Engaging Students through Projects

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History

* We revamped intro course sequence 5 years ago
* Included redesigning projects
* More visual
* More interactive
* More games
Example

* Letter Maker
Example

* Photo Manipulator
Polynomials

Example

Polynomial Tester

Enter polynomial coefficients - a: 2, b: 0, c: 10

Specified polynomial \((a \times x^2 + b \times x + c)\) in red, derivative in blue
Example

* Puzzle

```
J   U   M   B   L   E   P   Z   U   Z   L   E
```

But So Isolated

- Computers today talk to each other
- Programs don’t work in isolation
- How can we bring social in to programming?

⇒ Social programming process
⇒ Social programs
Initial effort:

- Two-player games
- State passes between players
- Solution must modify state legally (i.e., follow rules)
Automated and Rapid

* Students submit programs via “submit server”
* Unit tests assure legal solution
* Automatically submitted to “tournament server”
* Complete round-robin run every 10 minutes
* Leaderboards and complete game history displayed on web
* Students learn from results and resubmit as often as they like
### What it Looks Like

#### Tic Tac Toe leaderboard from tournament 2010-06-03 15:48:07
- [past tournaments]
- Show TAs

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<tr>
<th>Pos</th>
<th>TA</th>
<th>Entrant</th>
<th>Wins</th>
<th>Ties</th>
<th>Losses</th>
<th>Points</th>
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#### Tic Tac Toe Played between T3 and cx131005 in game #9312 on 2010-06-03 15:48:07

```
  X | O | O
  O | X | X
  O | X | O
```

- **Round** | **Player** | **Game State** |
- 1          | T3          | 0/ /          |
- 2          | T3          | 0/ /          |
- 3          | cx131005    | 0/ /          |
- 4          | T3          | 0/ /          |
- 5          | cx131005    | 0/ /          |
- 6          | T3          | 0/ /          |
- 7          | cx131005    | 0/ /          |
- 8          | T3          | 0/ /          |
- 9          | cx131005    | 0/ /          |
- 10         | T3          | 0/ /          |

**Tie**
How it Works

* Tournament server loads all solutions
* Runs round-robin tournament
* Treats all game state as a simple string
* Stores results in database

* Games designed by instructor
* Convert string state in/out of structured format
* Provide legal move analysis (Java)
* Provide web page to display game (php)

* Standard open source tools (Java, Apache, mysql, php)
* Under development and unfunded...
Gave to ~150 students this past Spring
Did not effect grade in any way
Anecdotally: positive or ignored
Some students LOVED it
Did survey after semester ended (36 responses)
Submissions After Receiving Full Points

- None - I didn't participate
- None - once I passed
- 1-2 times
- 3-5 times
- 6-10 times
- More than 10 times
Did Tournament Motivate You?

No motivation Super exciting
Expected Grade

- A
- B
- C
- D
- F

Scale: 0 to 20
Five Women’s Responses

* “I didn't like how we had to beat random to enter the first two tournaments.”
* “Was able to compare my code with others.”
* “The projects were so hard that the tournament was an added obstacle to finish the projects.”

* How much did tournament server motivate you?
  * 1,1,3,3,5
* How many times did you resubmit after full credit?
  * 0, 0, 1-2, 1-2, 6-10
Next Steps

- Robustify
- More games
- Non-competitive games
- Support human players
- More than 2 players (for simulations)
- Lower barrier to entry
  - Simpler game requirements
  - Simpler programming languages
Contact

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