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{\Large CS 541: Artificial Intelligence Planning}

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{\large Instructors: Yolanda Gil and Craig Knoblock}

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{\large Meeting Time and Location: TTH, 3:30-4:50pm, GFS 108}

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Planning has been an area of research in Artificial Intelligence for

over two decades. It is concerned with the synthesis of sequences of

actions (plans) that can be used by agents to achieve their desired

goals. Planning involves the representation of actions and world

models, reasoning about the effects of actions, and techniques for

efficiently searching the space of possible plans. Planning has been

used to automate a variety of tasks including robotic control,

process planning, information gathering, transportation planning,

experiment planning in molecular genetics, and spacecraft mission sequencing.

This will be an exciting and challenging course that will focus on the

basic foundations and techniques in planning and survey a wide variety

of planning systems. The class will be run as a lecture course with

lots of student participation. The topics covered in the course will

include:

\begin{tabbing}

xxxxx\= \kill

\>Action and Plan Representation\\

\>Generative Planning\\

\>Reactive Systems\\

\>Abstraction and Hierarchical Planning\\

\>Case-based Planning\\

\>Machine Learning in Planning\\

\>Extended Plan Representations\\

\>Real-World Planning Applications

\end{tabbing}

{\flushleft Prerequisites: CS561 -- Introduction to AI }

{\flushleft Grading: Grades will be based on homeworks, quizes, a course project,

class presentation, and class participation.}

{\flushleft Textbook: ``Readings in Planning'' by Allen, Hendler, and

Tate \cite{allen90}.}

{\flushleft Office Hours: immediately after class or by appointment,

contact Craig Knoblock at knoblock@isi.edu or Yolanda Gil at gil@isi.edu}

{\flushleft Student responsibilities in the class will consist of the following:}

\begin{enumerate}

\item Presentations and Class Participation[20\% of final grade]\\

Class presentations that provide a detailed analysis of one of the

articles listed below or other related papers. The presenter will

hand out a 2-3 page analysis of the papers describing: the principal

contributions of the paper, the principal weaknesses of the paper, and

suggested extensions to the work.

\item Homework assignments. [20\% of final grade]

\item Final exam and short quizes given in class. [30\% of final grade]

\item A course project. [30\% of final grade]\\

A project includes any of the following:

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\item Implementing an extension to an existing planning system to

enhance its capabilities.

\item Building a new planning system.

\item Writing a new domain for an existing planner.

\item Anything else that you can convince us would make an interesting

project.

\end{enumerate}

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{\large\bf Course Syllabus and Schedule}

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\item \underline{INTRODUCTION/MOTIVATION}, {\bf Aug 29 (Knoblock)}

\begin{itemize}

\item Real-World Planning Problems

\item Action and Plan Representation

\item Historical Overview (GPS, STRIPS, etc.) \cite[chapter 15]{cohen82}

\end{itemize}

\item \underline{PLANNING APPROACHES}

\begin{itemize}

\item Generative Planning

\begin{itemize}

\item MTC Planners

\begin{itemize}

\item NOAH (Sacerdoti) \cite[pages 162-170]{allen90}, {\bf Sept 3 (Knoblock)}

\item TWEAK (Chapman) \cite[pages 537-558]{allen90}, {\bf Sept 5 (Knoblock)}

% \item O-Plan (Currie and Tate) \cite[pages 361-368]{allen90}

\item SIPE (Wilkins) \cite[pages 319-335]{allen90}, {\bf Sept 10 (Gil)}

\end{itemize}

\item Causal-Link Planning, {\bf Sept 12 (Knoblock)}

\begin{itemize}

\item SNLP (McAllester and Rosenblitt) \cite{mcallester91}

\item UCPOP (Weld) \cite{weld94:pop}

\end{itemize}

\item Unified Framework, {\bf Sept 17 (Knoblock)}

\begin{itemize}

\item Planning as Refinement Search \cite{kambhampati95:joint-aij}

\end{itemize}

\end{itemize}

\item Case-based Planning, {\bf Sept 19 (Veloso)}

\begin{itemize}

\item Prodigy/Analogy \cite{veloso94:analogy}

\item CHEF (Hammond) \cite[pages 655-659]{allen90}

\end{itemize}

\item New Approaches, {\bf Sept 24 (Knoblock)}

\begin{itemize}

\item Planning by Graph Analysis \cite{blum95:ijcai}

\item Planning as Stochastic Search \cite{kautz96:aaai}

\end{itemize}

\item Hierarchical Task Network Planning, {\bf Sept 26 (Gil)}

\begin{itemize}

\item Nonlin \cite[pages 291-296]{allen90}

\item (Barrett and Weld)\cite{barrett94:aaai}

\end{itemize}

\item New Approaches, {\bf Oct 1 (Knoblock)}

\begin{itemize}

\item Approximate Planning \cite{ginsberg94:aips}

\item Planning as Constraint Satisfaction \cite{joslin96:aaai}

\end{itemize}

\item Reactive Systems, {\bf Oct 3 (Gil)}

\begin{itemize}

% \item (Kaebling) \cite[pages 713--728]{allen90}

\item Anytime Algorithms (Dean and Boddy) \cite{dean88:anytime}

\item PRS (Georgeff and Lansky) \cite[pages 729--734]{allen90}

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\item \underline{CONTROLLING SEARCH}

\begin{itemize}

\item Planning Complexity, {\bf Oct 8 (Gil)}

\begin{itemize}

\item Joslin and Roach \cite{joslin89}

\item Bylander \cite{bylander92:aips}

\end{itemize}

\item Abstraction and Hierarchical Planning, {\bf Oct 10 (Knoblock)}

\begin{itemize}

\item (Knoblock) \cite{knoblock91:search}

\item ALPINE \cite{knoblock94:aij}

\end{itemize}

\item Macros and Abstraction, {\bf Oct 15 (Gil)}

\begin{itemize}

\item Planning as Search \cite[pages 566--578]{allen90}

\end{itemize}

\item Skeletal Planning, {\bf Oct 17 (Gil)}

\begin{itemize}

\item Molgen \cite[pages 161-180]{friedland85}

\end{itemize}

\item Learning Control Rules, {\bf Oct 22 (Gil)}

\begin{itemize}

\item SOAR \cite{rosenbloom92}

\item PRODIGY \cite{minton87:ijcai,etzioni90:aaai}

\end{itemize}

\item Postponing Interactions {\bf Oct 24 (Gil)}

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\item Postponing Threats\cite{smith93:aaai}

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\item \underline{INTERACTING WITH THE ENVIRONMENT }

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\item Sensing and Incomplete Information, {\bf Oct 29 (Knoblock)}

\begin{itemize}

\item UWL \cite{etzioni92:incomplete}

\item (Owalski and Gini) \cite{olawsky90}

\end{itemize}

\item Planning and Execution, {\bf Oct 31 (Knoblock)}

\begin{itemize}

\item IPEM, \cite[pages 735--740]{allen90}

\item Sage \cite{knoblock95:ijcai}

\end{itemize}

\item Learning from the Environment, {\bf Nov 5 (Gil)}

\begin{itemize}

\item Reinforcement Learning \cite{sutton90}

\item Learning Action Models \cite{gil94}

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\item \underline{EXTENDING THE REPRESENTATION}

\begin{itemize}

\item Temporal Planning, {\bf Nov 7 (Gil)}

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\item DEVISER \cite[pages 297--318]{allen90}

% \item FORBIN \cite[pages 369--388]{allen90}

\item Zeno \cite{penberthy94:aaai}

\end{itemize}

\item Probabilistic Planning, {\bf Nov 12 (Knoblock)}

\begin{itemize}

\item Buridan \cite{kushmerick94:aaai}

\end{itemize}

\item Decision Theory, {\bf Nov 14 (Knoblock)}

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\item Feldman and Sproull \cite[pages 207--224]{allen90}

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\item \underline{PLANNING APPLICATIONS}

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\item Planning in the Physical World, {\bf Nov 19 (Gil)}

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\item Robotics \cite{simmons94}

\item Process Planning \cite{nau95:ijcai}

\end{itemize}

\item Planning for Software Agents, {\bf Nov 21 (Gil)}

\begin{itemize}

\item Softbots \cite{etzioni94:softbots}

\item Information Gathering \cite{knoblock95:ijcai}

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\item Project Presentations, {\bf Nov 26, Dec 3, Dec 5}

\item Final Exam, {\bf Dec 10, 4:30-6:30pm}

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\bibliographystyle{named}

\bibliography{/home/knoblock/bib/defs,/home/knoblock/bib/abs,/home/knoblock/bib/planning,/home/knoblock/bib/knoblock,/home/knoblock/bib/databases,/home/knoblock/bib/learning,/home/knoblock/bib/books}

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