Computational Law

Introduction

Michael Genesereth
Computer Science Department
Stanford University
Computational Law

The Cop in the Backseat

Michael Genesereth
Computer Science Department
Stanford University
Computational Law

Law Without Lawyers

Michael Genesereth
Computer Science Department
Stanford University
Variety of Regulations

Laws

Business Rules

Personal Rules

Contracts
Size of Regulations

The Lord’s Prayer

Our Father, Who art in heaven, Hallowed be Thy name; Thy kingdom come; Thy will be done on earth as it is in heaven. Give us this day our daily bread; and forgive us our trespasses as we forgive those who trespass against us; and lead us not into temptation, but deliver us from evil.

Amen.

26,911 Words

The Gettysburg Address

Delivered by Abraham Lincoln
Nov 19, 1863

At the Dedication of the Memorial
Stones on the Battlefield

Fourscore and seven years ago our fathers brought forth on this continent a new nation, conceived in liberty, and dedicated to the proposition that all men are created equal.

Now we are engaged in a great civil war, testing whether that nation, or any nation so conceived and so dedicated, can long endure. We are met on a great battle-field of that war. We have come to dedicates a portion of that field as a final resting place for those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this. It is rather a distinct honor, we believe, to be standing here today.

Amen.

286 Words

A Declaration by the Representatives of the United States of America
In General Congress Assembled

We hold these truths to be self-evident, that all men are created equal, that they are endowed by their creator with certain unalienable rights, that among these are Life, Liberty, and the pursuit of Happiness.

We Apollo to the several states, to form a more perfect Union, establish Justice, insure domestic tranquility, provide for the common defense, promote the general welfare, and secure the blessings of liberty to ourselves and our posterity.

That we hereby resolve, that these deeds shall not be done in vain, that this government is not for the people, but by the people, shall not perish from the earth.

1322 Words

26,911 Words
Excerpts from my homeowner’s insurance policy:

Page 32: “Coverage includes… water damage…”

Page 112: “The coverage on page 32 does not apply to damage caused by flood water.”
Inconsistency

11.06.12
COLORADO BECOMES THE FIRST STATE TO LEGALIZE MARIJUANA

State

NORML.ORG

Federal

SMOKE THE VOTE

NO
Problems:

Variety of Regulations - multiple jurisdictions
Size of Regulations
Complexity of Regulations
Incompleteness and Inconsistency

Results:

Widespread inefficiency
Lack of compliance
Frequent disenchantment with the legal system
It is one of the greatest anomalies of modern times that the law, which exists as a public guide to conduct, has become such a recondite mystery that it is incomprehensible to the public and scarcely intelligible to its own votaries.

- Lee Loevinger 1949
Computational Law
Answer: Legal Technology
Good news - most online legal information (e.g. cases, statutes, analysis) online in the form of free-form text, in many cases, with key phrases and pagination.

Bad news - The *bad news* is that this does not provide adequate search and does not support automation.
Computational Law is that branch of legal informatics concerned with computable rules and regulations.
Portico (Symbium)

Portico

Use sliders to adjust view. Click and drag to move building. Click Larger, Smaller, Taller, Shorter to adjust size.

http://complaw.stanford.edu/chapters/portico.html
Building Codes

Electronic Commerce (transportation, shipping,…)

Privacy (HIPAA, COPPA, etc.)

Labor Law

Financial Management (stocks, retirement funds)

Civil Procedures
Self Help Guide to the California Courts

Resources and information to help you navigate your court case, including step-by-step guides for following procedures and help with understanding your options.

What would you like to do?

- Get help with papers I was served
  - Look up by form number and understand your options
  - Choose form ▼ Go

- Start a court case
  - Find your case type to get started
  - Choose case type ▼ Go

- Take action on my court case
  - Move your case forward, make a change to a decision, dismiss a case
  - Choose case type ▼ Go
  - Choose action ▼ Go

- Get information about a legal matter
  - Find out what kind of help you can get from the court for a variety of situations
  - Choose case type ▼ Go

- Look up a court case or citation
  - Find a traffic ticket or court case using the county court’s website
  - Choose County ▼ Go

- Get help from the court
  - Find in-person self-centers, court interpreters, disability access and more.
  - Choose resource ▼ Go
Computable Contracts

Insurance Contracts

Stock Trading Contracts

Real Estate Transactions

Information Access Contracts

Alimony and Child Support Contracts
DEPARTMENT OF COMPUTER SCIENCE
MSCS Program Sheet (2010-11)

Name: Charles Parnell Nault
Advisor: 
Student ID #: 
Email: cnault@stanford.edu
Proposed date for degree confirm: 
Date: 10/8/2010

GENERAL INSTRUCTIONS
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Required:
- Logic, Automata and Complexity ( CS 103)
- Probability ( CS 109, STATS 116, CME 106, or MS&E 220)
- Algorithmic Analysis ( CS 161)
- Computer Organization and Systems ( CS 107)
- Principles of Computer Systems ( CS 110)

TOTAL UNITS USED TO SATISFY FOUNDATIONS REQUIREMENT: 10
Note: This total may not exceed 10 units.

http://complaw.stanford.edu/chapters/program.html
Nineboard Tic Tac Toe

http://complaw.stanford.edu/chapters/nineboard.html
Technology
Databases and Knowledge Graphs
Regulations as Programs

Facts \rightarrow Regulation-Specific and Task-Specific Software \rightarrow Conclusions
Regulations as Data

- Regulations
- Regulation-Independent Software
- Facts
- Conclusions
One Representation, Multiple Uses

- Regulations
  - Facts
    - Compliance Checking
      - Conclusions
  - Facts
    - Compliance Planning
      - Conclusions
  - Facts
    - Legislative Analysis
      - Conclusions
Definitions of Concepts

Office mates are people who share an office.
officemate(X,Y) :- office(X,Z) ∧ office(Y,Z)

Definitions of Legality

Managers and subordinates may not be office mates.
illegal :- manages(X,Y) ∧ officemate(X,Y)

The new Legalese!
Office mates are people who share an office. Managers and subordinates may not be office mates.

John manages Ken.
John is in 22.
Ken is in 22.

Violation detected.
Office mates are people who share an office. Managers and subordinates may not be office mates.

Automated Reasoner

John manages Ken. John is in 22.

Ken not in 22.
All projects have managers and subordinates.
No manager may share an office with a subordinate.
All skunkworks personnel must be housed in a common room.

Inconsistency detected.

Automated Reasoner

Inconsistency detected.
Open Texture
“Law is not a matter of simply applying rules to facts via Modus Ponens.”

- Edwina Rissland

Many legal decisions are made through case-based / analogical reasoning, bypassing explicit reasoning about laws and statutes.

While there is research on analogical reasoning, there is no widely accepted standard for what constitutes a “correct” answer.
Enterprise Management
Government as Enterprise
Embedded Law
Embedded Law
The Cop in the Cockpit
What is that flower?

Can I pick it?

You are in Massachusetts
Picking wild orchids is prohibited in Massachusetts
[Chapter 266 of the General Laws, Section 116A, 1935]
Technology-Enabled Law
Enforceable vs. unenforceable regulations

Technology enhances enforceability
From blanket to conditional regulations
From human to automated enforcement

Speed Limit Examples Follow
Lane-Specific Speed Limits
Time-Specific Speed Limits

- Speed Limit 55
- Night 45
Vehicle-Specific Speed Limits?

- TRUCKS 40
- Corvettes 80
Ability-Based Speed Limits?

Age 20 - 60
Eyesight 20-20
BP 125/80
60
Montana-Specific Speed Limits!

- **Day** — *Reasonable & Prudent*
- **Truck** — 65
- **Night** — *All Vehicles* — 65
SCHOOL

SPEED LIMIT 25

6:49-7:15 AM
7:52-8:22 AM
8:37-9:07 AM
2:03-2:33 PM
3:04-3:34 PM
3:59-4:29 PM

SCHOOL DAYS ONLY
Automated Enforcement?
Automatic Reporting and Billing

- Speed
- DMV bill
- Insurance bill
Issues

Desirability
  Safety
  Efficiency

Concerns
  Equity - discrimination on the basis of age
  Privacy vs automatic DMV reporting

Feasibility
  “No way, no how!”
  “It’ll never happen.”
Conclusion
Power to the People!

Legal Empowerment Through Information Technology

Law Without Lawyers!!
Evolution of Legal Technologies
Legal Empowerment through Information Technology
This course
Schedule

Apr
1  Introduction
8  Modeling the World
15 View Definitions and Legality of Situations
22 Action Definitions and Legality of Behavior
29 Complaw Applications (guest speakers)

May
6  Complaw Applications (guest speakers)
13 Computable Contracts (guest speakers)
20 Regulatory Implications (guest speakers)
27 Legal Informatics

Theory & Technology
Applications
Extensions & Implications
Sets

\{a, b, c\} \cup \{b, c, d\} = \{a, b, c, d\}

a \in \{a, b, c\}

\{a, b, c\} \subseteq \{a, b, c, d\}

Functions and Relations

father(bob) = art
likes(john, sally)

Comfort with use of simple mathematical notation
Numerical Score
   5% for Assignment 1
   10% for each of Assignments 2, 3, 4
   5% for each of Assignments 5, 6
   15% for class attendance / participation
   40% for term project / paper (details to follow)

Discretionary Extra Credit
   Added to score before determining Reported Grade

Reported Grade
   Based on numerical score (see above)
   *No* curve - independent of number of students
   Satisfactory = 70% and above
Computational Law
Spring 2020-2021

Lessons  Epilog  Worksheets  Corpus Legis  Piazza

Computational Law is an innovative approach to legal informatics concerned with the representation of regulations in computable form. From a practical perspective, Computational Law is important as the basis for computer systems capable of performing useful legal calculations, such as compliance checking, legal planning, and regulatory analysis. In this course, we look at the theory of Computational Law, we review relevant technology and applications, we discuss the prospects and problems of Computational Law, and we examine its philosophical and legal implications. Work in the course consists of reading, class discussion, and practical exercises. The course is cross-listed with Law 4019.

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Office Hours: Wed 3-4  Office Hours:

Comments and complaints to genesereth@stanford.edu.
Computational Law

Lessons

Color Code
- Black - Lectures
- Blue - Readings
- Green - Exercises
- Red - Assignments
- Grey - Comment

Lesson 1 - Computational Law (Genesereth)
- Lecture 1 - Introduction
- Example - Nine Board Tic Tac Toe
- Example - Gates
- Example - Portico
- Reading 1.1 - Computational Law
- Reading 1.2 - The British Nationality Act as a Logic Program
- Reading 1.3 - The Rule of Law as a Law of Rules
- Reading 1.4 - Computer Elected Governor of California
- Assignment 1.1 - Nine Board Tic Tac Toe
- Assignment 1.2 - Gates
- Assignment 1.3 - Portico
The following syllabus lists all of the materials of the course. Note that there are interactive exercises at the ends of the chapters in the course textbook. (Click on the exercise numbers to go to the exercise pages.) These exercises are an essential part of the course, and you will benefit from tackling them. Some are easier than others, but you should attempt them all. Do the exercises! Do The Exercises!! DO THE EXERCISES!!!

**Color Code**
- Black - Lecture Slides
- Blue - Readings
- Red - Assignments
- Grey - Comment

**Introduction (Week 1)**
- Lecture 1 - Introduction
- Lecture 2 - Datasets
- Chapter 1 - Introduction
- Chapter 2 - Datasets
- Programs With Common Sense
- Logic Programming
- Assignment 1.1 - Datasets in Sierra
- Assignment 1.2 - Game State
- Assignment 1.3 - Triples
- Project
Introduction to Logic Programming

Michael Genesereth, Stanford University
Vinay K. Chaudhri, Stanford University

“This is a book for the 21st century: presenting an elegant and innovative perspective on logic programming. Unlike other texts, it takes datasets as a fundamental notion, thereby bridging the gap between programming languages and knowledge representation languages; and it treats updates on an equal footing with datasets, leading to a sound and practical treatment of action and change.” – Bob Kowalski, Professor Emeritus, Imperial College London

“In a world where Deep Learning and Python are the talk of the day, this book is a remarkable development. It introduces the reader to the fundamentals of traditional Logic Programming and makes clear the benefits of using the technology to create runnable specifications for complex systems.” – Son Cao Tran, Professor in Computer Science, New Mexico State University

“Excellent introduction to the fundamentals of Logic Programming. The book is well-written and well-structured. Concepts are explained clearly and the gradually increasing complexity of exercises makes it so that one can understand easy notions quickly before moving on to more difficult ideas.” – George Younger, student, Stanford University

ABOUT SYNTHESIS

This volume is a printed version of a work that appears in the Synthesis Digital Library of Engineering and Computer Science. Synthesis books provide concise, original presentations of important research and development topics, published quickly, in digital and print formats.
Assignments
Reading 1.1 - Computational Law

Reading 1.2 - The British Nationality Act as a Logic Program

Reading 1.3 - Cabaret: rule interpretation in a hybrid architecture

Reading 1.4 - The Rule of Law as a Law of Rules

Reading 1.5 - Computer Elected Governor of California
Assignment - Portico

Portico

Use sliders to adjust view. Click and drag to move building. Click Larger, Smaller, Taller, Shorter to adjust size.

http://complaw.stanford.edu/chapters/portico.html
## DEPARTMENT OF COMPUTER SCIENCE
### MSCS Program Sheet (2010-11)

**Primary Specialization**

<table>
<thead>
<tr>
<th>Name: Charles Parnell Naut</th>
<th>Advisor:</th>
<th>Proposed date for degree conferred:</th>
<th>Date: 10/8/2010</th>
<th>HCP?</th>
<th>Coterm?</th>
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<tbody>
<tr>
<td>Student ID #:</td>
<td>Email:</td>
<td></td>
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</tr>
<tr>
<td></td>
<td><a href="mailto:cnaut@stanford.edu">cnaut@stanford.edu</a></td>
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<table>
<thead>
<tr>
<th>Equivalent elsewhere (course number/title/institution)</th>
<th>Approval</th>
<th>Grade</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logic, Automata and Complexity (CS 103)</td>
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<td>Principles of Computer Systems (CS 110)</td>
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Assignment - Nineboard Tic Tac Toe

http://complaw.stanford.edu/chapters/nineboard.html
Assignment - Teaming

Form a team and choose a name

Composition
  3 people each (2 or 4 okay with *good* reason)

Sample Names:
  Mighty Bourgeoisie
  Michael Genesereth
  Red Hot Chili Peppers
Legal Empowerment through Information Technology

CODEX
The Stanford Center for Legal Informatics

Legal Empowerment through Information Technology