



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

Mark Chang and Allen Downey

Olin College of Engineering

Needham MA



Introduction



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



SCOPE



- 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 (\sim 1 hour).
- Programmer interface, no user interface.
- Ill-defined termination condition.
- Scaling?



Questions?

- `allen.downey@olin.edu`
- `mark.chang@olin.edu`