

# Syllabus

## CS62S -- Expert Systems Fall 2004

**Instructor:** Pamella Johnson  
**Class:** Mon, Thur 1800 – 2100  
**Office hours:** Mon, Thur 1600 – 1800  
**E-mail:** pjohnson@mail.ucf.edu

**Objectives:** The concepts of expert systems will be introduced. The students will design an expert system using appropriate knowledge-based software tools.

**Catalog:** Apply AI techniques to the problem of acquisition and representation of expert knowledge for problem solving in the expert's domain.

**Topics:** History of knowledge-based systems  
Survey of expert systems  
Rule-based reasoning  
Uncertainty management  
Expert systems lifecycle  
Advanced reasoning techniques

**Ref. Text:** *The Engineering of Knowledge-based Systems - Theory and Practice*, Gonzalez and Dankel, Prentice Hall Inc., 1993

**Grading:**

Project	35%
Presentation	5%
Final	60%

Letter Grades will be awarded as follows:

**A 70 to 100**  
**B+ 60 to 69**  
**B 50 to 59**  
**F 0 to 49**

### Important Dates:

Project due November 11, 2004

*The instructor reserves the right to modify this document. It is the student's responsibility to ensure that (s)he has the most current copy.*

## Term Project

### CS62S -- Expert Systems Fall 2004

The term project is worth 35% of the final grade:

Term Project: Expert System design and development  
Due Date: November 11, 2004  
Percent of final grade: 35% of final grade

Each student should be prepared to learn the expert systems tool that will be used to develop the project. [CLIPS](#) is recommended and may be [downloaded](#).

Details of the project are stated below:<sup>1</sup>

- 1) Student teams:** Students are allowed to form development teams for the project. The teams should be composed of no more than two (2) students, and it should be ensured that all work is divided as evenly as possible. A student may work individually (i.e., a team of one) if (s)he prefers. No penalties or advantages will be given to anyone as a result of the size and makeup of the team.
- 2) Size of Project:** The system developed should be no smaller than 50 rules per student team member. The rules counted will be only those that are meaningful towards solution of the problem. In order to avoid "rule padding", the instructor reserves the right to disqualify any rules not considered to be meaningful, or not of maximum efficiency. Failure to meet the size requirement will result in a loss of 10 semester points (one letter grade).
- 3) Project Topic:** The students are responsible for finding their own topic, but the instructor can help if necessary. All topics must be approved by the instructor by **October 20**.
- 4) Knowledge acquisition:** Each project must have an outside expert (i.e., not part of the project team) whose knowledge is elicited and implemented in the prototype. Not all knowledge, however, need be sourced from this expert or experts, but it must represent at least 30% of the total knowledge. The students will have to identify the expert(s) and the knowledge obtained from them in the project documentation, as well as document each meeting with the experts.
- 5) Project result presentation:** All student teams will have to present their work to the rest of the class. It will represent 5% of the final grade.

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<sup>1</sup> Used with permission from Dr Avelino J. Gonzalez coauthor of "*The Engineering of Knowledge-based Systems - Theory and Practice*"

**6) Final submittals:** The final submittal should be typed, with a font no larger the 12 point. One-inch margins all around should be used. No handwritten corrections, please. Although use of a graphics package is preferred, diagrams can be hand drawn, but it must be done neatly. The following will be required as part of the final submittal of the project documentation: (in the following order!)

- a) Abstract (1/2 page)
- b) Project description (1 to 2 pages)
- c) Feasibility Analysis
- d) Requirements Specification
- e) System Design, including Modified Structure Chart
- f) System implementation, including Knowledge Diagram, and discussion of personnel
- g) Verification and validation record - to include at least 10 test cases w/ results
- h) Summary and Conclusions: Include lessons learned, number of rules, and # of hours spent.

Appendix A) External expert interview record

Appendix B) Knowledge base printout hardcopy, including rule count

Appendix C) Presentation overhead hardcopy (can be turned in separately)

Appendix D) User's manual (2 to 3 pages)

Attachment) Diskette containing knowledge base

**7) Grading Criteria:** The following grading criteria will be used for the final project. It will be based upon a maximum attainable 35 points (35% of the final grade).

- a) Goodness of application (5 pts.)
- b) Inclusion of all requirements in submittal (5 pts.)
- c) System is free of bugs (5 pts)
- d) Presentation (5 pts)
- e) Appropriate validation and verification and documentation (5 pts)
- f) Quality of written presentation - submittal document (10 pts)

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# Class Schedule

## CS62S -- Expert Systems Fall 2004

### October 4

- Introduction to knowledge-based systems<sup>2</sup>
- Knowledge-based Structure
  - a) *A causal knowledge-driven inference engine for expert system*, Kun Chang Lee; Hyun Soo Kim; Proceedings of the Thirty-First Hawaii International Conference on System Sciences, Volume: 5 , 6-9 Jan. 1998 Pages:284 - 293 (*Anderson, Charles*)
  - b) *KASER: a qualitatively fuzzy object-oriented inference engine*, Rubin, S.H.; Rush, R.J., Jr.; Murthy, J.; Smith, M.H.; Trajkovic, L.; Fuzzy Information Processing Society, Proceedings. NAFIPS. 2002 Annual Meeting of the North American, 27-29 June 2002 Pages:354 – 359 (*Green*)

### October 7

- Paper presentation
- Rule-based reasoning
  - a) *Rule-based Systems*, Frederick Hayes-Roth, Communications of the ACM, Volume 28 Issue 9, September 1985 (*Beckford*)
  - b) *Fuzzy rule-based expert system for power system fault diagnosis*, Monsef, H.; Ranjbar, A.M.; Jadid, S.; IEE Proceedings- Generation, Transmission and Distribution, Volume: 144 , Issue: 2 , March 1997 Pages:186 - 192 (*Barham*)

### October 11

- Paper presentation
- Rule-based reasoning
- Expert systems life cycle
  - a) *A Rete-based integration of forward and backward chaining inferences*, Lee, Y.H.; Yoo, S.I.; 1995., Proceedings of the 1995 IEEE International Symposium on Intelligent Control, 27-29 Aug. 1995 Pages:611 – 616 (*Hyde*)
  - b) *Developing knowledge-based systems: reorganizing the system development life cycle*, Communications of the ACM, Volume 32 , Issue 4, April 1989, Pages: 482 - 488 (*Ferguson*)

### October 14

- Paper presentation
- Feasibility Analysis
- Requirements specification and design
  - a) *Producing consistent specifications for a shipping expert system*, Wergeland, T.H.; Vermesan, A.; 1995. Proceedings., 11th Conference on Artificial

<sup>2</sup> Although, *The Engineering of Knowledge-based Systems - Theory and Practice*, Gonzalez and Dankel, Prentice Hall Inc., 1993, is not a required text, the course will follow closely the outline of the text.

Intelligence for Applications, 20-23 Feb. 1995, Pages:210 – 216 (*Cotterell*)  
b) *Knowledge specification of an expert system*, Slagle, J.R.; Gardiner, D.A.;  
IEEE Expert, Volume: 5 , Issue: 4 , Aug. 1990 Pages:29 - 38 (*Lemard*)

#### **October 20 (Wed)**

- Paper presentation
- CLIPS presentation (*Dockery*)
- Uncertainty management
- ***Deadline for project topic approval***
  - a) *Knowledge representation and uncertainty management: applying Bayesian belief networks to a safety assessment expert system*, Guo, B.; Proceedings 2003 International Conference on Natural Language Processing and Knowledge Engineering , 2003., 26-29 Oct. 2003, Pages:114 – 119 (*Ebanks*)
  - b) *A comparison of the manipulation of certainty factors by individuals and expert system shells*, Kopcsó, D.; Pipino, L.; Rybolt, W.; System Sciences, 1988. Vol.III. Proceedings of the Twenty-First Annual Hawaii International Conference on Decision Support and Knowledge Based Systems Track, Volume: 3 , 5-8 Jan. 1988, Pages:181 – 188 (*Morrison, R*)

#### **October 21**

- Paper presentation
- Knowledge acquisition and system implementation
  - a) *Knowledge acquisition for expert systems: some pitfalls and suggestions*, Forsythe, D.E.; Buchanan, B.G.; Systems, Man and Cybernetics, IEEE Transactions on , Volume: 19 , Issue: 3 , May-June 1989, Pages:435 – 442 (*Simmonds*)
  - b) *Knowledge acquisition: issues, techniques, and methodology*, Proceedings of the 1990 ACM SIGBDP conference on Trends and directions in expert systems, Orlando, Florida, Pages: 212 – 236, 1990 (*Chevannes*)

#### **October 25**

- Paper presentation
- Practical considerations in knowledge acquisition
  - a) *Interview-based knowledge acquisition using dynamic analysis*, Kawaguchi, A.; Motoda, H.; Mizoguchi, R.; IEEE Expert, Volume: 6 , Issue: 5 , Oct. 1991, Pages:47 – 60 (*Brown*)
  - b) *Experts' estimation of uncertain quantities and its implications for knowledge acquisition*, Mullin, T.M.; IEEE Transactions on Systems, Man and Cybernetics, Volume: 19 , Issue: 3 , May-June 1989, Pages:616 – 625 (*Whyte*)

#### **October 28**

- Paper presentation
- Verification and validation

*Software certification for industry-verification and validation issues in expert systems*, Vermesan, A.I.; 1998. Proceedings. Ninth International Workshop on Database and Expert Systems Applications, , 26-28 Aug. 1998, Pages:3 – 14 (*Morrison, W*) b) *Developing a strategy for expert system verification and validation*, Sunro Lee; O'Keefe, R.M.; IEEE Transactions on Systems, Man and Cybernetics, Volume: 24 , Issue: 4 , April 1994, Pages:643 – 655 (*Smith*)

#### **November 1**

- Paper presentation
- Knowledge representation schemes
  - a) *Object-oriented programming and frame-based knowledge representation*, Rathke, C.; TAI '93. Proceedings. Fifth International Conference on Tools with Artificial Intelligence, 8-11 Nov. 1993, Pages:95 – 98 (*Walter*)
  - b) *Using semantic networks for knowledge representation in an intelligent environment*, Peters, S.; Shrobe, H.E.; Proceedings of the First IEEE International Conference on Pervasive Computing and Communications, 23-26 March 2003, Pages:323 – 329 (*Bryan*)

#### **November 4**

- Paper presentation
- Advanced reasoning techniques
  - a) *Model-based diagnosis or reasoning from first principles*, Peischl, B.; Wotawa, F.; Intelligent Systems, IEEE [see also IEEE Expert] , Volume: 18 , Issue: 3, May-June 2003, Pages:32 – 37 (*Scarlett*)
  - b) *Case based reasoning*, Xu, L.D.; Potentials, IEEE , Volume: 13 , Issue: 5, Dec. 1994-Jan. 1995, Pages:10 – 13 (*Tate*)
  - c) *Using qualitative reasoning for diagnostic applications*, Price, C.; Hunt, J.; Expert Systems for Fault Diagnosis in Engineering Applications, IEE Colloquium on , 20 Apr 1989, Pages:8/1 - 8/3 (*Stewart*)

#### **November 8**

- Paper presentation
- Advanced reasoning techniques (cont.)
- Legal Issues

#### **November 11**

- Project presentation
- Project due

#### **November 18**

- Final Examination



**Policy:**

The university codes on academic integrity and classroom conduct are in effect and should be observed throughout the duration course.

Class attendance is mandatory and class participation contributes to final grade.

Late assignment is not accepted.

The student is responsible for missed work if absent, and should not expect the instructor to repeat the entire lecture during office hours.

Inform the instructor of all foreseen absences well in advance.

The instructor will consider each case individually, so please feel free to discuss any issues that may affect your performance in this course.