Towards Active Learning in Online Education

Ideas from the classroom and crowdsourcing complex tasks

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active learning

engaging students in ‘doing’
collaborative problem solving
• breakout modeling sessions
• collaboration on problem sets
• active sections
• extreme optimization

\[
\begin{bmatrix}
1 & c_B^T B^{-1} A - c^T \\
0 & B^{-1} A
\end{bmatrix}
\begin{bmatrix}
Z \\
x \\
x_s
\end{bmatrix}
= \begin{bmatrix}
c_B^T B^{-1} b \\
B^{-1} b
\end{bmatrix}
\]
1 The Objective Function and Solutions for LPs

Consider the following linear program:

\[
\begin{align*}
\text{maximize} & \quad c_1 x_1 + c_2 x_2 \\
\text{subject to} & \quad x_2 \geq 1 \\
& \quad x_1 + x_2 \geq 2
\end{align*}
\]

Exercise 1

Can you find an example of values for \(c_1\) and \(c_2\) such that the problem

1. has a single optimal solution?
2. has exactly two optimal solutions?
3. has an infinite number of optimal solutions.
4. becomes infeasible?

End Exercise 1

By completing the above exercises, you should now:

- understand the relationship between the objective function, constraints, feasibility, and the number of optimal solutions.
- be comfortable identifying coefficients that will change the number of optimal solutions.
active sections

80-90% section attendance
extreme optimization

real world scenario: large-scale problem that is non-trivial, yet (to-an-extent) solvable using techniques covered in the class
extreme optimization
collaborative problem solving in the online classroom?
collaborative problem solving in the online classroom?

**Potential Benefits**

- Improve student learning
- Higher student retention
- Learn teamwork skills

- `flipped classroom` online
- Large-scale collaboration
collaborative problem solving in the online classroom?

**Challenges**

- Students often asynchronous
- Students can vary greatly in skill and dedication

- How can a large number of students solve a problem together?
crowdsourcing complex tasks
travel planning

amazing cafes
cool artsy things
somewhere to read
...

[Map of San Francisco with icons and locations labeled 1 to 5]
human computation with global constraints

many small contributions
difficult to decompose
What I am looking for:
I am going to San Francisco for a conference and have a day to explore the city before the conference starts. I’d love to go to some amazing cafes, check out some cool artsy things, and also just to relax and read a little.

Specific requirements:
- have at least 2 cool artsy things activities.
- have at least 1 place to read activity.
- have at least 1 amazing coffee/cafe activity.
- spend at least 3 hours on fresh local foods.
**Going to San Francisco**

**Saturday, 11am to 10pm**

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- spend at least 3 hours on **fresh local food** activities

**Going to San Francisco Saturday, 11am to 10pm**

1. **arrive at Hyatt Regency** (11:00am)
2. **Cool cafe + People watching** (11:15am–11:45am)
3. **place to read** (11:55am–12:25pm)
4. **Ferry Plaza Farmers Market** (12:35pm–2:05pm)
5. **San Fran Museum of Modern Art** (2:20pm–4:20pm)
6. **Art at Grace Cathedral** (4:35pm–5:05pm)
7. **Stop at Philz Coffee** (5:25pm–6:10pm)
8. **balmy alley murals** (6:40pm–7:10pm)
9. **Local food at unique Localvore restaurant** (7:25pm–8:55pm)
10. **Westin St. Francis glass elevators** (9:15pm–9:45pm)
11. **arrive at Hyatt Regency** (9:55pm)
Our Brainstream

- #fresh local food restaurants  #cool artsy things
- #people watch  #amazing coffee/cafes
- #somewhere to read  #todo  #activity  #note

Add more things to the itinerary

- There is still 5 hours and 3 minutes left empty in the itinerary. The trip can go till 10:00pm.
  #todo  #time

- Add more 'amazing coffee/cafes' to the itinerary
  We need at least 2 amazing coffee/cafes activities. The current itinerary contains 1 amazing coffee/cafes activities. [...] #todo  #amazing coffee/cafes

- Add more 'cool artsy things' to the itinerary
  We need at least 2 cool artsy things activities. The current itinerary contains 1 cool artsy things activities. [...] #todo  #cool artsy things

Cool cafe + People watching
Check out this North Beach cafe for great coffee and even better people watching!
#activity  #people watch  #amazing coffee/cafes

Art at Grace Cathedral
See the triptych created by world famous artist Keith Haring, marvel at the murals and the beautiful stained glass [...] #activity  #cool artsy things

Starbucks for coffee
Get some coffee
#activity  #amazing coffee/cafes

Ferry Plaza Farmers Market
Fresh local food. The back walkway, which has views of the bay and the coming and going of the ferries, is also a great [...] #activity  #fresh local food restaurants  #people watch  #somewhere to read

Trip time: 5 hours and 57 minutes

Itinerary

- arrive at Hyatt Regency (11:00am)
- Cool cafe + People watching (11:05am–11:35am)
- place to read (11:45am–12:15pm)
- Ferry Plaza Farmers Market (12:25pm–1:55pm)
- balmy alley murals (2:05pm–2:35pm)
- Local food at unique Locavore restaurant (2:40pm–4:10pm)
- Westin St. Francis glass elevators (4:25pm–4:55pm)
- arrive at Hyatt Regency (5:00pm)
Our brainstream

#fresh local food restaurants  #cool artsy things
#people watch  #amazing coffee/cafes
#somewhere to read  #todo  #activity  #note

search or add an idea, or click on one below  Add

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Crowdware

(a) the crowd contributes opportunistically given the current solution context

(b) the system indirectly coordinates the problem solving effort
Groupware
[Ellis et al., CACM 1991]

Wikipedia
[Cosley et al., IUI ’07]
[Hoffman et al., CHI ’09]
showing TODO items

resolve constraints quicker
Crowdware for online education?

(a) Students contributes opportunistically given the current solution context

(b) the system indirectly coordinates the problem solving and learning effort
task platforms
thanks