A semi-automatic approach for project assignment in a capstone course

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Introduction

- Olin College of Engineering
  - Founded in 1997, first graduating class in 2006.
  - 300 students: ME, ECE, E.
Senior Consulting Program for Engineering

~15 industry-sponsored two-semester projects.

Teams of 4–6 students, faculty advisor.

Similar to Harvey Mudd clinic program.
Allocation goals

- Accomodate student interest.
- Match skills to projects.
- Avoid personal conflicts.
- Aim for parity across teams.
Our algorithm

1. Students fill out survey.
2. Computer generates candidate allocations.
3. Faculty evaluate allocations.
4. Mark and I refine and repeat.
Data

- Hard data:
  - Interests, conflicts.
  - Major, courses, GPA.
  - Skills (software, shop, etc.)

- Soft data:
  - Leadership.
  - Enthusiasm.
  - Past and current relationships.
Survey

- Absolute scale:
  - 5 : strong interest.
  - 3 : willing.
  - 1 : no interest.
- Not relative (first choice, second choice).
- Up to two anti-preferences.
Generating allocations

- Define a cost function.
- Search for low-cost allocations.
Cost function

- Putting a student on a “5” is free.
- A “4” costs 1 point; a “3” costs 5 points.
- A “2” costs 1000; a “1” costs 10000.
- Violating an anti-preference = 100 points.
- Under/overstaffing = badness 10000.
Automated search

- Two greedy algorithms: student- and project-centric.
- Enumerate all possible trades; accept improvements.
- Take desperate measures.
Distributed manual evaluation

- Generate ~20 candidates.
- Faculty advisors evaluate their teams, 5-point scale.
- Find an allocation with all 5’s and 4’s: you’re done.
- An allocation with any 1’s or 2’s is out.
- Add constraints and repeat.
Manual fine-tuning

- Program generates table of all 2-way trades.
- Faculty search for n-way trades.
Evaluation

- Process took fewer person-hours.
- Faculty satisfied with process and outcome.
- Students satisfied with outcome.
- Testing on previous years: as good or better.
Why not optimize?

- Bin packing is NP hard.
- Combination of hard and soft data.
- Users need a feel for the landscape.
Why not run a draft?

- Violates “pack the big rocks first.”
- Gets wedged in a local minimum.
- Fosters competitive mindset.
- Emphasizes “have” and “have not” projects.
- Raises expectations and then dashes them.
Advantages of semi-automation

- (Faculty) Efficient use of time.
- (Faculty/Students) Distributed responsibility.
- (Faculty/Students) Confidence in pseudo-optimality.
- (Program) Good matching, parity.
Limitations

- Off-line search (~ 1 hour).
- Programmer interface, no user interface.
- Ill-defined termination condition.
- Scaling?
Questions?

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