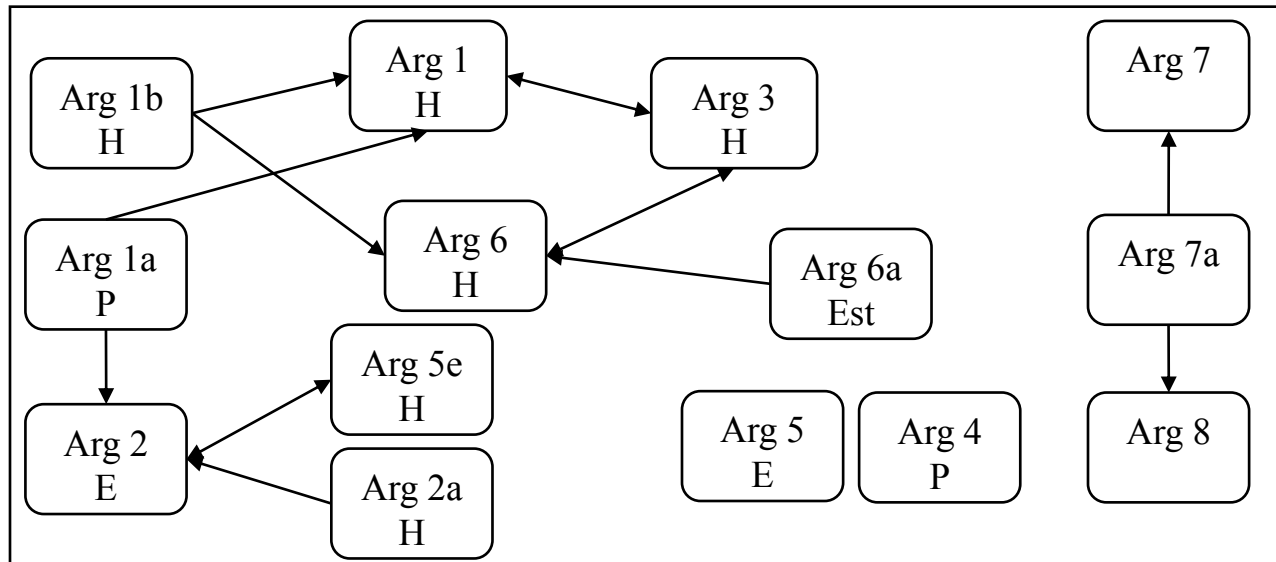
## Determining The Arguments

- In the current state X, agent Ag should perform action Ac to reach state Y achieving goal G promoting value V<sub>[2]</sub>

Arg	In State	Action	To get to State	Realize Goal								
				Budget	Attend	Paper	Prev	H	P	E	Est	
Arg1	Q0	J0	Q1		S1		S1	S1				
Arg2	Q0	J0	Q1		S1		S1				S1	
Arg3	Q0	J1	Q2		S2		S2	S2				
Arg4	Q0	J1	Q2		S2		S2			S2		
Arg5	Q0	J1	Q2		S2		S2				S2	
Arg6	Q0	J2	Q3		S3			S3				
Arg7	Q0	J3	Q4			S1						
Arg8	Q0	J5	Q5			S3						

# Step 3/5

## Building the Argumentation Framework



*CQ1: Are the stated circumstances true?*

*CQ11: Does the action preclude some other action which would promote some other value?*

*CQ2: Does the action have the stated consequences?*

*CQ8: Does the action have side effects which demote the value?*

*CQ9: Does the action have side effects which demote some other value?*

*CQ7: Are there other ways to promote the same value?*

# Step 4/5

## Evaluating the Argumentation Framework

- Determine the Value Order (VO)  
( Esteem > Publication > Experience > Happiness )
- Find the Preferred Extension (PE)

ARG4

Send S2 - P

ARG3

Send S2 - H

ARG5

Send S2 - E

ARG7

Write S1 - ?

ARG8

Write S3 - ?

# Step 5/5

## Sequencing the Actions

Write S1 - ?

Send S2 - P

Write S3 - ?

Safe	Opportunity	Threat
Yes	Yes	Yes
Yes	No	Yes
Yes	Yes	No

# Conclusion

- In this paper a case study was used to present an approach to decision making where a number of competing interests needs to be evaluated.
- The desired decision is not aimed to be the optimal decision with regards to the situation but rather the acceptable decision to a certain audience.
- Future work on this will be investigating more on the uncertainty aspects and questioning and exploring the value preferences of the audience (Working with an incomplete value order).

# References

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