BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI (Rajasthan), India 333 031
INSTRUCTION DIVISION
SECOND SEMESTER 2008-2009
Course Handout (Part II)

Date: 10.12.2008

In addition to part I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No : **EA C461**
Course Title : **Artificial Intelligence**
Instructor-in-charge : **S.P.Vimal** **vimalsp@bits-pilani.ac.in**

Objective

Artificial Intelligence (AI) is one of the oldest disciplines in computer science. A primary goal of AI is to build intelligent entities. This course is structured to give an overview of the area, as well as provide necessary depth those fundamental techniques. We will keep investigating as what it means to be intelligent throughout the course. We will also try to attain an understanding on the contributions AI has made to the field of computer science.

By the end of the course, you should have a general knowledge of the field of AI. You should be able to recognize when AI techniques are necessary, apply standard AI techniques to solve problems. You should also be able to evaluate new techniques you encounter.

Scope

This course covers the issues and techniques involved in the creation of computer systems that engage in intelligent behavior. The following are among the topics that we will cover: AI search techniques, Game Playing, Planning, Knowledge Representation, Reasoning under Uncertainty and Machine Learning. Students will implement algorithms introduced in this course using LISP or any other suitable programming languages.

Prerequisite: It is recommended to have good exposure in computer programming, data structures and algorithms.

Text Book

T1. Stuart Russell and Peter Norvig.
Artificial Intelligence A Modern Approach
Prentice Hall**,** Second Edition (Indian reprint: Pearson Education).

Reference Books

R1.George F.Luger
Artificial Intelligence
Pearson Education

R2.Ben Coppin
Artificial Intelligence Illuminated
Jones and Bartlett Publishers

R3 Peter Seibel
Practical Common Lisp (Can be accessed from http://www.gigamonkeys.com/book/)
APress

R4 Ivan Bratko
PROLOG : Programming for Artificial Intelligence
Pearson Ed. India

R5.Ethem Alpaydin
Introduction to Machine Learning
PHI

Course Plan:

Lecture Modules

Modules	Topic	Learning Objectives
-	Introduction	Definitions of Artificial Intelligence, Different Perspectives, Historical background
1	Problem Solving by search	To understand those elements constituting problems and learn to solve it by various uninformed and informed (heuristics based) searching techniques
2	Knowledge Representation and Reasoning	To understand those formal methods for representing the knowledge and the process of inference to derive new representations of the knowledge to deduce what to do
3	Planning	To understand the notion of planning in AI and some techniques in the classical planning system
4	Uncertain Knowledge Representation and Reasoning	To understand the notion of uncertainty and some of probabilistic reasoning methods to deduce inferences under uncertainty
5	Machine Learning	To understand some of those mechanisms by which an AI system can improve it's behavior through its experience
--	Selected Topics on AI	To give an overview on topics relevant to robotics and advanced AI topics.

Lecture Schedule

Module	Topics	Reading	Tentative Lecture Hours
0	**Introduction to AI, background, Overview of course,**		1
1	**Searching as solutions for some toy/real world problems**	**T1** :3.1, 3.2	1
	Uninformed search strategies Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Depth First Search, Bidirectional Search and comparisons	**T1**: 3.4	2
	Heuristic Functions Significance of heuristic Functions, Desirable Properties, Design of Heuristic Functions	**T1**: 4.2	1
	Informed Search Strategies Greedy Best First Search, A* Search, Hill Climbing, Simulated Annealing	**T1**: 4.1, 4.3	2
	Constraint Satisfaction Problems (CSP)	**T1:**5	2
	Introduction to game theory Minimax Algorithm, Alpha-Beta Pruning, Making Real-Time Decisions	**T1**: 6.1-6.4	2
2	**Propositional Logic** (SL) Propositional logic: formal system, Resolution principle, Propositional inference	**T1**: 7.4, 7.5, 7.6	2
	First Order Logic (SL) Syntax & semantics, Expressivity of first-order logic Unification in first-order logic	**T1**: 8.2, 8.3, 8.4	2
	Inference in FOL Unification and Lifting, Forward Chaining, Backward Chaining, Resolution	**T1**: 9	2
	Situation Calculus, Time and Event Calculus		2
	Theory of belief, Knowledge and Belief, Reasoning Systems for Taxonomic Knowledge	**T1**:10	

3	**Planning:** The Planning Problem, Planning with State Space Search, Partial Order Planning, Planning Graphs Analysis of Approaches **Planning and Acting in the Real World** Time, Schedules and Resources Hierarchical Task Network Planning Planning and Acting in Non deterministic Domain Conditional Planning Execution Monitoring and Re-planning **Multi-Agent Planning**	**T1**: 11, 12	3
4	**Uncertainty** (SL) Notion of Uncertainty Representing knowledge in uncertain Domain **Bayesian Networks**: Semantics, Exact inference, Approximate Inference **Other Approaches to Uncertain Reasoning**: Rule-based methods for uncertain reasoning Representing Ignorance: Dempster Shafer Theory Fuzzy Logics in expressing vagueness **Making Simple Decisions** Combining Beliefs and Desires under Uncertainty Utility Theory, Utility Functions Decision Networks Value of Information, Decision-Theoretic Expert Systems **Making Complex Decisions** Sequential Decision Problems, Value Iteration, Policy Iteration, Decision Theoretic Agents, Decisions with Multiple Agents	**T1**: 13.1, 14.1 **T1**: 14.2, 14.4, 14.5 **T1**: 14.7 **T1**: 16 **T1**: 17	1 3 1 3 2
5	**Learning** Learning from observations Learning in the presence of knowledge Statistical Learning Methods Reinforcement Learning **Why Learning Works?** An introduction to computational learning theory	**T1**: 18, 19,20,21	7
	Selected Advanced Topics **Course summary**		3
			41 hours
Topics marked with (**SL**) will have **S**elf **L**earning components, to be assigned in during the course.			

Evaluation Scheme

Component	**Mode**	**Duration**	Date	**Weightage**
Test 1	Closed Book	50min		**15%**
Test 2	Open Book	50min		**15%**
Comprehensive	Partly Open Book	3 hours		**40%**
Labs & Assignments	Open Book			**25%**
Surprise Quiz	Class Notes Only			**05%**

Assignments

- There will be written and programming assignments. Specifics of assignments will be announced in the class.
- Programming assignments will usually be based on Prolog / Lisp
- Homework problems, which are typically based on the previous 2 days lectures, have one day deadlines.
- The due date for each of the assignments will be announced. The written assignments should be submitted before 05:00 PM of the due day. Programming assignments should be submitted before midnight.
- For each day beyond the due date of the assignment, there will be 25% of the assignment weightage will be the penalty, and assignment submission is allowed only 4 days beyond the due date.
- All work is to be the result of your own individual efforts unless explicitly stated otherwise. Plagiarism, unauthorized cooperation or any form of cheating will be brought to the attention of the Dean for disciplinary action and will attract severe penalty.

Labs

- There will be 3 tutorial lab sessions conducted primarily to introduce Prolog/Lisp and it is up to the individual student to raise their acquaintance level with Prolog/Lisp to work on the subsequent programming assignments and attempt the laboratory evaluation

Chamber Consultation Hours: *To be announced in the class*

Notices:

- All notices concerning this course will be put on the **IPC notice board** and the **course home page (to be accessed through the instructor's page http://discovery.bits-pilani.ac.in/~vimalsp/)**

Makeup Policy:

- Prior Permission of the Instructor-in-Charge is required to take a make-up for a test.
- A make-up test shall be granted only in genuine cases where - ***in the Instructor's judgment*** - the student would be physically unable to appear for the test.
- No make-ups given for surprise quizzes and Laboratory evaluations
- Requests for make-up for the comprehensive examination – under any circumstances – can only be made to Dean, Instruction Division.

Instructor-in-charge

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