Tournament Approach to Peer Review in a Quantitative Course

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Overview

• Brief Introduction
• Hands-on Activity
• Conclusions
• Q&A

Please keep all questions for the end to make sure we have time to get through the demonstration.
Introduction

Peer-review = students evaluate each other’s work
  • Peer-review is widely used in writing courses, but not quantitative.
  • Physics 405, Intermediate Electricity and Magnetism
    • ~50 students
    • Traditional: lecture, homework from book, graded by GSI
  • Tournament-based Online Peer Review System
Introduction: Tournament Algorithm

Round 1

Round 2
Introduction: Tournament System

This tournament is now finished, results are below.

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# Introduction: Compare Styles

**Traditional Peer Review**

- See work of 1-2 students
- Not anonymous
- Used for feedback on first draft

**Tournament Peer Review**

- See everyone’s work
- Anonymous
- Used to determine student’s grade
Introduction: Benefits

- “It allows for a greater variety of solutions to homework, namely the ones in the upper percentage of voting, which helps me to understand homeworks better”

- “Peer grading offers numerous advantages, and can itself help cement learning and reinforce concepts learned in class. Material commentary is also a net benefit, as "teaching" through comments helps one break concepts down and reinforces one's own learning.”

- “While somewhat flawed, the voting process still [g]ave me an incentive to make my solutions clear and explicit while thoroughly showing my work process. In doing so, I believe I learned more from them than if they were traditionally graded.”
Introduction: Drawbacks

• “If incorrect solutions are voted to the top and we use the top solutions to clear up our confusion on a topic then we could learn incorrect procedures.”

• “Also I know that one of the goals was for us to learn by looking at our peers work, but when my schedule is packed full of other assignments I don't have the time to actually look over someone else's, and a lot of my voting was done very arbitrarily.”

• “One of the big problems is that truly the majority of homework problems are submitted correctly (at least in this course). Thus, students gloss over each correct answer they see and pick the most aesthetically appealing submission. I shouldn't have to be giving my homework a makeover before I turn it in to get a good grade.”
Hands-On: Rank Assignments

Round 1

3 minutes
Hands-On: Rank Assignments

Round 1

Winners

Loseers
Hands-On: Rank Assignments

Round 1

Round 2

3 minutes
Hands-On: Rank Assignments

Round 1

Round 2
# Hands-On: Student Rankings

This tournament is now finished, results are below.

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Hands-On: Examples of Student Comments

1. Griffiths 1.12

(a) The height of the hill (in feet) is given by:

\[ h(x, y) = 10(2xy - 3x^2 - 4y^2 - 18x + 28y + 12) \]

To find the top of the hill, we need to find where \( \nabla h = 0 \) (i.e. the location of the function extrema)

\[ \nabla h = 10(2y - 6x - 18)\dot{x} + 10(2x - 8y + 28)\dot{y} = 0 \]

\[ \Rightarrow 2y - 6x - 18 = 0 \]
\[ \Rightarrow 2x - 8y + 28 = 0 \]

We can solve this system of equations by solving the second equation for \( x \) and substituting \( x \) into the first equation to obtain \( y \)

\[ \Rightarrow 2y - 24y + 84 - 18 = 0 \]
\[ \Rightarrow y = 3 \]

Substituting \( y \) back in to find \( x \) we obtain

\[ \Rightarrow x = -2 \]

Therefore the top of the hill is located at \( (x, y) = (-2, 3) \)

or equivalently 3 miles north and 2 miles west of South Hadley

“Gorgeous. You win.”
“Good work.”
“Awesome!”
Hands-On: Examples of Student Comments

“We Part A and B: Great Explanation where the root 2 came from and calculation great explanations”

“It would be easier to follow if you put your work under the corresponding part.”

Problem 1.12

\[ \begin{align*} h(x, y) &= 10(2xy - 3x^2 - 4y^2 - 18x + 28y + 12) \\ h_x &= 10(2y - 6x - 18) \\ h_x &= 10(2x - 8y + 28) \end{align*} \]

Solve system of equations:

\[ \begin{align*} 2y - 6x - 18 &= 0 \\ 2x - 8y + 28 &= 0 \end{align*} \]

Solution: \( x = -2, y = 3 \)

\( D(a, b) = f_{xx}(a, b)f_{yy}(a, b) - [f_{xy}(a, b)]^2 \)

\( h_{xx} = 10 \cdot -6 = -60 \)

\( h_{xy} = -80 \) and \( h_{yx} = h_{xx} = 20 \)

\( D(-2, 3) = -60 \cdot -80 - 20^2 = 4800 - 400 = 4400 \)

Since \( D(-2, 3) > 0 \), the point \((-2, 3)\) is a maximum.

The top of the hill is located 2 miles west and 3 miles north of South Hadley.
“Right method, but I'm pretty certain you mixed up the algebra in the first steps. The mistake happens when you take the partial with respect to y, you get d/dy -4y^2 = -16y, where it should be -8y.”
Conclusions: Future

• “Instructors should give guidelines, if not solutions, before voting.”

• “Putting in a grade system so the voters can give a grade. Sometimes I get two submissions that are both wrong, but I still have to vote for one which feels like a false up-vote. Also, sometimes (more often) I get two solutions that are both right, then most of the time it comes down to which one looks prettier. This means the best looking ones go to the top…”

• “making it mandatory to submit a comment about each homework problem and why it is either correct or incorrect.”

• “I think not all problems are worth doing peer-review tournament. Some homework problems are quite basic and straightforward.”
Thanks!

If this is something that you are interested in using in your own class, we’re happy to work with you!

Please contact Jared Tritz (jtritz@umich.edu) if you’re interested.
Survey Results

If you did this course over again, would you prefer this homework system over traditional GSI-graded homework?

- Yes: 16 (64%)
- No: 8 (32%)

Would you recommend we continue in this direction with peer-reviewed homework using this system?

- Yes: 18 (72%)
- No: 7 (28%)
Survey Results

How seriously did you take your submissions for the homework assignments?

- very seriously: 5 (20%)
- seriously: 14 (56%)
- somewhat seriously: 5 (20%)
- not seriously: 1 (4%)

How seriously did you take the voting?

- very seriously: 4 (16%)
- seriously: 7 (28%)
- somewhat seriously: 10 (40%)
- not seriously: 4 (16%)
Introduction

• Peer-review is widely used in English courses, but not science
  • Correct answer is correct
    • Better and worse ways of approaching a problem
  • Students work in groups
    • If you’re working with a group, you’re only looking at the work from a limited number of students resulting in limited growth

• Physics 405, Intermediate Electricity and Magnetism
• Tournament-based Online Peer Review System
Introduction: Tournament Model

Round 1

Round 2
Hands-on: Tournament-model Peer Review System

Why does the earth have seasons?
Hands-on: Tournament-model Peer Review System

https://ecoach2.lsa.umich.edu/coach14/tournament/2/vote/
or
http://tinyurl.com/lsff362

- **Submit so as to win!!!** There will be prizes!!!
- While you’re going through this, be thinking about...
  - What are some of the **benefits** of this system?
  - What are some of the **drawbacks** of this system?
  - What would you **change** about this system?
Hands-On: Student Rankings

https://ecoach.lsa.umich.edu/coach14/tournament/6/vote/
Introduction: Benefits

• “It allows for a greater variety of solutions to homework, namely the ones in the upper percentage of voting, which helps me to understand homeworks better”

• “While somewhat flawed, the voting process still [g]ave me an incentive to make my solutions clear and explicit while thoroughly showing my work process. In doing so, I believe I learned more from them than if they were traditionally graded.”

• “Peer grading offers numerous advantages, and can itself help cement learning and reinforce concepts learned in class. Material commentary is also a net benefit, as "teaching" through comments helps one break concepts down and reinforces one's own learning.”

• “This format of homework allowed people to really take pride in their work. Time and time again, I would find amazingly written solutions, creative techniques and beautifully presented work. That alone was huge for me, and I think it almost brought the class that much closer together in exploring the material we were studying.”
Introduction: Drawbacks

• “Allows me to get away with slacking off and not putting in a ton of effort and still get points for submission and voting.”

• “…the behavior of voting participants, which is not necessarily rational (people who vote "just to get the grade"). This distorts the points awarded which do affect the course grade over the semester.”

• “One of the big problems is that truly the majority of homework problems are submitted correctly (at least in this course). Thus, students gloss over each correct answer they see and pick the most aesthetically appealing submission. I shouldn't have to be giving my homework a makeover before I turn it in to get a good grade.”

• “If incorrect solutions are voted to the top and we use the top solutions to clear up our confusion on a topic then we could learn incorrect procedures.”

• “time consuming”