Decision Support Systems

<table>
<thead>
<tr>
<th>Cod</th>
<th>Denumire</th>
<th>Ore: C+S+L+P</th>
<th>Finalizare</th>
<th>Credite</th>
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<tbody>
<tr>
<td>MID1009</td>
<td>Sisteme pentru fundamentarea deciziilor</td>
<td>2+1+0+1</td>
<td>E</td>
<td>8 cr.</td>
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<tr>
<td>Joi</td>
<td>16~18</td>
<td>L320</td>
<td>S2</td>
<td>Ica, Is, Pbc</td>
<td>Sem.</td>
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<td>18~20</td>
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<td>Curs</td>
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- Mail: per@cs.ubbcluj.ro,
- Web: www.cs.ubbcluj.ro/~per
- Dss: http://www.cs.ubbcluj.ro/~per/Dss.html
# Course objectives

| 7.1 General objective of the discipline | • Good understanding of hands-on applications;  
|                                      | • Be able to identify meaningful applied computing problems;  
|                                      | • Be able to apply theories, principles and concepts with technologies to design, develop, and verify computational solutions; |
| 7.2 Specific objective of the discipline | • Knowledge about general theory and specific DSS theory;  
|                                      | • Systematic knowledge about what the designer of a DSS needs to know; |
## Course contents:

1. The concept of *Decision Support Systems* (DSS)
   - The Steps of Decision Support, Classification of Problems
   - The Components of a DSS.
   - Some Computerized Tools for Decision Support

2. Computerized Decision Support
   - Decision Making - Rational Decisions, Definitions of Rationality, Bounded Rationality and Muddling Through

   Group Decision Making

   - Human Judgment and Decision Making.
   - Modeling Decisions. Components of Decision Models
### Course contents:

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<tr>
<td>5. Normative Systems</td>
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<tr>
<td>- Normative and Descriptive Approaches.</td>
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<td>- Equation-Based and Mixed Systems</td>
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<td>6. Data Component</td>
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<tr>
<td>- Characteristics of Information.</td>
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<td>- Databases to Support Decision Making.</td>
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<td>- Database Management Systems</td>
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<td>7. Data Warehouses.</td>
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<tr>
<td>- Data Mining and Intelligent Agents</td>
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<td>8. Model Component</td>
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<tr>
<td>- Models, Representation, Methodology</td>
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<td>- Integrating Models, Sensitivity of a Decision</td>
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<td>Course contents:</td>
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<tr>
<td><strong>10. Intelligence and Decision Support Systems</strong></td>
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<tr>
<td>- Programming Reasoning</td>
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<td>- Backward Chaining Reasoning and Forward Chaining Reasoning.</td>
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<tr>
<td><strong>11. Knowledge Representation for Decision Support Systems</strong></td>
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<tr>
<td>- Computational Intelligence for Decision Support,</td>
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<tr>
<td>- Expert Systems and Artificial Intelligence in Decision Support Systems</td>
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<tr>
<td><strong>12. User Interfaces to Decision Support Systems</strong></td>
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<tr>
<td>- Support for Model Construction and Model Analysis.</td>
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<tr>
<td>- Support for Reasoning about the Problem Structure in Addition to Numerical Calculations.</td>
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<tr>
<td>- Support for Both Choice and Optimization of Decision Variables</td>
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<td><strong>13. Graphical Interface</strong></td>
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<tr>
<td>- The Action Language, Menus.</td>
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<tr>
<td>- Mail Component</td>
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<td>- Integration of Mail Management.</td>
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<td>- Implications for DSS Design</td>
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<tr>
<td><strong>14. Visualization in Decision Support Systems</strong></td>
<td></td>
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<tr>
<td>- Visualization User Interface for Decision Support Systems</td>
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# Total estimated time (hours/semester of didactic activities)

<table>
<thead>
<tr>
<th>Hours per week</th>
<th>3</th>
<th>Of which: 2 course</th>
<th>2</th>
<th>seminar/laboratory</th>
<th>1 / -</th>
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<tbody>
<tr>
<td>Total hours in the curriculum</td>
<td>42</td>
<td>Of which: 5 course</td>
<td>28</td>
<td>seminar/laboratory</td>
<td>14 / -</td>
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**Time allotment:**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Hours</th>
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<tbody>
<tr>
<td>Learning using manual, course support, bibliography, course notes</td>
<td>36</td>
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<tr>
<td>Additional documentation (on electronic platforms, field documentation, …)</td>
<td>36</td>
</tr>
<tr>
<td>Preparation for seminars/labs, homework, papers, portfolios and essays</td>
<td>36</td>
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<tr>
<td>Tutorship</td>
<td>18</td>
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<tr>
<td>Evaluations</td>
<td>18</td>
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<tr>
<td>Other activities: <strong>Project</strong></td>
<td>14</td>
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**Total individual study hours** 158

**Total hours per semester** 200

**Number of ECTS credits** 8
**R_Bibliography:**


## Assessment

### Evaluation:

<table>
<thead>
<tr>
<th>Type of activity</th>
<th>Evaluation criteria</th>
<th>Evaluation methods</th>
<th>Share in the grade</th>
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<tbody>
<tr>
<td>Course</td>
<td>- know the basic elements and concepts of an Dss;</td>
<td>Written exam</td>
<td>50%</td>
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<tr>
<td>Seminar / Project</td>
<td>- complexity, importance and degree of timeliness of the synthesis made</td>
<td>Paper presentation</td>
<td>15%</td>
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<tr>
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<td>- apply the course concepts</td>
<td>Project presentation</td>
<td>35%</td>
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<td>- problem solving</td>
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**Minimum performance standards**

- At least grade 5 at written exam, paper presentations and project realised.


1. Introduction

The *Decision Support Systems* are used because they have the following properties:

- **Speedy computation**: enables many computations quickly at a low cost; the speed of executions increasing every day;
- **Improved communication and collaboration**: decisions are made by groups from different locations (travel costs);
- **Increased productivity of group members**: using software optimization tools to find the best solution;
- **Improved data management**: store, search, transmit data (text, sound, graphics, video even in foreign languages) quickly, securely, and so on;
- **Managing giant data warehouse** – great storage capability of any type of information that can be accessed and searched very rapidly (parallel computing);

[22] - *Decision Support System and Business Intelligence*  
*Turban, E., ...*
1. Introduction

- **Quality support**: improve the quality of decisions made – more alternatives can be evaluated, (can be performed) quick(ly) risk analysis using simulations, artificial intelligence methods, …;
- **Agility support**: intelligent systems allow to make good and quick decisions;
- **Overcoming cognitive limits in processing and storing information**: computerized systems enable to overcome the cognitive limits by quickly accessing and processing stored information;
- **Using the Web**:
  - access to a vast body of data, information, knowledge,
  - user-friendly graphical user interface – GUI,
  - collaboration with remote partners,
  - intelligent search tools to find quickly any information;
- **Anywhere, anytime support**: using wireless technology, we can access information anytime and from anyplace and communicate the result of the analysis and interpretation.
1.1. The Steps of Decision Support

Simon (1977): the decision-making process is a 4-phase process:

- **Intelligence**: searching for conditions that call for decisions;
- **Design**: inventing, developing, analyzing solutions;
- **Choice**: selecting a course of action;
- **Implementation**: adapting the selected course of action;
1.2. Classification of Problems

The decision-making process may be range from highly structured \textit{programmed} - with standard solution methods, because is possible to abstract, analyze, and classify into specific categories for which we have a model and a solution – \textit{management science (MS) / operation research (OR)} - to highly unstructured \textit{non-programmed} fuzzy, complex problems there are no cut and dried solution methods).

Definitions:

- An \textit{unstructured} problem: all phases are unstructured,
- A \textit{structured} problem: all phases are structured, the procedures for obtaining the best solution are known,
- \textit{Semi structured} problem: has structured and also unstructured phases.
1.3. What is a DSS? - The concept of Decision Support Systems (DSS)

- Scott Morton (~1970) defined the major concepts of **Decision Support Systems**.
- Gorry and Scott-Morton (1971): “Interactive computer-based systems, which help decision maker utilize *data* and *model* to solve unstructured problems”.
- Keen and Scott-Morton (1978): “Decision support system couple the intellectual resources of individuals with the capabilities of the computer to improve the quality of decisions. It is a computer-based support system for management decision makers who deal with semi-structured problems”.
- DSS can be used to describe any computerizing system that supports decision making in an organization.
1.4. The Components of a DSS - The Architecture of DSS

The term DSS can be used to refer to the DSS application.

1. Every problem requires **Data** from many sources;
2. Data are manipulated by using **Models** (standard or customized);
3. Systems sometimes have a **Knowledge** or **intelligence** component;
4. **Users** are another important component;
5. The **User interface** is the last component of the DSS architecture.
1.5. Some Computerized Tools for Decision Support

**Data management**
- DBMS - *Databases and database management system*;
- ETL - *Extraction, transformation and load system*;
- DW - *Data warehouses, real-time DW and data marts*;

**Reporting status tracking**
- OLAP - *Online analytical processing*;
- EIS - *Executive information system*;

**Visualization**
- GIS - *Geographical information system*;
  - *Dashboards; Information portals; Multidimensional presentation*;

**Business analytics**
- *Optimization; Web analytics*;
- *Data mining, Web mining and text mining*;

**Strategy and performance management**
- B(C)PM - *Business (Corporate) performance management*;
- BAM - *Business activity management*;
  - *Dashboards and scorecards*;
Some Computerized Tools for Decision Support

- **Communication and collaboration**
  - GDSS - Group decision support system;
  - GSS - Group support system;
  - Collaborative information portals and systems;

- **Knowledge management**
  - KMS - Knowledge management systems;
  - Expert locating system;

- **Intelligent systems**
  - ES - Expert systems;
  - ANN - Artificial neural networks;
  - Fuzzy logic, Genetic algorithm, Intelligent agents;
  - ADS - Automated decision systems;

- **Enterprise systems**
  - ERP - Enterprise resource planning;
  - CRM - Customer relationship management;
  - SCM - Supply-chain management;
1.6. Why companies want to use Computerized Decision Support?

- Changing economy;
- Many business operations;
- Global competition;
- E-commerce;
- For decisions making;
- Solve directly the management’s inquiries – without Inf. Sys. Depart.;
- Need a special analysis of profitability and efficiency;
- Need an accurate information;
- Computerizing support is viewed as an organizational winner;
- Need new information;
- Need higher decision quality;
- Desire improved communication;
- Want improve customer and employee satisfaction;
- Need timely information;
- Want to reduce costs;
- Want to see improved productivity.
Seminar (Laboratory): the planning of the papers and projects.

- How many students? \( n \)
- How many papers/lab (2 weeks)? \( n/5 \)
- When? For each student! (~What?) Paper ↔ Project
- To do a Calendar 1-2; 3-11, 13-14 (2,9,2) = 9 hours
- Alphabetical?
- Individually or in groups of 2,3, … students??

... C_1 / 5.10.2017