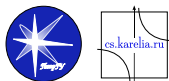


# Modeling resources for training based on cognitive maps

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AMICT Seminar, May 19, 2009

# Goals

- Application of Cognitive Maps (**CM**) for the problem of planning the Training Resource content
- Application of Genetic Algorithms (GA) for solving the problem of optimizing the content of the Training Resource on the importance, given the constraints of time



## Description of problem

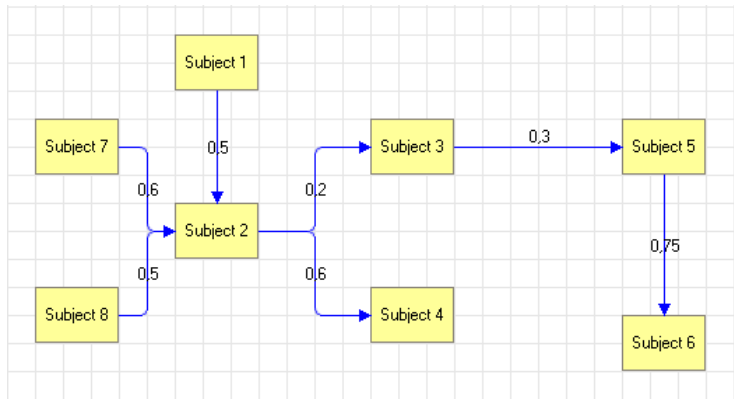
**The task of planning the Training Resource content** is to select from all the available volume of the original subjects (usually greater than the volume of the curriculum) the most important (for certain user groups) and place them on any time intervals (eg, semester) optimally, in the sense of the certain criterion of optimality.

- The importance of Training Resource subjects is defined by experts
- Most of subjects depend on each other, including implicitly dependence (One subject may depend on another in a few intermediate)



# Description of Cognitive Maps

**CM** - are the variety of mathematical models for the formalization of complex systems as a set of concepts, which reflects its systemic factors and identifies causal relationships between them



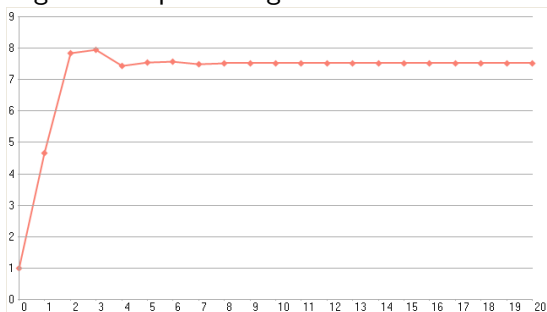
# Analysis of Cognitive Maps

- The main objective: finding indirect influence of one concept to another

	Concept 1	...	Subject N
Concept 1	...	...	...
...	...	...	...
Concept N	...	...	...

	Sys. Impacts	Consonance	Dissonance	Impact on Sys.	Consonance	Dissonance
Concept 1	...	...	...	...	...	...
...	...	...	...	...	...	...
Concept N	...	...	...	...	...	...

- The calculation of integral indicators of the influence: Consonance and Dissonance
- Impulse Simulation: prediction of behavior of some concepts of cognitive maps duaring time



# Modeling based on CM

## A graph of Training Resource IS Cognitive Map.

- Every concept has an expert estimation of importance (importance of this subject)
- This graph is oriented and weighted. Weights of links are expert estimations
- Model pre-follow-up of subjects

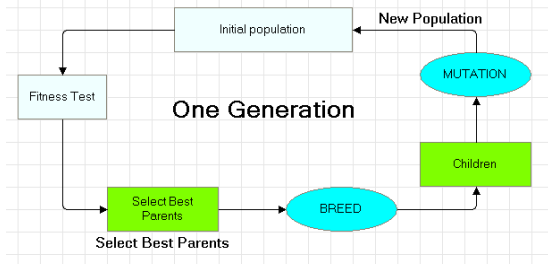


## Description of problem

**The task of optimization Training Resource content** is to construct a model of the course content to maximize the total importance of including in its concepts and length (during) of course study doesn't exceed a given value.

**The Goal** is to get such set of concepts, which will more important, will not exceed time limitation and will follow pre-follow-up model





The Fitness Function:

$$FF = \sum_i \alpha C_{i \in N} + \beta D_{i \in N} - \gamma E_{i \in M \setminus N}$$

- Total influence of population concepts on the system
- Total expert estimation of population concepts
- Total influence of all concepts are not included in the population on each population concept





# Computer System "Cognitive Making Decisions System" is developed for the analysis and modeling of different cognitive maps

The screenshot displays the 'Cognitive Making Decisions System' interface. The main window shows a cognitive map with subjects 1-8 and their interconnections. A secondary window displays 'Инициальное моделирование' (Initial modeling) with a table of initial impulses and a line graph showing the evolution of these impulses over 10 steps.

**Инициальное моделирование: Инициальное моделирование 000000015 от 10.05.2009 0:00:00**

Действия: Сформировать Обновить график.

Номер: 00000015 Дата: 10.05.2009 0:00:00 Количество шагов: 10

Карта: Ввод когнитивной схемы 000000024 от 10.05.2009 17:25:10

Начальный импульс:

N	Концепт	Импульс
1	1	12,0000
2	2	
3	3	
4	4	
5	5	12,0000
6	6	
7	7	12,0000

График: Матрица смежности Расчет

Гривки: когнитивной зависимости 1 2 3 4 5 6 7

Комментарий:

OK Записать Закрыть

**Концепты**

Код	Наименование	Владелец
Раздел 1	Раздел 1	ПримерДиаг'геническогоАлг
Раздел 2	Раздел 2	ПримерДиаг'геническогоАлг
Раздел 3	Раздел 3	ПримерДиаг'геническогоАлг
Раздел 4	Раздел 4	ПримерДиаг'геническогоАлг
Раздел 5	Раздел 5	ПримерДиаг'геническогоАлг
Раздел 6	Раздел 6	ПримерДиаг'геническогоАлг
Раздел 7	Раздел 7	ПримерДиаг'геническогоАлг
Раздел 8	Раздел 8	ПримерДиаг'геническогоАлг



# Main Functionality

- Creating, storing and editing of Cognitive Maps (CM) of various types
- Calculation of different parameters of cognitive maps - the mutual influence, consonance, dissonance, etc.
- Pulse simulation for prediction the behavior of CM in the duaring the time
- Optimizing cognitive maps using genetic algorithms



# Results

- Application of modeling Training Resource content based on Cognitive Maps
- **General:** application of modeling different systems based on Cognitive Maps
- Application of Genetic Algorithms to optimize content of Training Resource on the importance, given the constraints of time
- **General:** Application of Genetic Algorithms to solve different optimization tasks in Cognitive Maps
- Computer System "Cognitive Making Decisions System" is developing



**Thank you for your attention!**

