Logic Programming
Semantic Worksheets

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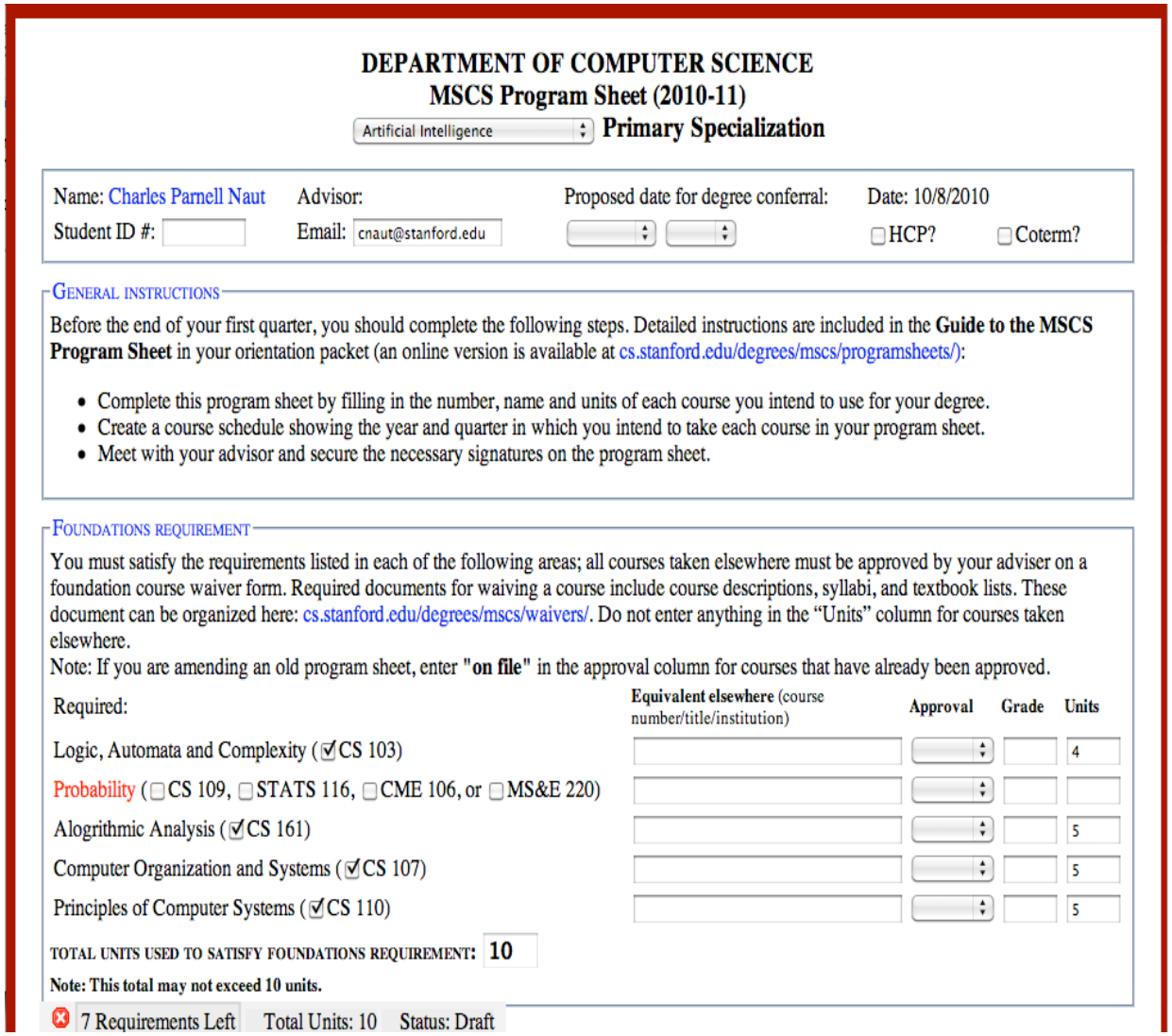
Simple Worksheets



DEPARTMENT OF COMPUTER SCIENCE
MSCS Program Sheet (2010-11)
Artificial Intelligence **Primary Specialization**

Name: Charles Parnell Naut Advisor: Proposed date for degree conferral: Date: 10/8/2010
Student ID #: Email: cnaut@stanford.edu ☐ HCP? ☐ Coterm?

GENERAL INSTRUCTIONS

Before the end of your first quarter, you should complete the following steps. Detailed instructions are included in the **Guide to the MSCS Program Sheet** in your orientation packet (an online version is available at cs.stanford.edu/degrees/mscs/programsheets/):

- Complete this program sheet by filling in the number, name and units of each course you intend to use for your degree.
- Create a course schedule showing the year and quarter in which you intend to take each course in your program sheet.
- Meet with your advisor and secure the necessary signatures on the program sheet.

FOUNDATIONS REQUIREMENT

You must satisfy the requirements listed in each of the following areas; all courses taken elsewhere must be approved by your adviser on a foundation course waiver form. Required documents for waiving a course include course descriptions, syllabi, and textbook lists. These document can be organized here: cs.stanford.edu/degrees/mscs/waivers/. Do not enter anything in the "Units" column for courses taken elsewhere.
Note: If you are amending an old program sheet, enter "**on file**" in the approval column for courses that have already been approved.

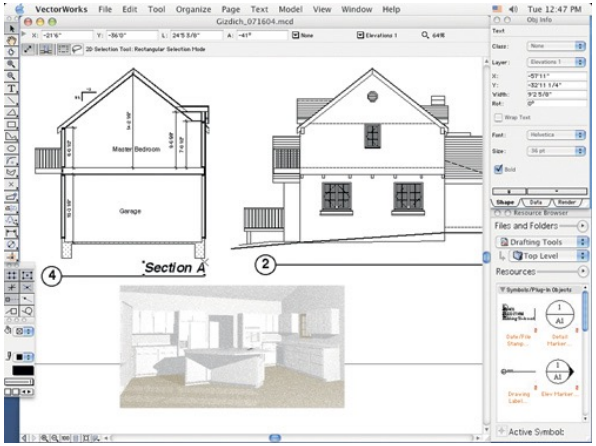
Required:	**Equivalent elsewhere** (course number/title/institution)	Approval	Grade	Units
Logic, Automata and Complexity (☑ CS 103)				4
Probability (☐ CS 109, ☐ STATS 116, ☐ CME 106, or ☐ MS&E 220)				
Alogrithmic Analysis (☑ CS 161)				5
Computer Organization and Systems (☑ CS 107)				5
Principles of Computer Systems (☑ CS 110)				5

TOTAL UNITS USED TO SATISFY FOUNDATIONS REQUIREMENT: 10

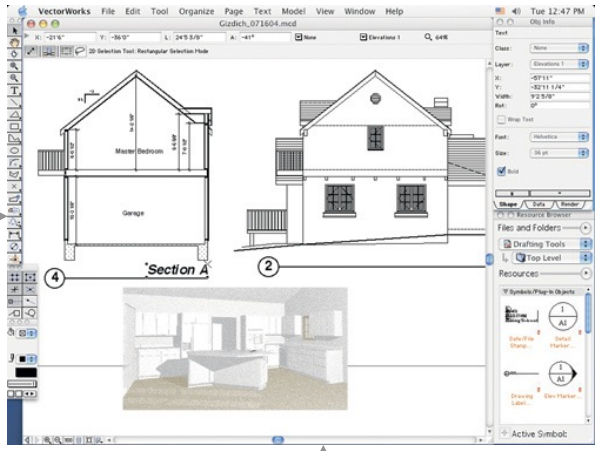
Note: This total may not exceed 10 units.

7 Requirements Left Total Units: 10 Status: Draft

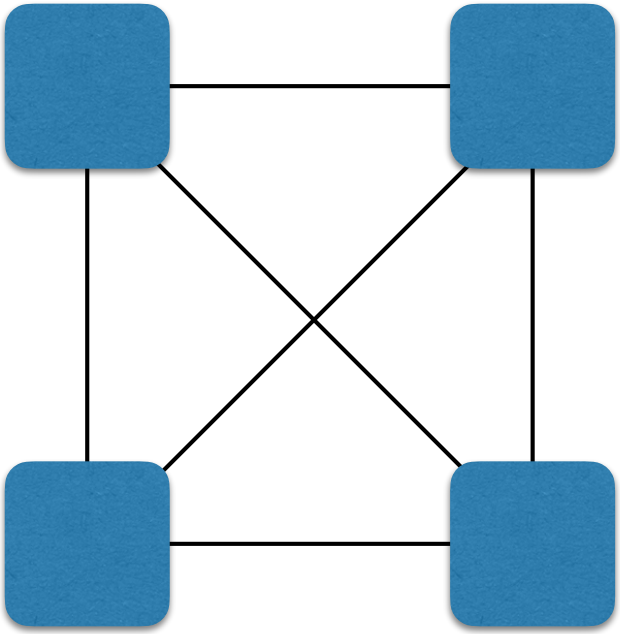
Heterogeneous Worksheets

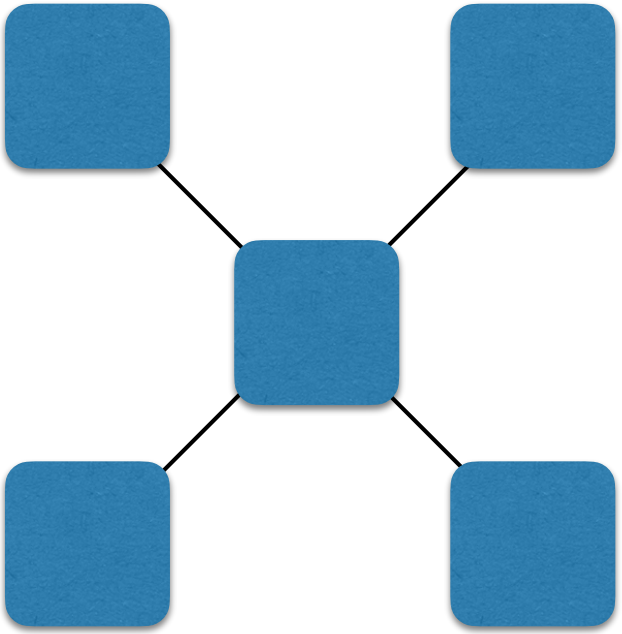


Collaborative Heterogeneous Worksheets



Architectural Alternatives





Syntactic vs Semantic Worksheets

Syntactic Worksheets

User gestures (e.g. clicking buttons) change *widget state*
Widget state (e.g. values of selectors) stored in lambda
Page state (e.g. colors of text) affects the display

Semantic Worksheets

User gestures translated to *application operations*

Application operations view and change *application state*
Application state (e.g. courses student has taken) stored
Page state defined as views of *application state*

Page state (e.g. colors of text) affects the display

Multiple Perspectives Example

Course Scheduling Perspectives

When

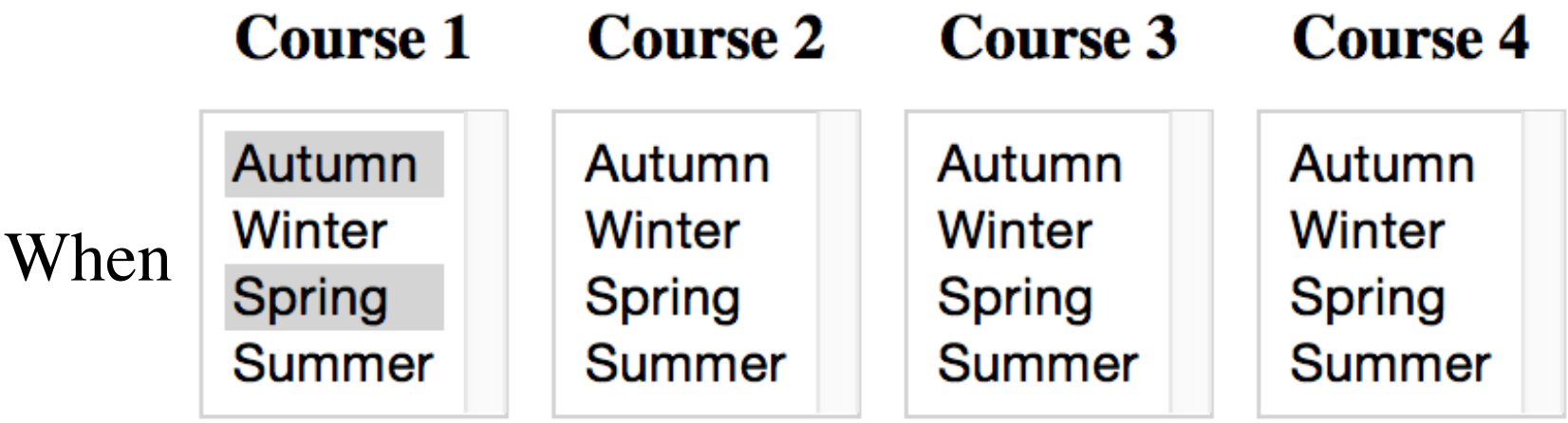
Course 1	Course 2	Course 3	Course 4
Autumn	Autumn	Autumn	Autumn
Winter	Winter	Winter	Winter
Spring	Spring	Spring	Spring
Summer	Summer	Summer	Summer

What

Autumn	Winter	Spring	Summer
Course 1	Course 1	Course 1	Course 1
Course 2	Course 2	Course 2	Course 2
Course 3	Course 3	Course 3	Course 3
Course 4	Course 4	Course 4	Course 4

http://logicprogramming.stanford.edu/examples/courses/index.html

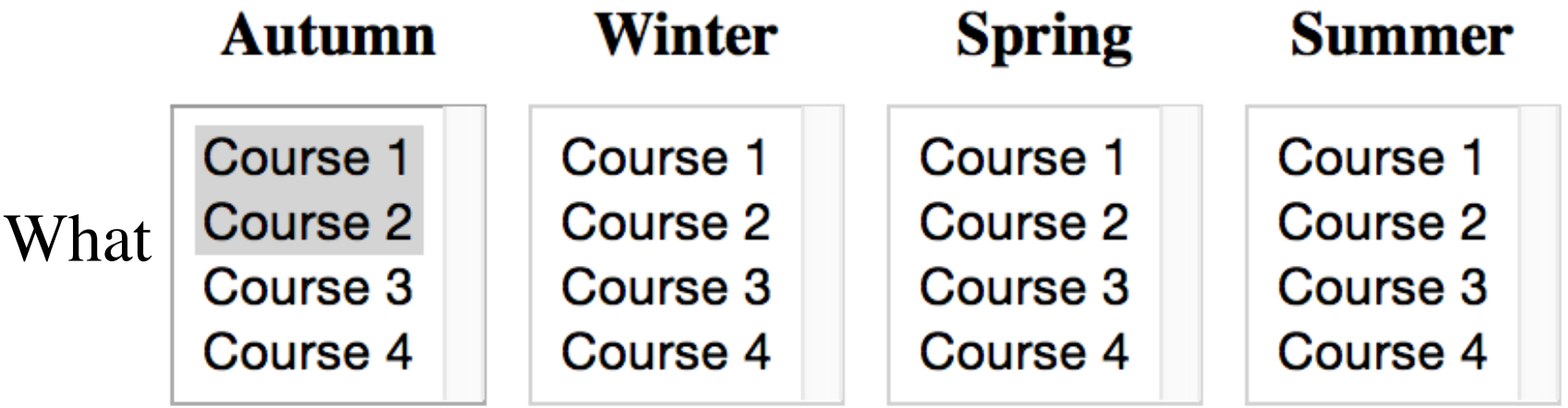
Schedule 1




```
click(when(C,Q)) :: style(when(C,Q),"background-color",white)
  ==> ~style(when(C,Q),"background-color",white) &
      style(when(C,Q),"background-color",grey)

click(when(C,Q)) :: style(when(C,Q),"background-color",grey)
  ==> ~style(when(C,Q),"background-color",grey) &
      style(when(C,Q),"background-color",white)
```

Schedule 2




```
click(what(Q,C)) :: style(what(Q,C),"background-color",grey)
  ==> ~style(what(Q,C),"background-color",grey) &
      style(what(Q,C),"background-color",white)

click(what(Q,C)) :: style(what(Q,C),"background-color",white)
  ==> ~style(what(Q,C),"background-color",white) &
      style(what(Q,C),"background-color",grey)
```

Syntactic Mapping Rules

```
click(when(C,Q)) :: style(when(C,Q),"background-color",white)
  ==> ~style(when(C,Q),"background-color",white) &
      style(when(C,Q),"background-color",grey)

click(when(C,Q)) :: style(when(C,Q),"background-color",grey)
  ==> ~style(when(C,Q),"background-color",grey) &
      style(when(C,Q),"background-color",white)
```

```
click(when(C,Q)) :: style(what(Q,C),"background-color",grey)
  ==> ~style(what(Q,C),"background-color",grey) &
      style(what(Q,C),"background-color",white)

click(when(C,Q)) :: style(what(Q,C),"background-color",white)
  ==> ~style(what(Q,C),"background-color",white) &
      style(what(Q,C),"background-color",grey)
```

+ 4 analogous rules for `what(Q,C)`

Semantic Version

Operations (similar to previous operation definitions)**:**

```
click(when(C,Q)) :: offered(C,Q) ==> ~offered(C,Q)
click(when(C,Q)) :: ~offered(C,Q) ==> offered(C,Q)

click(what(Q,C)) :: offered(C,Q) ==> ~offered(C,Q)
click(what(Q,C)) :: ~offered(C,Q) ==> offered(C,Q)
```

Lambda:

```
offered(course1,autumn)
offered(course2,autumn)
```

Views (in place of mapping rules)**:**

```
style(when(C,Q),"background-color",grey) :- offered(C,Q)
style(when(C,Q),"background-color",white) :- ~offered(C,Q)

style(what(Q,C),"background-color",grey) :- offered(C,Q)
style(what(Q,C),"background-color",white) :- ~offered(C,Q)
```

Schedule

Course	Room	Time
cs151		
cs157		
cs161		

Schedule	g100	g200	g300
morning			
afternoon			
evening			

Schedule Problem

Schedule

Course	Room	Time
cs151		
cs157		
cs161		

Schedule	g100	g200	g300
morning			
afternoon			
evening			

Schedule Problem

Collaborative Worksheets


Google
Sheets

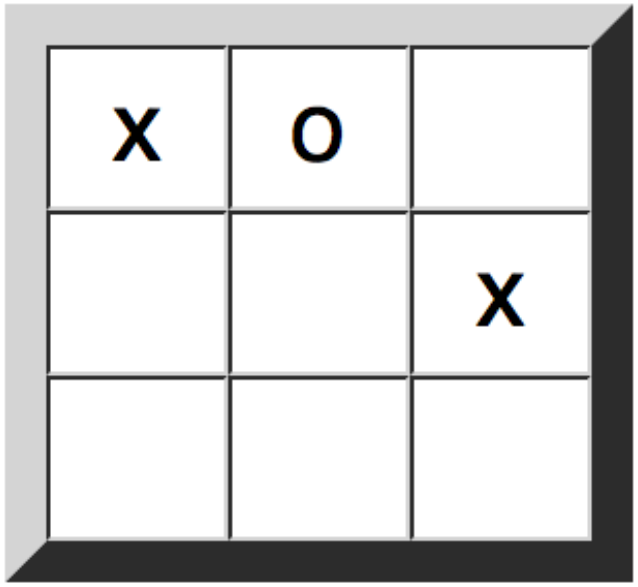
Skirmish

http://worksheets.stanford.edu/examples/skirmish/peertopeer.html?room=skirmish

Collaborative Skirmish

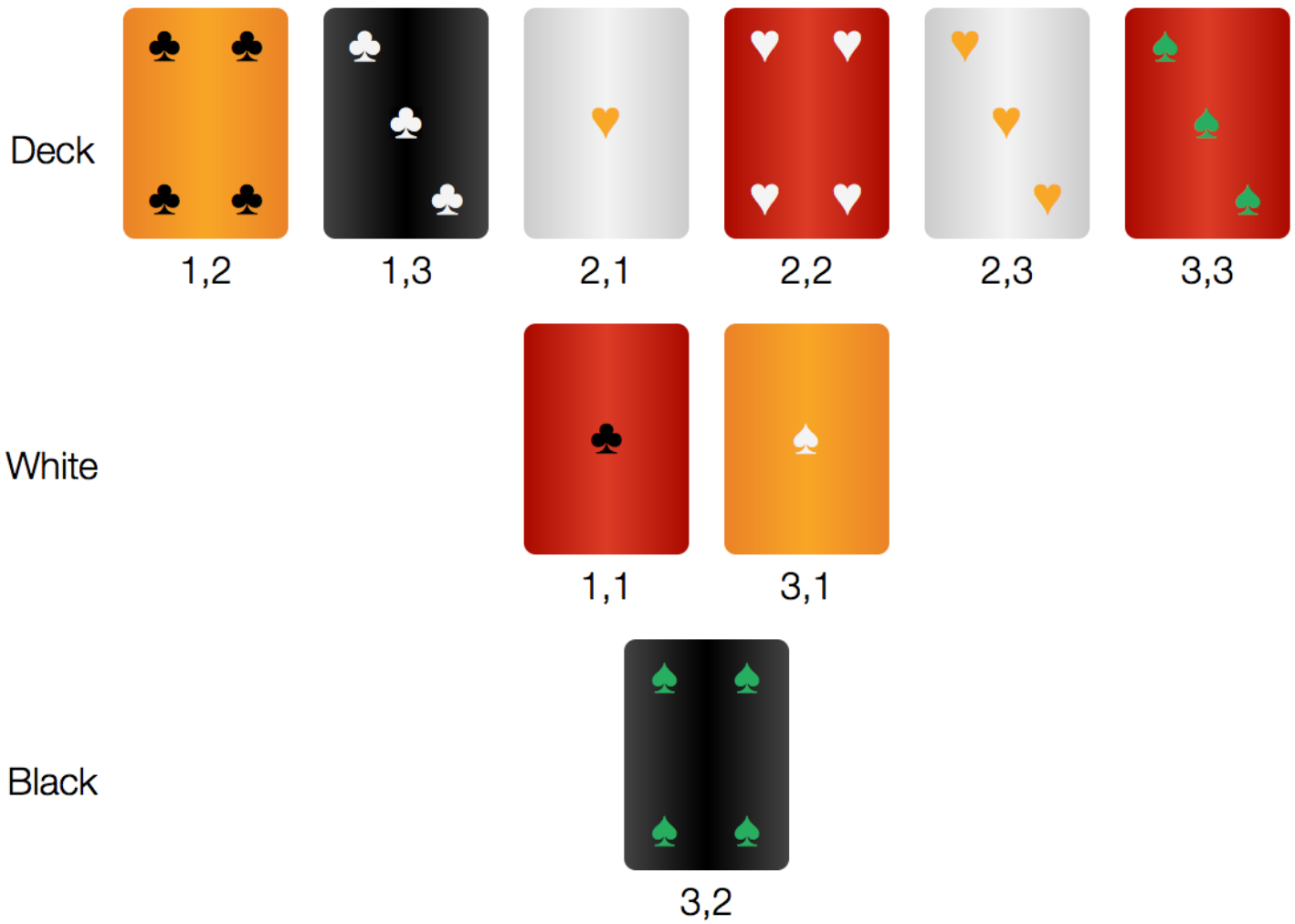
http://worksheets.stanford.edu/examples/skirmish/peertopeer.html?room=skirmish

Tic Tac Toe



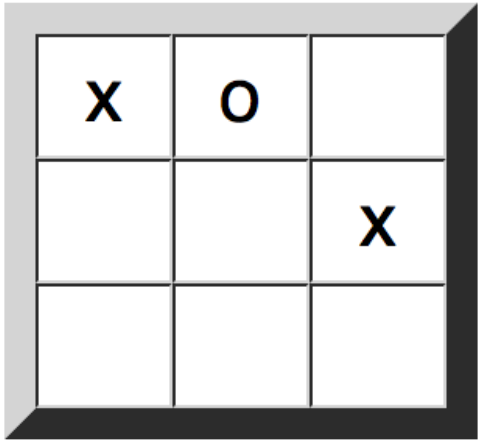
http://worksheets.stanford.edu/examples/tictactoe/peertopeer.html?room=cs151

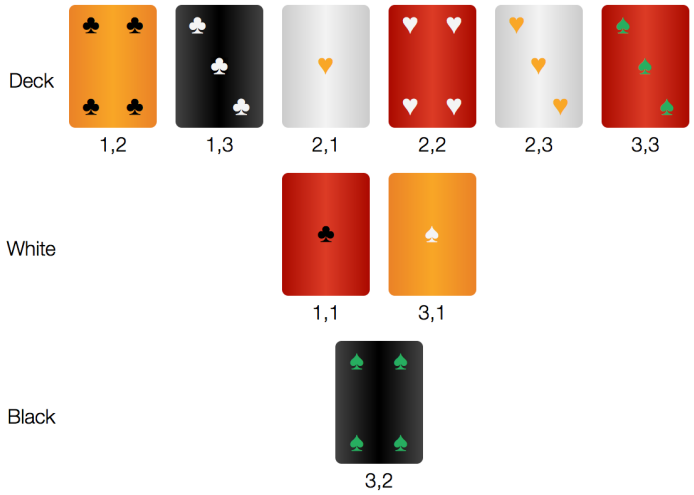
Trifecta



http://worksheets.stanford.edu/examples/trifecta/peertopeer.html?room=cs151

Tic Tac Toe - Trifecta





Remote Collaboration

Dataset Sharing

- Easy to implement and debug
- May move lots of data
- Allows all users to see and modify all data

Message Passing (Communication Channels)

- Difficult to implement and debug
- Moves minimal data
- Privacy and security assured

Backend Server (MySQL, PHP, etc.)

- Moderate effort to implement and debug
- Development and maintenance of backend infrastructure
- Moves minimal data
- Privacy and security assured

Collaboration Code

```
<script src='http://epilog.stanford.edu/javascript/
epilog.js'></script>

<script src='http://worksheets.stanford.edu/javascript/
worksheets.js'></script>

<script src='http://worksheets.stanford.edu/javascript/
warehouse.js'></script>
```

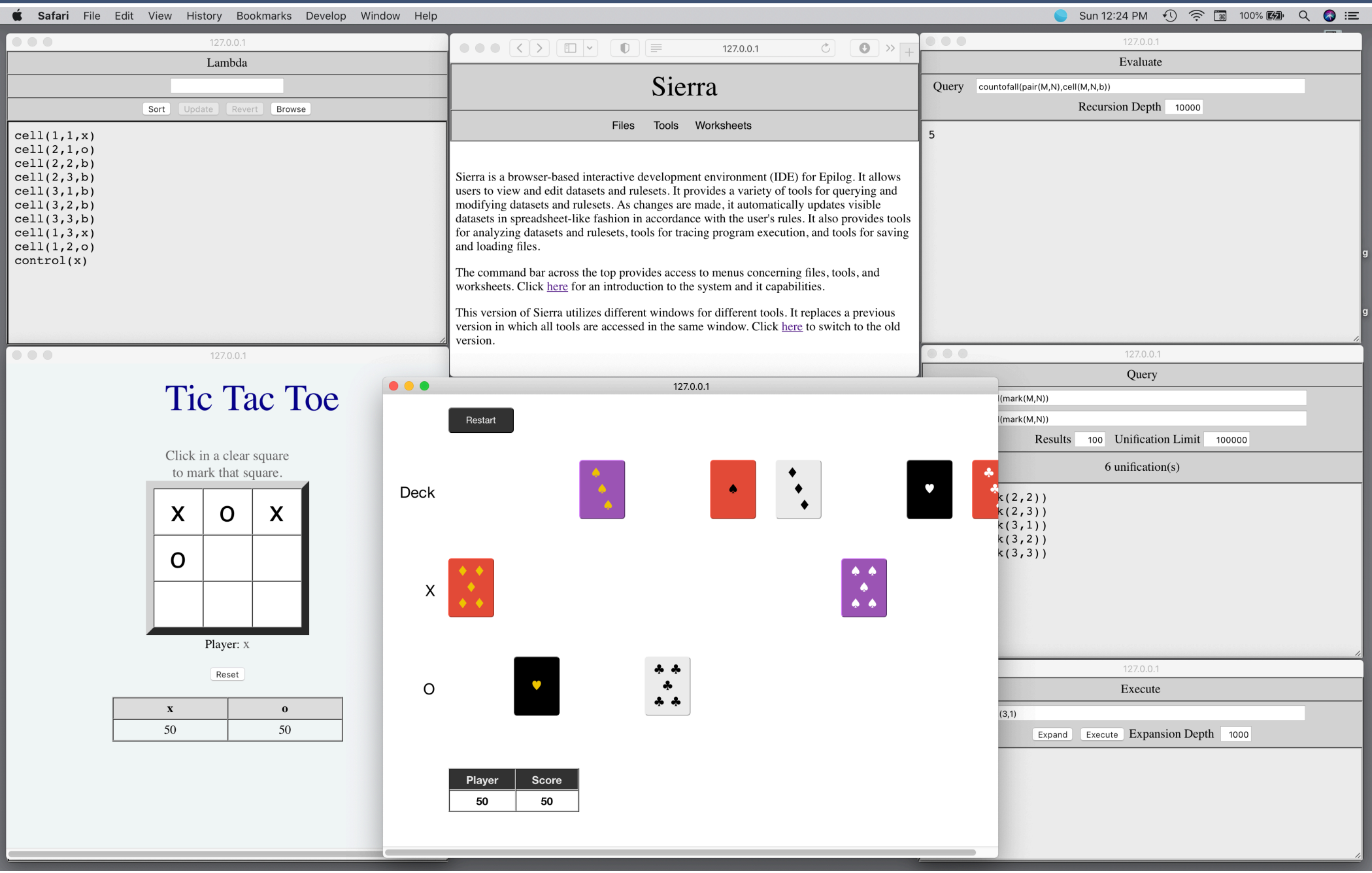
Collaboration Control

```
<textarea id='lambda' type='text/hrf'
          broadcast='true' reception='true'
          style='display:none'>

location(cell(a,1),piece(white,rook,1))
location(cell(b,1),piece(white,knight,1))
   ...
location(cell(g,8),piece(black,knight,2))
location(cell(h,8),piece(black,rook,2))
white(50)
black(50)
control(white)
step(1)

</textarea>
```

Worksheet Editing



Editing Code

```
<script src='http://epilog.stanford.edu/javascript/
epilog.js'></script>

<script src='http://worksheets.stanford.edu/javascript/
worksheets.js'></script>

<script src='http://worksheets.stanford.edu/javascript/
debugger.js'></script>
```