AI: CONSTRAINT SATISFACTION

PROF. DEEPAK KHEMANI
Department of Computer Science and Engineering
IIT Madras

PRE-REQUISITES : Exposure to AI: Search Methods for Problem Solving and AI: Knowledge Representation & Reasoning helps, but is not necessary.

INTENDED AUDIENCE : Both UG and PG students studying Computer Science (any degree) can take it.

INDUSTRIES APPLICABLE TO : Software companies dealing with artificial intelligence applications

COURSE OUTLINE :

Human beings solve problems in many different ways. Problem solving in artificial intelligence (AI) is inspired from these diverse approaches. AI problem solvers may be based on search, on memory, or on knowledge representation and reasoning. An approach to problem solving is to pose problems as constraint satisfaction problems (CSP), and employ general methods to solve them. The task of a user then is only to pose a problem as a CSP, and then call an off-the-shelf solver. CSPs are amenable to combining search based methods with reasoning. In this 2 credit course we will look at general approaches to solving finite domain CSPs, and explore how search can be combined with constraint propagation to find solutions.

ABOUT INSTRUCTOR :

Prof. Deepak Khemani is Professor at Department of Computer Science and Engineering, IIT Madras. He completed his B.Tech. (1980) in Mechanical Engineering, and M.Tech. (1983) and PhD. (1989) in Computer Science from IIT Bombay, and has been with IIT Madras since then. In between he spent a year at Tata Research Development and Design Centre, Pune and another at the youngest IIT at Mandi. He has had shorter stays at several Computing departments in Europe.
Prof. Khemani's long-term goals are to build articulate problem solving systems using AI that can interact with human beings. His research interests include Memory Based Reasoning, Knowledge Representation and Reasoning, Planning and Constraint Satisfaction, Qualitative Reasoning and Natural Language Processing.

COURSE PLAN :

Module 1: Constraint satisfaction problems (CSP), examples.

Module 2: Constraint networks, equivalent and projection networks.

Module 3: Constraint propagation, arc consistency, path consistency, i-consistency.

Module 4: Directional consistency and graph ordering, backtrack free search, adaptive consistency.

Module 5: Search methods for solving CSPs, lookahead methods, dynamic variable and value ordering.

Module 6: Lookback methods, Gaschnig's backjumping, graph based backjumping, conflict directed back jumping. Combing lookahead with lookback, learning.

Module 7: Model based systems, model based diagnosis, truth maintenance systems, planning as CSP. Wrapping up.