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 deciziiilor</td>
<td>2+1+0+1</td>
<td>E</td>
<td>8 cr.</td>
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<tr>
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<th>Ora</th>
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<th>Fr.</th>
<th>Gr.</th>
<th>Tip</th>
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<tr>
<td>Marti</td>
<td>16~18</td>
<td>L534</td>
<td>-</td>
<td>Ica, Is</td>
<td>Curs</td>
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<td></td>
<td>18~20</td>
<td>L308</td>
<td>S2</td>
<td></td>
<td>Sem.</td>
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- Mail: per@cs.ubbcluj.ro,
- Web: [www.cs.ubbcluj.ro/~per](http://www.cs.ubbcluj.ro/~per)
# 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:

<table>
<thead>
<tr>
<th>1. The concept of Decision Support Systems (DSS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- The Steps of Decision Support, Classification of Problems</td>
</tr>
<tr>
<td>- The Components of a DSS.</td>
</tr>
<tr>
<td>- Some Computerized Tools for Decision Support</td>
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</tbody>
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<table>
<thead>
<tr>
<th>2. Computerized Decision Support</th>
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<tbody>
<tr>
<td>- Decision Making - Rational Decisions, Definitions of Rationality, Bounded Rationality and Muddling Through</td>
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<tbody>
<tr>
<td>- Human Judgment and Decision Making.</td>
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<tr>
<td>- Modeling Decisions. Components of Decision Models</td>
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</table>
## Course Contents:

5. Normative Systems  
   - Normative and Descriptive Approaches.  
   - Equation-Based and Mixed Systems

6. Data Component  
   - Characteristics of Information.  
   - Databases to Support Decision Making.  
   - Database Management Systems

7. Data Warehouses.  
   - Data Mining and Intelligent Agents

8. Model Component  
   - Models, Representation, Methodology

   - Integrating Models, Sensitivity of a Decision
<table>
<thead>
<tr>
<th>Course contents:</th>
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</thead>
<tbody>
<tr>
<td>10. Intelligence and Decision Support Systems</td>
</tr>
<tr>
<td>- Programming Reasoning</td>
</tr>
<tr>
<td>- Backward Chaining Reasoning and Forward Chaining Reasoning.</td>
</tr>
<tr>
<td>11. Knowledge Representation for Decision Support Systems</td>
</tr>
<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>12. User Interfaces to Decision Support Systems.</td>
</tr>
<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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<tr>
<td>13. Graphical Interface</td>
</tr>
<tr>
<td>- The Action Language, Menus.</td>
</tr>
<tr>
<td>- Mail Component</td>
</tr>
<tr>
<td>- Integration of Mail Management.</td>
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<tr>
<td>- Implications for DSS Design</td>
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<tr>
<td>14. Visualization in Decision Support Systems</td>
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<tr>
<td>- Visualization User Interface for Decision Support Systems</td>
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</table>
## 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>
</tr>
</thead>
<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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</table>

### Time allotment:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Hours</th>
</tr>
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<tbody>
<tr>
<td>Learning using manual, course support, bibliography, course notes</td>
<td>36</td>
</tr>
<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>
</tr>
<tr>
<td>Tutorship</td>
<td>18</td>
</tr>
<tr>
<td>Evaluations</td>
<td>18</td>
</tr>
<tr>
<td>Other activities: <strong>Project</strong></td>
<td>14</td>
</tr>
</tbody>
</table>

### Summary

<table>
<thead>
<tr>
<th>Total individual study hours</th>
<th>158</th>
</tr>
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<tbody>
<tr>
<td>Total hours per semester</td>
<td>200</td>
</tr>
<tr>
<td>Number of ECTS credits</td>
<td>8</td>
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</table>

E_Bibliography:


See: http://www.cs.ubbcluj.ro/~per/Dss.html
### 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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</thead>
<tbody>
<tr>
<td><strong>Course</strong></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><strong>Seminar / Project</strong></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>
<td></td>
<td>- apply the course concepts - problem solving</td>
<td>Project presentation</td>
<td>35%</td>
</tr>
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</table>

**Minimum performance standards**

➤ At least grade 5 at written exam, paper presentations and project realised.
Additional references:


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;

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**Diagram:**

- **Intelligence**
  - Problem or opportunity
  - Environment, reports

- **Design**
  - Alternatives, Solutions

- **Choice**
  - Compare and select

- **Implementation**
  - Put solution into action
1.2. Classification of Problems

The decision-making process may be range from highly structured (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 – management science (MS) / operation research (OR) ) to highly unstructured (non-programmed - fuzzy, complex problems there are no cut and dried solution methods).

Definitions:

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

- 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.
- Observation: Decision Support System ≠ Management Information System (MIS).
The term DSS can be use 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 system;

- **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??