PARTICIPATORY BUDGET FORMATION THROUGH THE WEB

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ESF-TED Programme

Universidad Rey Juan Carlos

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Agenda

- Problem outline
- Formulation
- Methods
- Implementation
- Discussion

Problem outline

- Some municipalities are allowing their citizens to participate on deciding how to spend (part of) the municipal budget.
- First in Porto Alegre (Brazil), 1992

  More than 200 municipalities in 2003
- Differ a lot:
  - the percentage of budget allocated
  - Number of participants
  - Number of delegates to each body
  - Number of rounds
  - Rules
  - …

Problem outline

- Advantages:
  - Legitimation
  - Approaching decisions to citizens
  - Public decisions made publicly
  - Mitigation of alienation and apathy
  - Transparency

Problem outline

- Critiques
  - Based on discussion and physical meetings
  - Frequently limited to a small fraction of the population
  - Participation delegated on representatives
  - Little use of information technologies
  - Preferences established through voting
  - No formal modelling or quantification of the intensity of preferences of citizens
  - No use of formal negotiation or group decision support tools
  - Little methodology available
  - Little participation actually...

Problem outline

- Promoted in, e.g.,
  - 6th Framework Program
  - Spanish National Research Program
  - Main case study in ESF-TED programme
  - …

Formulation

- *n* citizens of a municipality have to decide how to spend (part) of the municipal budget
  - Available budget: *Budget*
  - *m* projects in which to spend the budget:

PROJECTS	COST	ATTRIBUTES
q_1	c_1	$(x_{11}, \ldots, x_{1k})$
$\vdots$	$\vdots$	$\ldots \vdots \ldots$
q_m	c_m	$(x_{m1}, \ldots, x_{mk})$

Formulation

- Alternatives:
  - Solution: $J \subseteq I = \{1, \ldots, m\}$
  - Feasible: $\sum_{j \in J} c_j \leq Budget$

Formulation

- Model preferences over consequences for each participant through a value function:

Proyectos	u_1	u_2		u_n
q_1	$u_1(1)$	$u_2(1)$	$\ldots$	$u_n(1)$
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$
q_j	$u_1(j)$	$u_2(j)$	$\ldots$	$u_n(j)$
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$
q_m	$u_1(m)$	$u_2(m)$	$\ldots$	$u_n(m)$

Formulation

	u_1	u_2		u_n
J^1	$u_1(J^1)$	$u_2(J^1)$	$\dots$	$u_n(J^1)$
J^2	$u_1(J^2)$	$u_2(J^2)$	$\dots$	$u_n(J^2)$
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$
J^s	$u_1(J^s)$	$u_2(J^s)$	$\dots$	$u_n(J^s)$
PM	$J_1^\star$	$J_2^\star$		$J_n^\star$

Maximise group satisfaction
with budget constraint

(S,d)

S=u(J), for all feasible solution **J**

d=0

Methods

- Preferences of group over alternatives are partially ordered:

$$J \succeq J' \Leftrightarrow u_i(J) \geq u_i(J') \ \forall i \in N$$

- The group decision should be nondominated.

Methods

- If $J_1^\star = J_2^\star = \cdots = J_n^\star$, all participants prefer the same alternative and it is taken as group decision.
- Typically, they prefer different optimal solutions, since preferences of participants are in conflict
- May be viewed as arbitration, or negotiation problem (we use BIM)

Participatory budgets: example

- EXAMPLE with TWO PARTICIPANTS
- Have to decide in which projects to spend (part of) the budget
  - Available budget: 180
  - Projects in which to spend the budget:

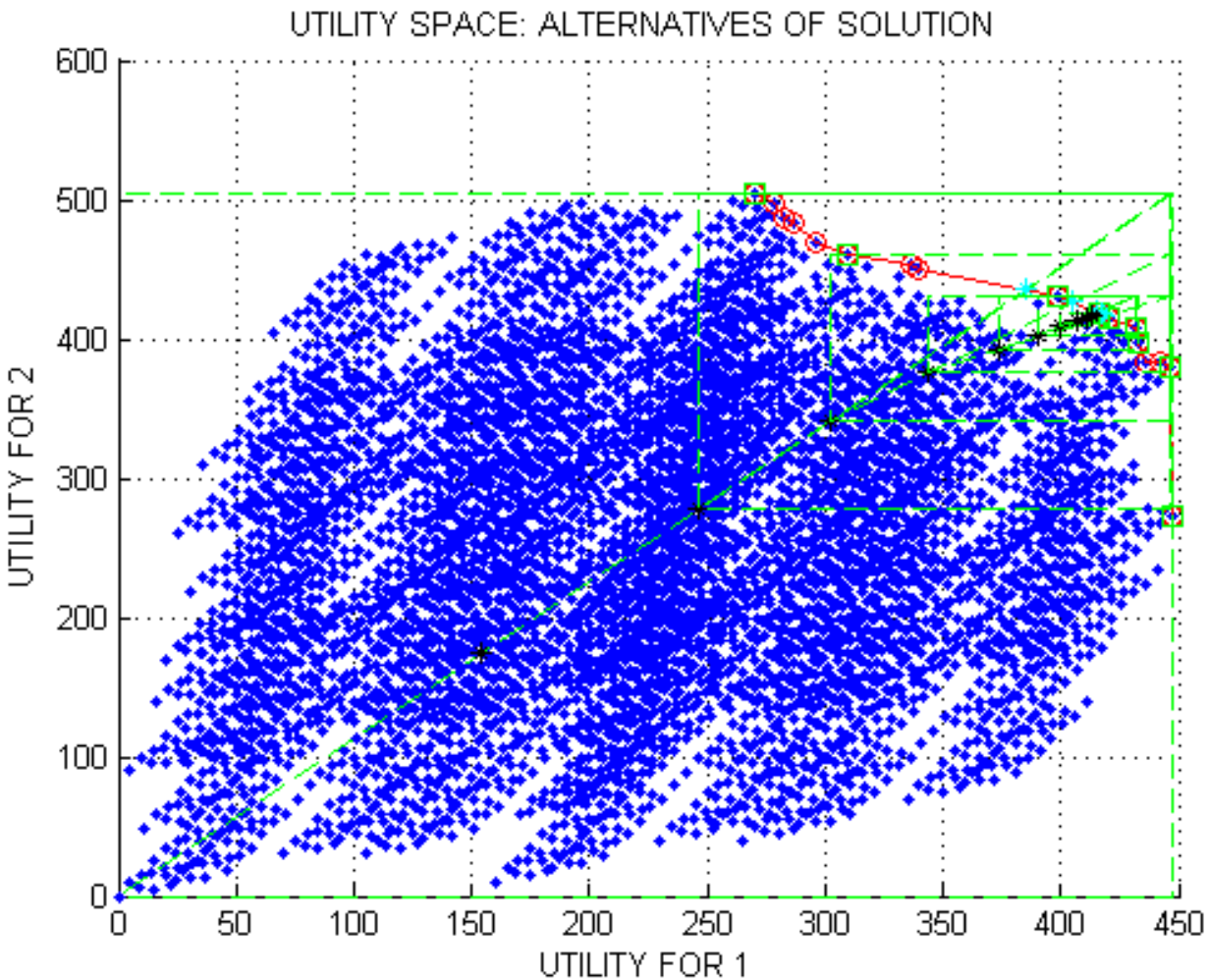
PROJECTS	COST	UTILITY 1	UTILITY 2
1	40	160	10
2	35	20	170
3	25	105	30
4	35	5	90
5	20	70	30
6	20	30	95
7	18	11	49
8	15	15	25
9	13	10	15
10	10	22	8
11	9	15	5
12	6	5	10
13	5	9	6

- Alternatives:
  - Solution: $J \subseteq \{1, \ldots 13\}$
  - Feasible: $cost(J) = \sum_{j \in J} c_j \leq 180$
- Utility is assumed additive

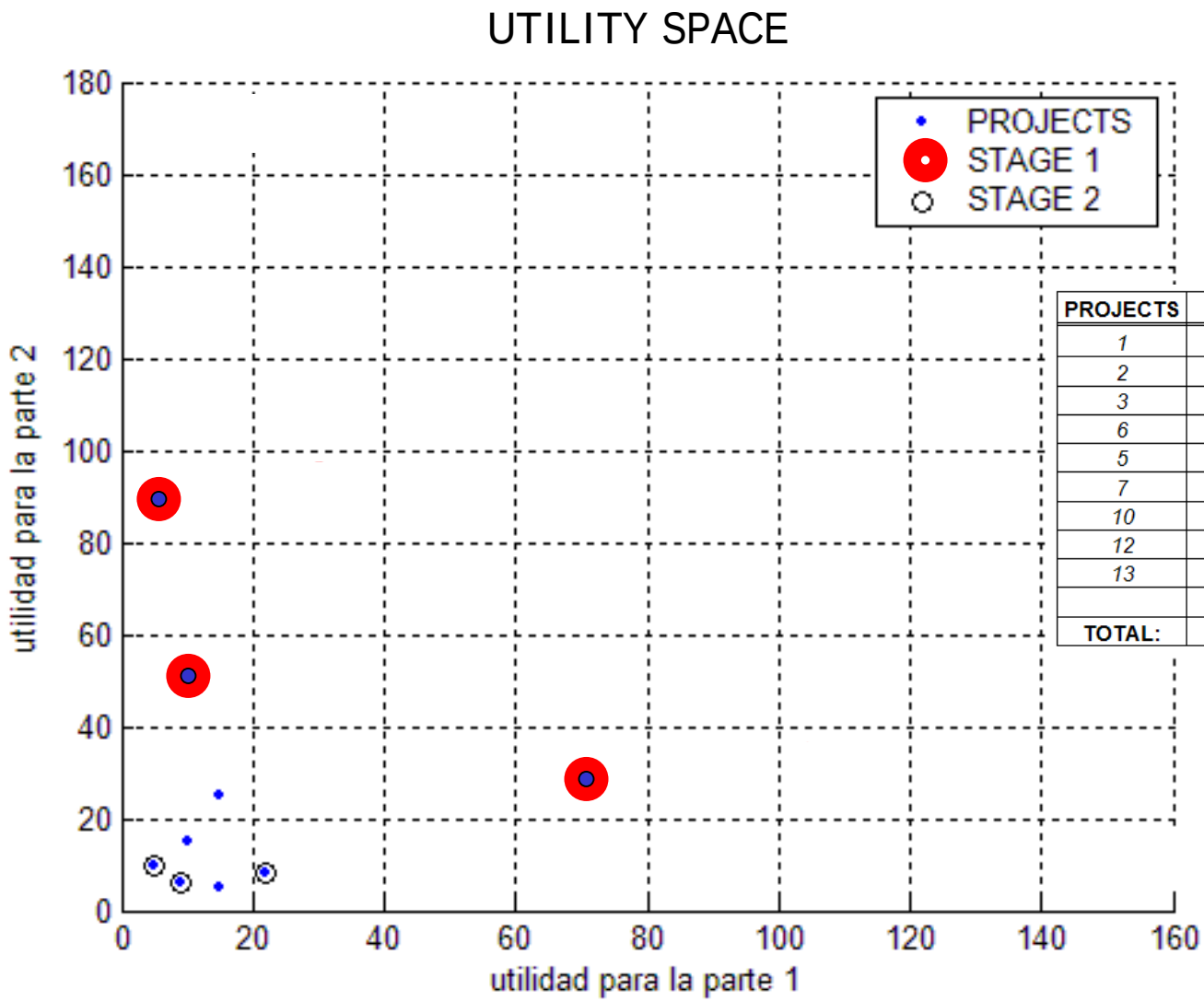
Participatory budget solution

- If all participants prefer the same alternative, take it as the group decision.
- Typically, they prefer different optimal solutions, since the participant preferences are in conflict
  - An agreement may be sought
- How to reach a consensus?
  - Use BIM to support multilateral negotiations
  - The system represents their preferences and an arbitration solution may be suggested.

Negotiation using BIM (exact method)



Heuristic Solution



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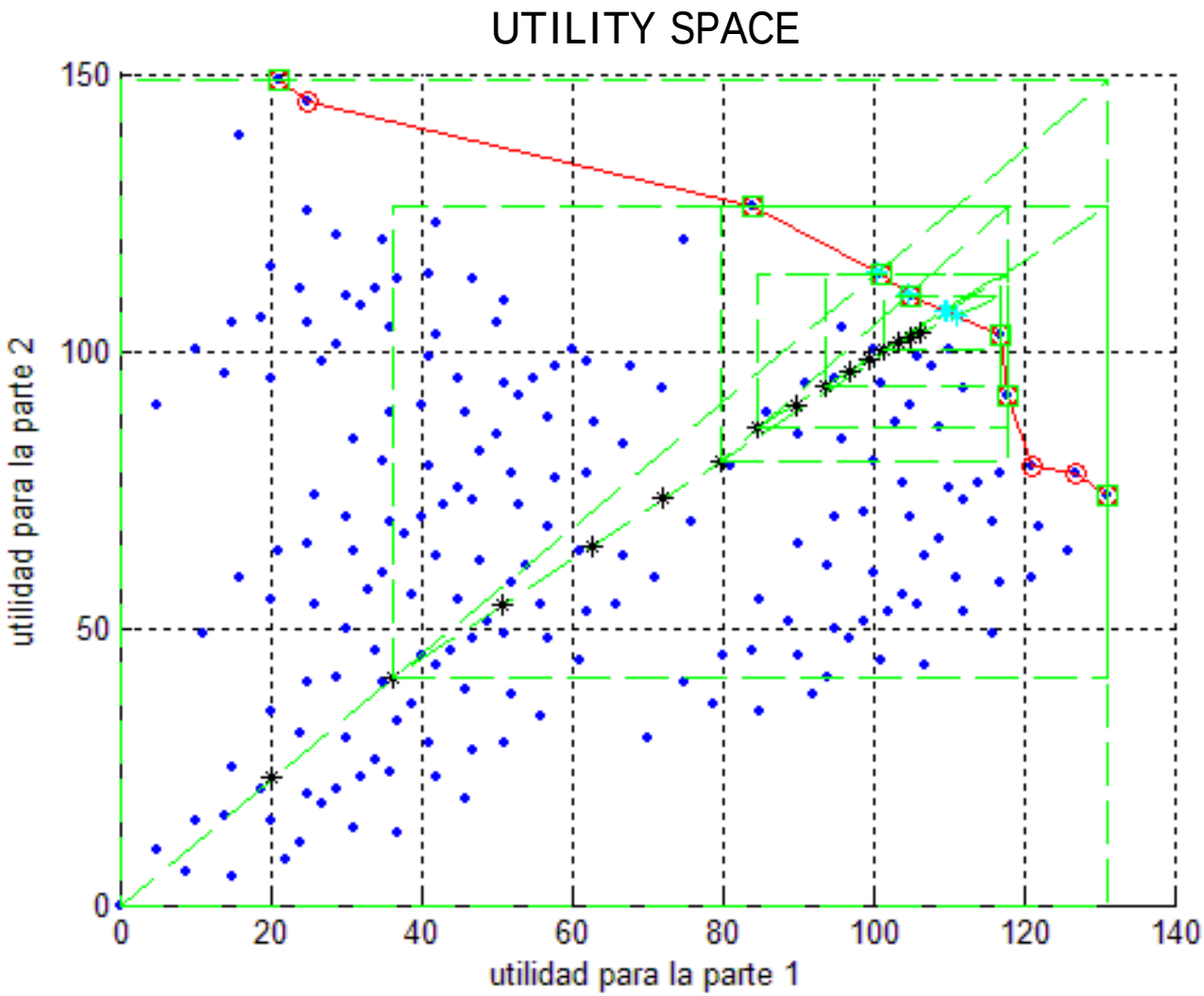
7	18	11	49
10	10	22	8
12	6	5	10
13	5	9	6
TOTAL:	179	432	408

Heuristic: stage 2



Implementation

- Three basic profiles:
  - *Problem owner:* the mayor of a town
  - *Stakeholders* or participants: citizens
  - The administrator: decision analysis team
- Mediation type:
  - **Negotiation**
  - Arbitration
  - Voting
- Safety and secure validation mechanisms are available

TED - Towards Electronic Democracy

Internet Based Complex Decision Support

[Reports for ESF] [Technical Reports] [Latest News] [Planning Anual] [Related Conferences] [Contact]

- What´s TED?
- TED Reports
  - Annual Reports
  - Technical Reports
- TED Newsletter
- TED Activities
  - Conferences
  - Summer Schools
  - Visits
  - Workshops
  - Call for Workshops
- Tools
  - Preference Modeling
  - Influence Diagrams
  - Negotiation Tools
  - What`s ENS?
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  - Voting Tools
- Steering Committe
- Participants
- MailList & Register
- Useful Links

Tipo de acceso

- Mediador
- Participante
- Nuevo Participante

Seleccione una de los dos alternativas.

MEDIADOR: Puedes definir problemas, asi como asignar ciudadanos y recursos a una negociación
PARTICIPANTES: Si es ud un ciudadano, introduzca aqui sus datos para poder participar en las negociaciones. Si ya dispone de una cuenta, pulse sobre PARTICIPANTES. Si quiere darse de alta pulse sobre NUEVO PARTICIPANTE.

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System Modules

- Proposal elaboration
- Value function assessment
- Individual optimal solutions
- Negotiation module
- Voting module
- Post-settlement module

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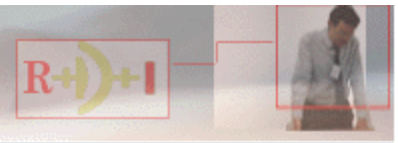

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Gestor de problemas -

Presupuesto Participativo URJC

Ir

- Acceso a Criterios
- Acceso a Proyectos
- Acciones

Mantenimiento de Problemas

Bienvenido **Federico**, seleccione un problema para empezar a operar.

Ciudadanos disponibles		Ciudadanos asignados
Perez Muñoz, Juan Perez Remoños, Arturi	>> << Guardar	Lazaro Dantes, Jose Mari Urdacci Telediario, Alfredi

Salir

Proposal elaboration

- Structure criteria or attributes to evaluate proposals by the participants
- Proposals:
  - associated costs
  - levels of each attribute
- Available budget

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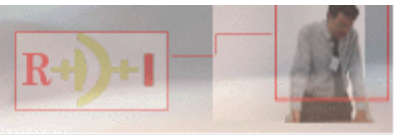

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Alta de Criterios

Descripción	Precio
Valor Mínimo	0
Valor Máximo	10000
Unidad	euros

Añadir criterio

Criterios Asignados

Tiempo	Eliminar
Personas	Eliminar

Volver

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Alta de Proyectos

Nombre	Creación de un polidep	
Descripción	Creación de un polidep	
Coste	5900000	
Fecha Inicio	01/02/05	**dd/mm/aa**
Fecha Fin	31/06/06	**dd/mm/aa**

Añadir proyecto

Proyectos Asignados

Reparacion via urbana C/ Tulipan	Eliminar
Creacion de una piscina	Eliminar
Creacion de una cafeteria	Eliminar

Volver

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Pre-negotiation support (I)

- Problem owner publishes initial draft
  - The participant receives e-mail with login and password with invitation to participate
- E-forum
  - Citizens propose new projects and criteria
  - Supervised by technical staff
  - Consolidate a final list of proposals

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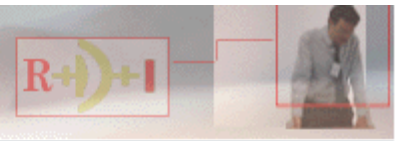

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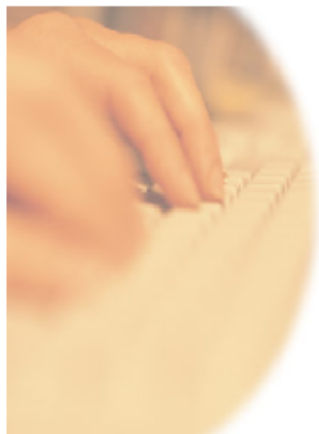

Login Ciudadanos

User	pepe
Password	•••••
	Enviar

Notas: Introduzca los datos de Usuario y Password que le facilitó por mail el Mediador del problema, asi como el ID del problema en el cual va a particiapar. Si ha olvidad su contraseña, puede mandar un **mail** al administrador del sistema.

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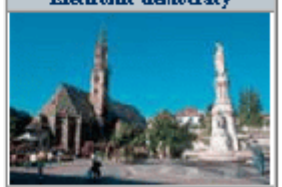

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Pre-negotiation support (II)

- Value Function Assessment
  - Common properties of multiple objectives
    - number of attributes
    - their scale and range.
  - Participants communicate privately their preferences to the system
  - Assessment of each component value function.
    - with the probability equivalent method.
  - Assessment of the weights of the additive value function
  - Saving the value function for later purposes.

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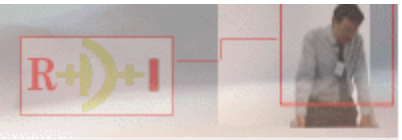

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Monotonia

Presupuesto Participativo URJC

Each line refers to an attribute.State its basic measurement step its range (lower and upper limit) and whether you prefer more of it (e.g. salary) or less of it (eg.,every consumption).

Indica la monotonía para los atributos a modelizar

Si señalas **more** entonces preferirás un mayor valor sobre ese atributo
Si señalas **less** entonces preferirás un mayor valor sobre ese atributo

Nº	Atributte	Unit	Lower	Upper	More	Less
1	Garantia	Dias	1	100	◉	○
2	Dinero	Pela	1	10	○	◉

Send

* **Do yo prefer a bigger or smaller quantity of the parameter?**

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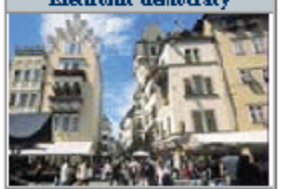

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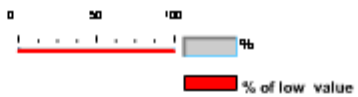
Atributo que esta evaluando actualmente: Garantia

La monotonia que eligio para estre atributo mayor

Obtener con probabilidad Obtain with Probability

Probability	Consequence
51	100
49	1

Representacion grafica:



Obtener con seguridad Obtain with Security

51 Dias

Me es indiferente Indifferent

We are assenssing your utility of the consequence below. You have to dide whether your prefer it for sure, you prefer the stated lottery in which you get the consequences with the sated probability or you are indifferent between then.

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Negotiations (I)

- Typically, various parties involved will reach different optimal solutions.
- Through our negotiation module they try to reach an agreement.
- BIM negotiation:
  - At each iteration of the algorithm, a solution is offered to participants and, if accepted, it stops, that being a consensus

Negotiations (II)

- Voting module
  - approval voting
- Post Settlement module
  - If system detects that the voted solution is dominated, start again negotiations taking the last solution as disagreement point and initial solution of BIM.

Web Implementation

- Client - Server application
  - Data base:
    - MySQL
  - Client language:
    - JavaScript
  - Server language:
    - php
  - Server:
    - Windows 2000 with IIS (Internet Information Server)

Discussion

- Growing interest with participatory budget formation
- IT based coherent methodology
- First experiment conducted with a group pf consultants from DMR: Company investment plan
- Implementation and interfaces to be improved
- First real small-scale tests to be conducted in Almeria
- Can it be scaled to large groups ??
- Unequal treatment of participants ??