Tips and tricks learned, teaching math online

by Mark Ebden
with Danny Zhang

20 July 2021

“Lessons Learned” EdTech talk

Slides: mebden.com/tips

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- 2016–19, and Winter 2021 (ECE286)
- Department of Statistics, and FASE

Director of Datatrie, Inc.

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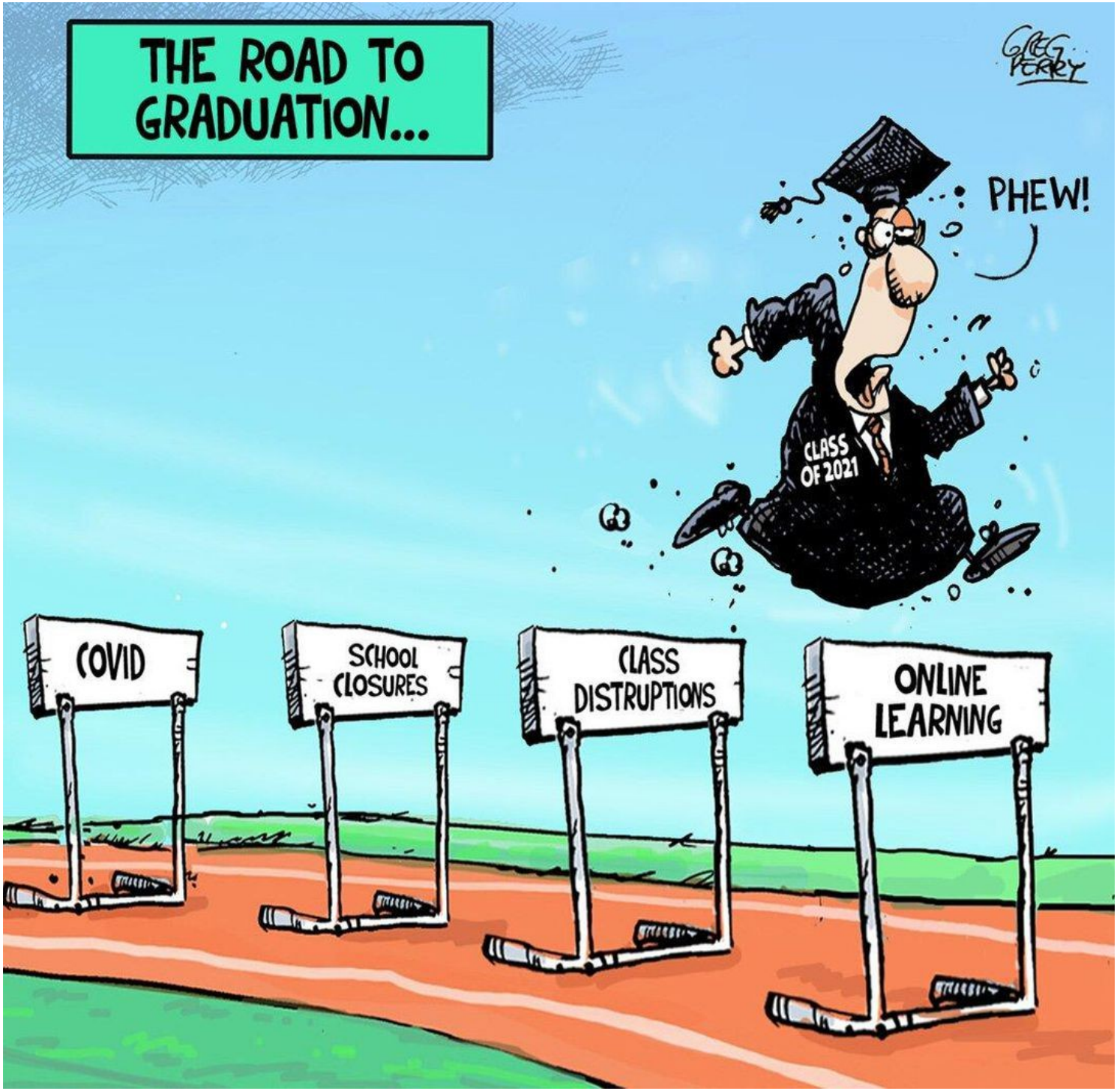


www.thestar.com/opinion/editorial_cartoon/2021/06/27/greg-perry-class-of-2021.html

Overview

Tips on...

1. Course setup
2. Class engagement
3. Tutorials (Danny)
4. Academic integrity

1(a) Listen to colleagues

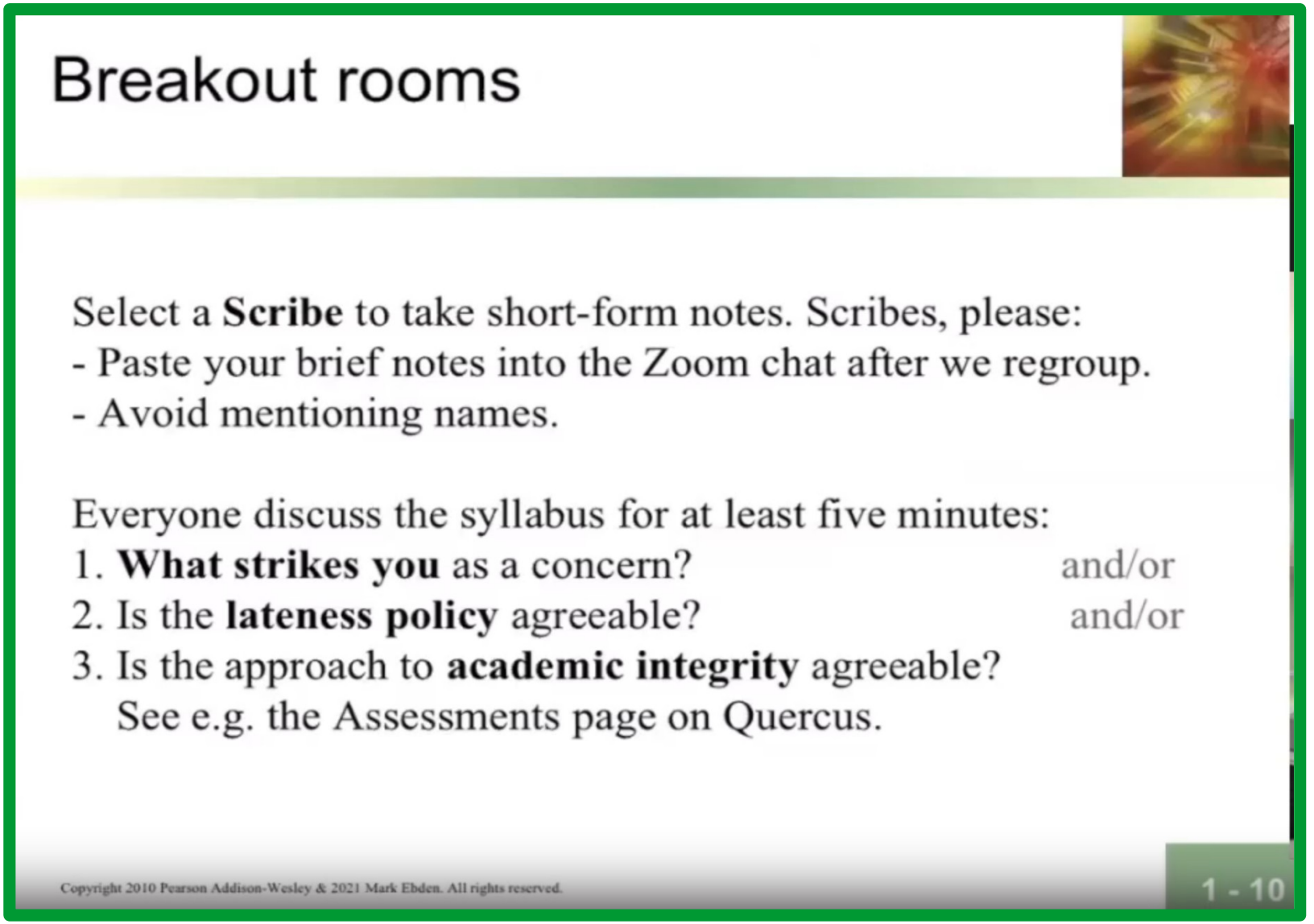
to avoid reinventing the wheel

- Education Technology Office
- ECE Lunch and Learn, December 2020
- Initiate and Facilitate (September 2020)
- Attend events particular to your field; e.g. the SSC Webinar on Teaching Statistics Online, June 2020
- In your introductory meetings with new TAs, ask what's worked well for them.

Click underlined text to visit a link. These slides are at mebden.com/tips

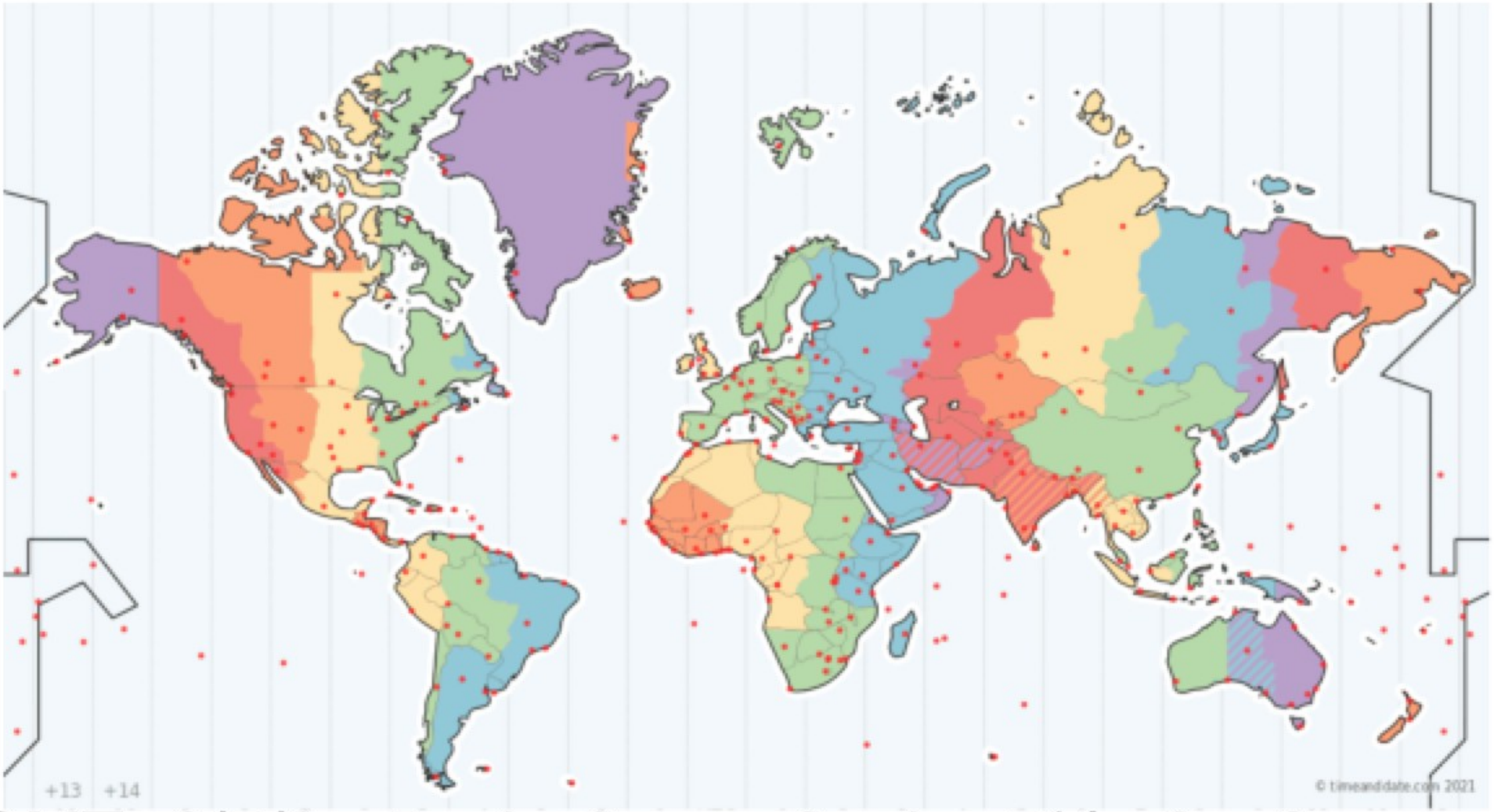
1(b) Spend your first lecture on the syllabus document

to get important pre-emptive feedback



1(c) Run a geography poll

to facilitate scheduling throughout the term

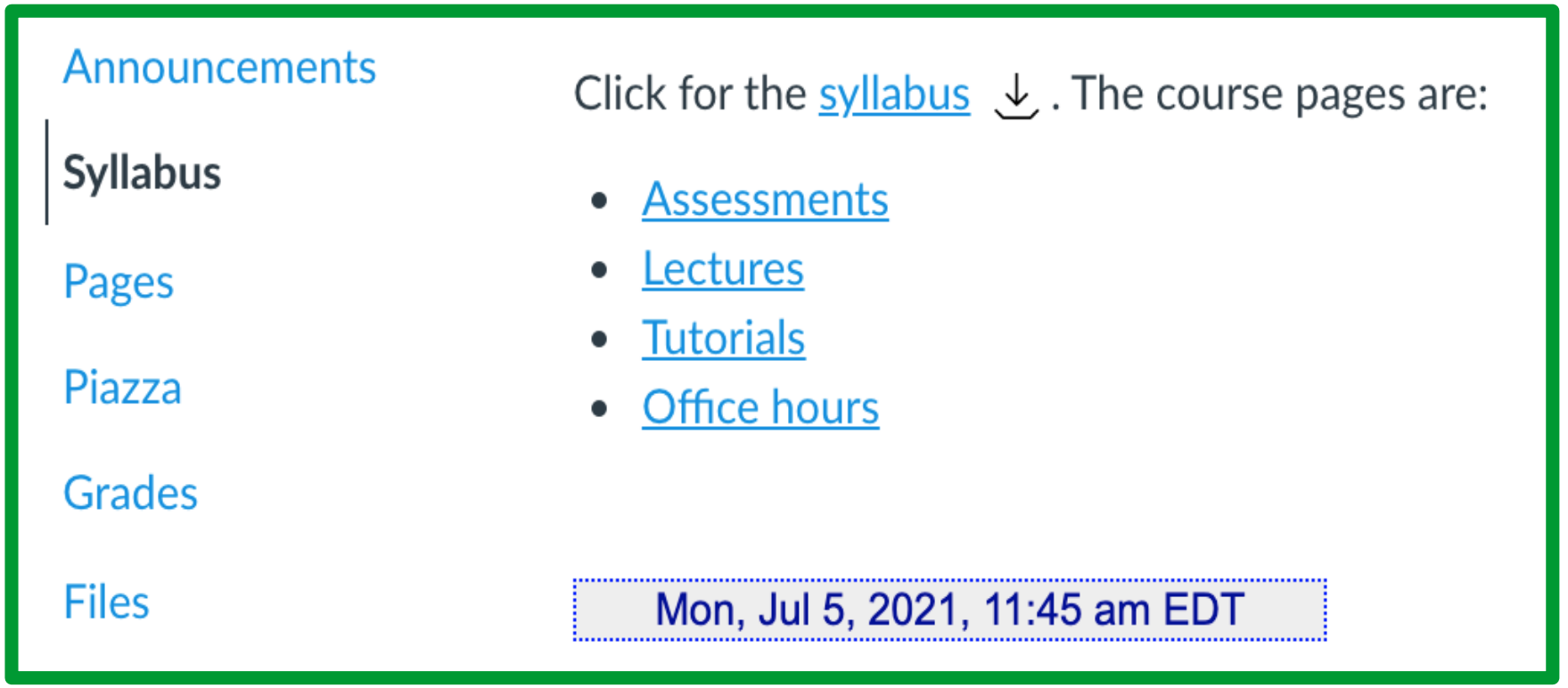


GMT	-6/7/8	-5	-4	-3	+3	+4	+5½	+8	+9
13	127	1	1	1	1	1	19	2	

www.timeanddate.com/time/map

1(d) Display Toronto's local time in Quercus

to help straddle daylight-savings transitions



(Click for instructions here)

1(e) Pay attention to Quercus structure

to ensure expectations are clear

Assessments

Introduction

For this online course, all assessments will be **open book:**

- For Test 1, Test 2, and the Final Exam, any information at q.utoronto.ca, or in printed material, or on the internet, as well as any computing resource such as a calculator or computing platform such as IDLE etc, is allowed provided that there is no *interaction* with other people directly or indirectly.
- For the Assignment, it's similar to the above except for the part about interaction. You'll be asked to identify the names of anyone with whom you interacted (details to appear in the assignment itself).

During the quiz, tests, and final exam, **questions & announcements** will be facilitated through the ordinary Zoom lecture link.

For a selection of **past assessments**, including quizzes, midterm tests, and final exams, click Files at left and then go to *4_previous_years*. You might notice that some of the questions from previous tests and exams closely resemble the homework assigned that same year. However, the style of the 2021 assessments should be different because of their open-book format. Assessments from previous years are included here not to guide your expectations, but to help those seeking additional, optional practice.

Administration's information on **petitions** (for time-zone accommodations, illness, crisis, etc) is here .

For some questions you might be encouraged to type your solutions where it's reasonable to do so, to help legibility. However, for any question, you may handwrite your answers and then scan them provided that the result is legible. Rotate images so that they appear upright.

Computer programming is not required. However, if you choose to write **code** for anything more than a trivial calculation, provide that code as part of showing your work. Adding a comment to each line of your code can help clarify to graders what the code is doing (this is especially helpful when something goes wrong and part marks are in question), that you understand the probability/statistics component, and that the work is your own. Cite sources whenever you adapt code. Don't be shy about using sentences outside of the code to help show your work. While any commonly used programming language will probably be acceptable, Python is encouraged; ask in advance if you are uncertain about language choice.

Added 8 April: You can use integral solvers but please notate where you do and which one you use. When looking up a quantile or probability using the textbook's appendix or an advanced calculator, please notate how you did this. Examples:

- "... using Table A.3"
- "... using the `integrate` command in WolframAlpha with the arguments `exp(-x^2), x=0...infinity`"
- "... using the `Binomial PD` function on a Casio FX-991EX with x=5, n=7, p=0.9"

TAs will be given general **grading guidelines** similar to those here , in addition to question-by-question rubrics. Students may wish to review the grading guidelines before each assessment as a quick reminder of how their work is evaluated.

"Am I ready for my online assessment?" is a document helping you **prepare** in *any* course; it's here .

Warmup Quiz

The quiz is due to occur from 7 to 7:15 pm on Monday 25 January, with 20 minutes for uploading your solutions. So, your work will be due by 7:35pm. Students with time-zone accommodations etc (page 3 of the syllabus) may take the alternative times of:

- Monday 25 January at 9 pm, or

1(e) Pay attention to Quercus structure

for navigability

Lectures

The Zoom link for lectures is https://utoronto.zoom.us/j/89872822035 with passcode 141592. The complete Zoom invitation, with phone numbers etc, can be reached by clicking the Calendar entries.

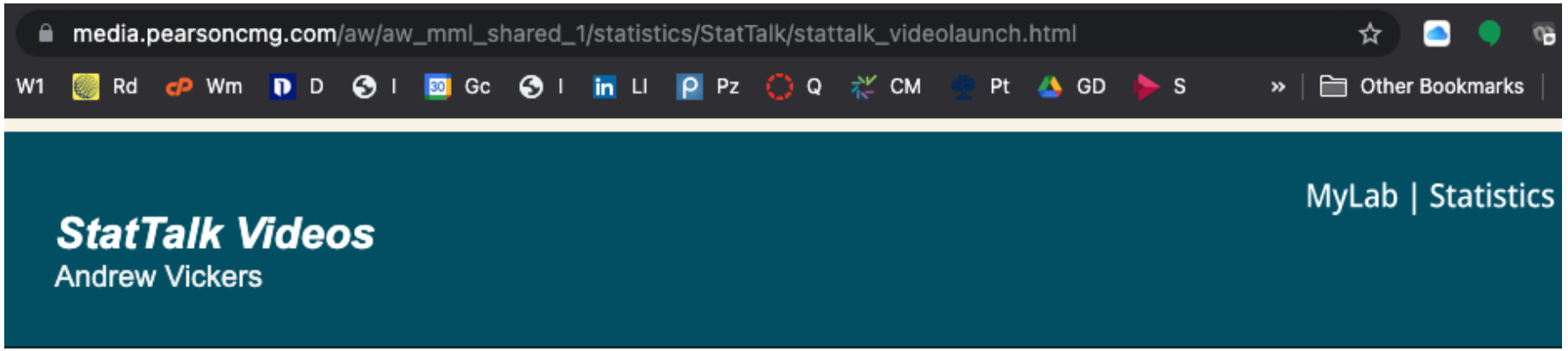
More about lectures is below. For example, you can click the "1A" in the first column of the table to view the 11 January lecture in Microsoft Stream. Lectures are of two types:

- Lectures ending with an 'A' are the synchronous, Monday lectures. Recordings tend to appear here on Monday afternoons.
- Lectures ending with 'B', 'C', etc are asynchronous. These tend to be uploaded by the Wednesday after each corresponding synchronous lecture.

Lecture	Date	Textbook sections	Notes
1A	Mon 11 Jan	None	Our first synchronous lecture. Beforehand, please read the draft syllabus, because today you'll be asked to interact regarding its content, among other things.
1B	Tue 12 Jan	1.1	Our first asynchronous lecture.
1C	Wed 13 Jan	1.2-1.4	An optional extra video, recommended by our textbook publisher, is here ; it compares means and medians, practically.
1D	Wed 13 Jan	1.5-1.7	Skipping the subsections *Stem-and-Leaf Plots* (pp. 21-22) and *What is Interaction?* (pp. 28-9). *End of Quiz coverage.*
2A	Mon 18 Jan	2.1-2.3	We reached slide 22 here .
2B	Tue 19 Jan	2.3	This video uses the rest of the above slide deck.

1(f) Ask each publisher for videos

to augment/replace your asynchronous material



1(g) Make lecture attendance optional, if you're new to online teaching

"I personally really liked the structure of the content (mostly a theoretical overview in short videos, with practice homework built in for an active learning component). I cannot express how helpful this was in **keeping me from burning out** in this course because the lectures have been piling up in all courses."

"I appreciate Professor Ebden's consistency with the textbook, as **it allowed students such as myself to take alternative approaches** to learning the content."

"He purposefully followed the textbook to allow students to learn from the textbook instead of going to lectures if they desire. This is what I did and I much preferred it. **I wish more professors did this**."

"Just reading the textbook was **not conducive to my learning** at all. I ended up not going to any lectures since I was behind on the textbook readings, as I know a few of my friends are too."

"While the textbook is good, verbal and human explanations are always very useful and **it was unfortunate we were almost teaching ourselves** from the textbook. Textbook reading also took much much longer than just going to lecture which made it easier to fall behind."

From the April 2021 course evaluations; bolding is my own.

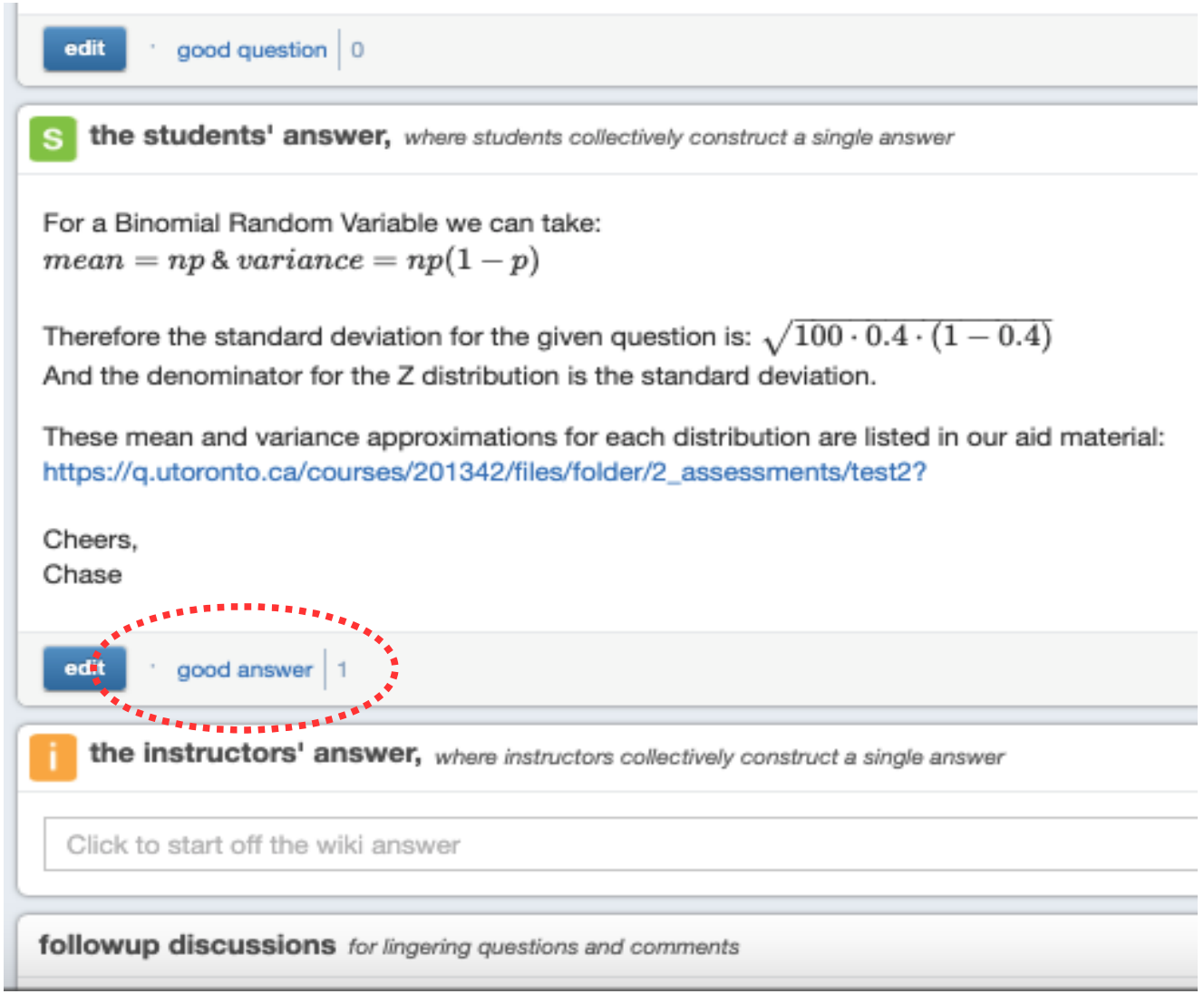
Overview

Tips on...

1. Course setup
2. **Class engagement**
3. Tutorials (Danny)
4. Academic integrity

2(a) Validate forum answers

to encourage contributors and readers alike



2(b) Monitor the forum's statistics

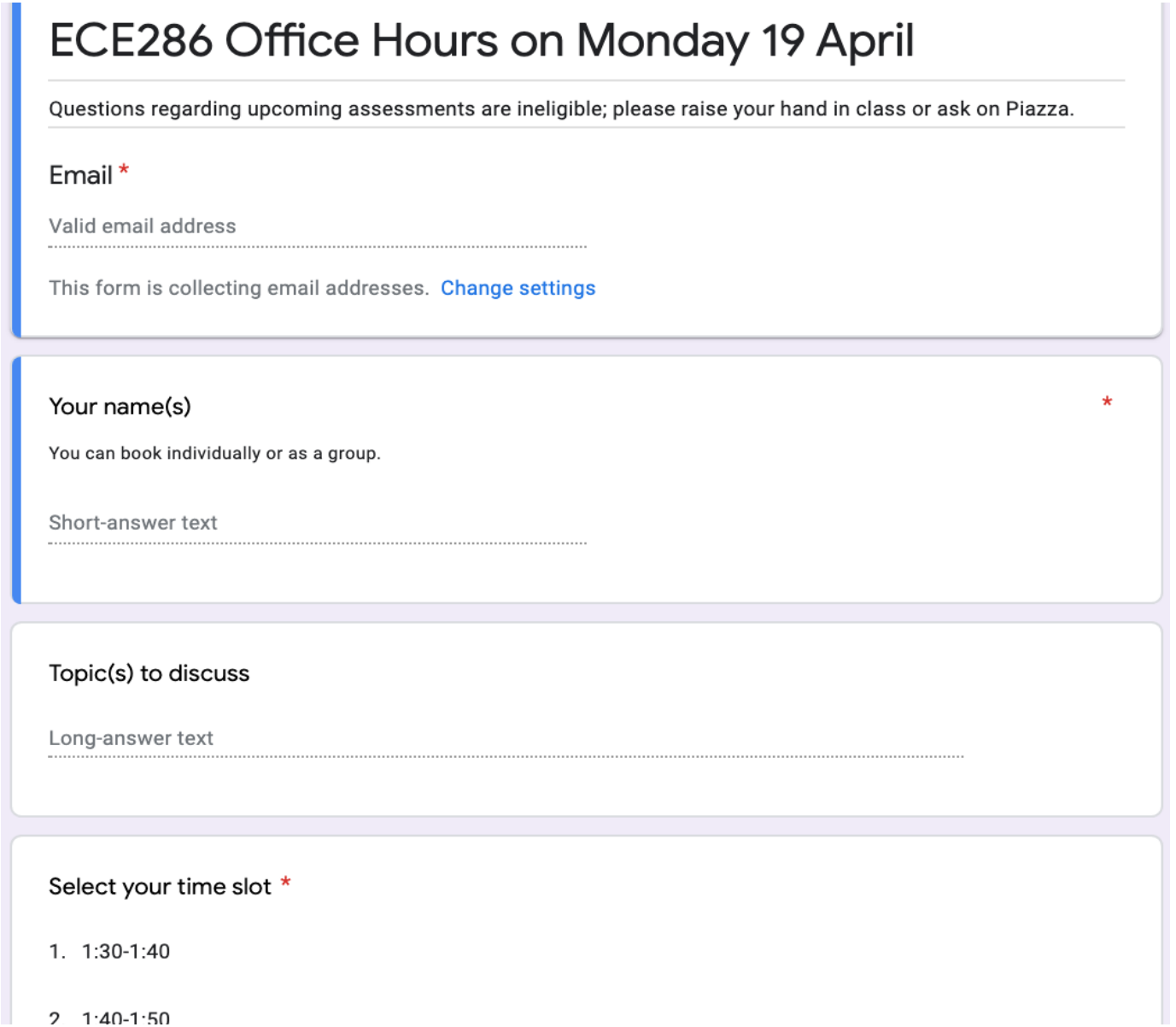
to encourage participants, and to help you discern who gets a reference letter

Top Student Answerers

Name, Email	number of answers
[redacted]mail.utoronto.ca	18
[redacted]toronto.ca	14
[redacted]@mail.utoronto.ca	13
[redacted]	8

2(c) Create an office-hour **booking form**

to save you time in large classes



ECE286 Office Hours on Monday 19 April

Questions regarding upcoming assessments are ineligible; please raise your hand in class or ask on Piazza.

Email *

Valid email address

This form is collecting email addresses. Change settings

Your name(s) *

You can book individually or as a group.

Short-answer text

Topic(s) to discuss

Long-answer text

Select your time slot *

1. 1:30-1:40

2. 1:40-1:50

[Choice Eliminator Lite (click here)]

2(d) Hold **drop-in** office hours, before each assessment

to engage students who don't book appointments

Details

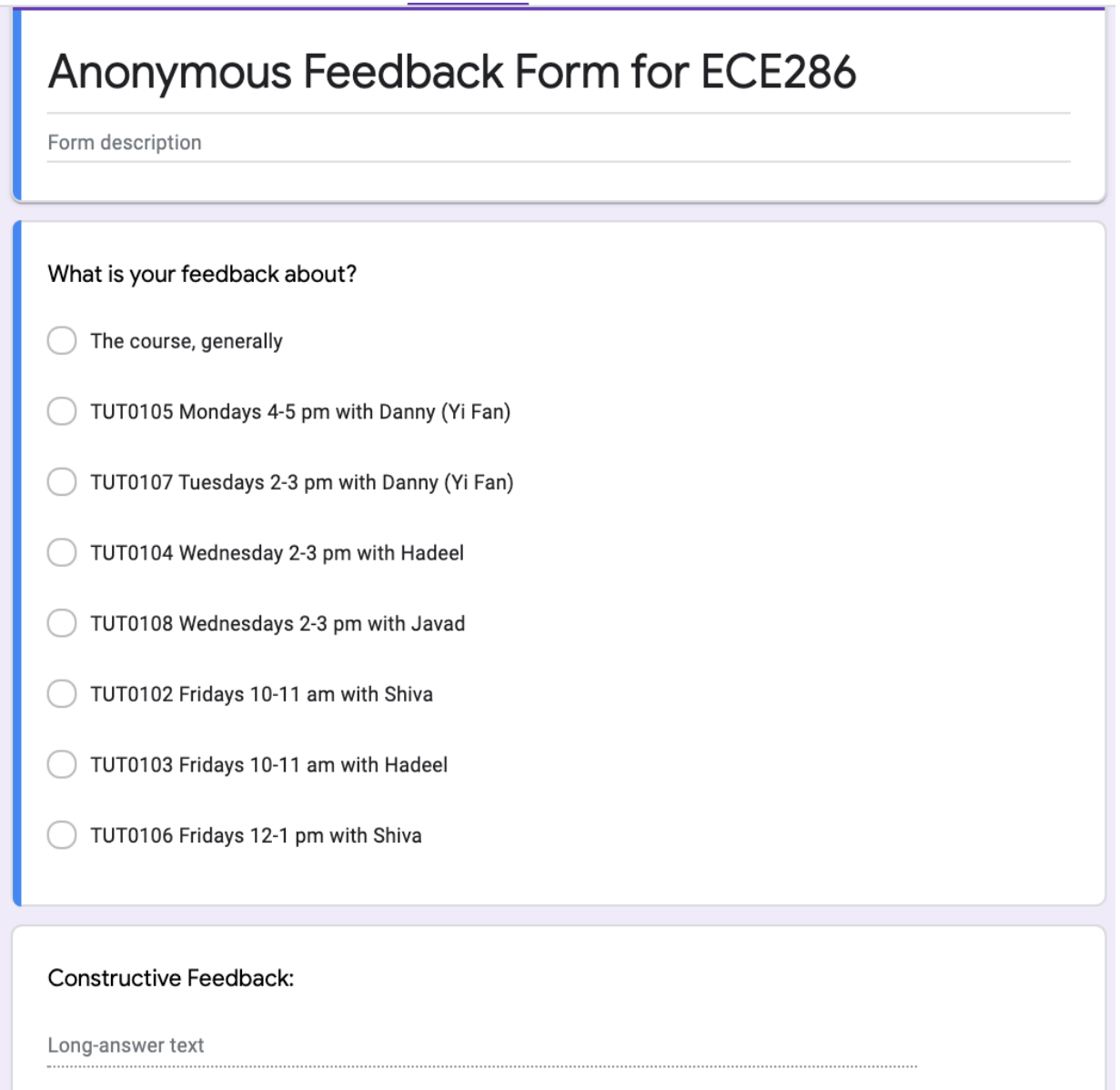
ECE286 Week 14 office hours - 23 April 2021

Published on 2021-04-23 by Mark Ebden Company 12 0

00:12: Welcome
01:11: Section 9.4 - meaning of a confidence interval
04:06: Exercise 10.71 (L11A, slide 7) - how to find a p-value for a chi-squared statistic
19:36: Section 11.6 - meaning of mu sub Y given x0, and Y-hat; the machine-learning context.
30:22: Exercise 8.40, page 260 - using a chi-squared table
32:15: Exericse 8.44 - using a t-distribution table

2(e) Create an **anonymous feedback form**

to allow more students to engage, and to act as a barometer



Anonymous Feedback Form for ECE286

Form description

What is your feedback about?

- The course, generally
- TUT0105 Mondays 4-5 pm with Danny (Yi Fan)
- TUT0107 Tuesdays 2-3 pm with Danny (Yi Fan)
- TUT0104 Wednesday 2-3 pm with Hadeel
- TUT0108 Wednesdays 2-3 pm with Javad
- TUT0102 Fridays 10-11 am with Shiva
- TUT0103 Fridays 10-11 am with Hadeel
- TUT0106 Fridays 12-1 pm with Shiva

Constructive Feedback:

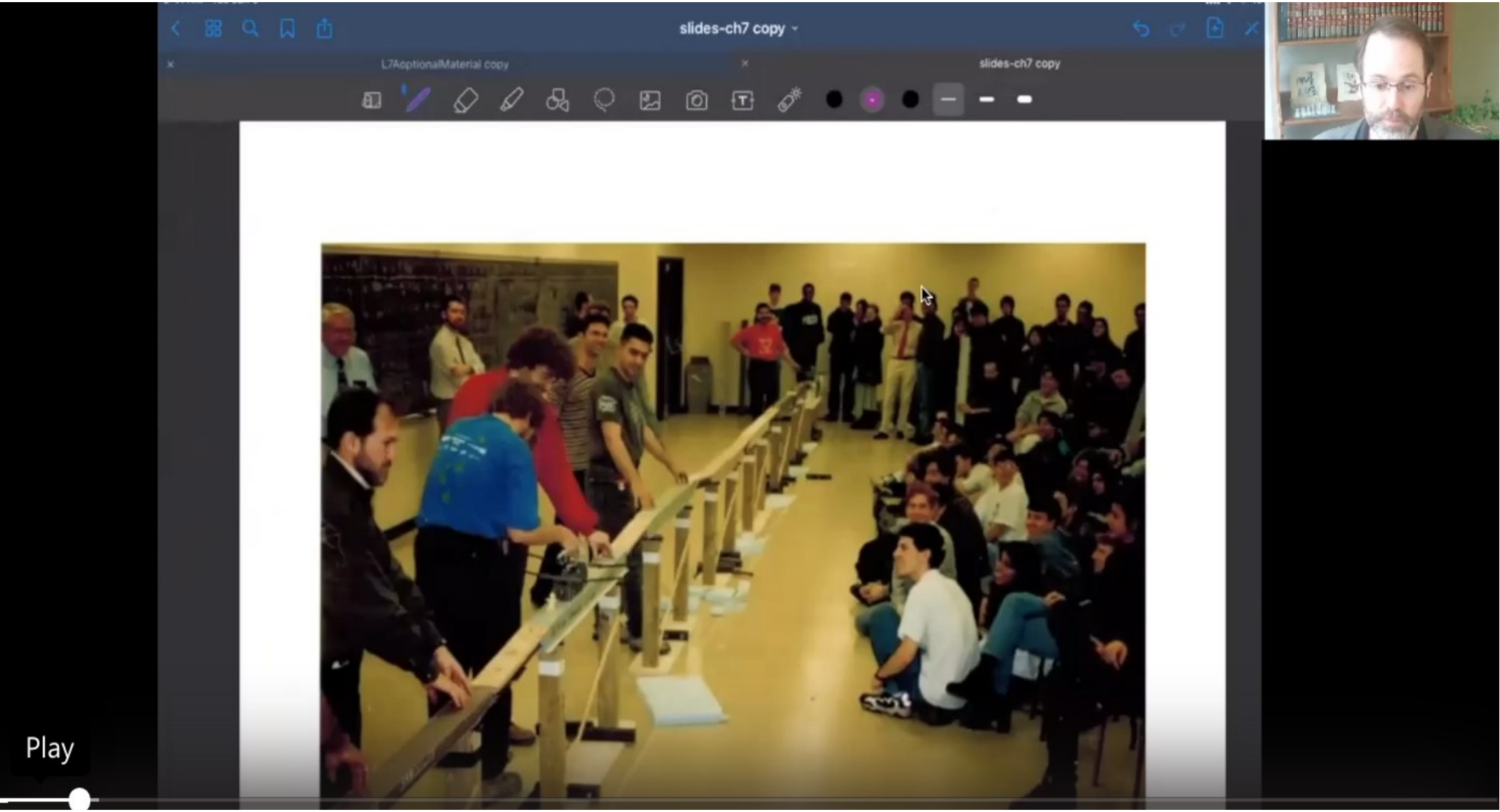
Long-answer text

2(f) Play music or fun videos on the hour
to encourage socializing and to set a mood

Week	Piece(s)	Artist(s)
1	*Tamacun, Diablo Rojo*	Rodrigo y Gabriela
2	*A Higher Place, Röyksopp's Night Out*	Röyksopp
3	*Garden Children, Hana Mash Hu Al Yaman, Ave Maria*	Cafe del Mar, A-WA, Paul Schwartz
4	**Video** (homemade) based on the first- and last movements of Beethoven's Symphony No. 6	Cleveland Symphony Orchestra
5	*Voyager, One More Time, Aerodynamic*	Daft Punk
6	*The Dyslexic...,* **videos** of squirrels, *Never An Easy Way...*	Morcheeba
7	**Video** of *Loving You, Cavatina, Danza Caracteristica / Brasileira*	Minnie Ripperton (vocalist), Norbert Kraft, Ricardo Cobo, Jason Vieaux
8	*Circuit Breaker, Alpha Male*	Röyksopp
9	*With Verdure Clad, Laudate Dominum, Exsultate Jubilate*	Emma Kirkby (vocalist)
10	*Allegro* from Dvorak's Cello Concerto Op. 104	Ofra Harnoy
11	*Cucurrucucu Paloma, Homework, Around the World*	Caetano Veloso, Daft Punk
12	First four pieces from the album “Love's Illusion” (medieval)	The Montpellier Codex
13	*Mood Time Swing, Wild Cat Blues, Juan Loco, P.P.A.*	Terry Lightfoot, Chris Barber/Monty Sunshine, Rodrigo y Gabriela

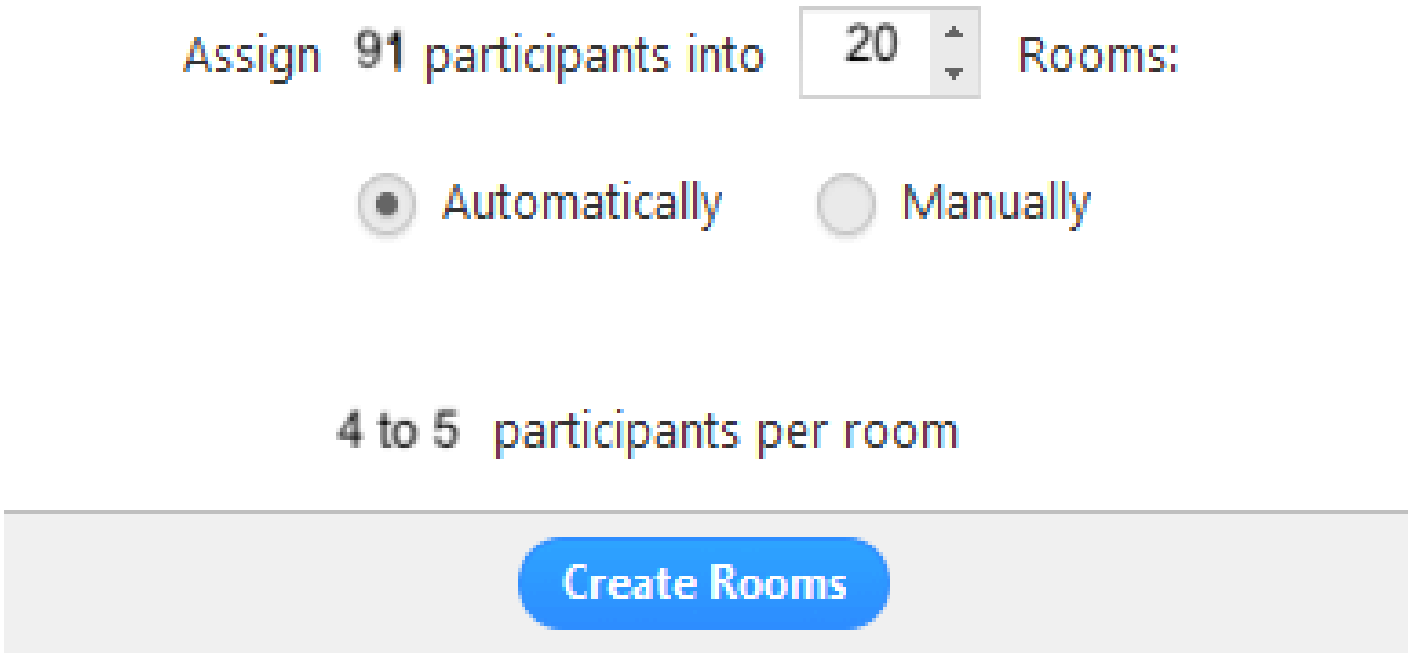
2(g) Promote career outcomes of your former classmates

to inspire students to "keep at it"



2(h) Hold a 3- or 4-minute breakout-room activity every 20 min., in groups of 4 to 5

to exploit a key function unavailable in classroom settings



Breakout room activity (4 min.)

A. What are your reactions to...

- 1(a)–(g): Course setup
- 2(a)–(h): Class engagement

B. What tips might you add, from your own experience of online teaching?

Remember: slides are at mebden.com/tips

Overview

Tips on...

1. Course setup
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3. **Tutorials (Danny)**
4. Academic integrity

3. Tutorial tips

Danny Zhang

- M.A.Sc Candidate
- Research area: Integrated circuits design for high-speed communications
- Tutorial TA for ECE286, Probability and Statistics

Challenges of Teaching Online

Challenges of Teaching Online

- Connecting with the students
  - Zoom meeting environments are less personal
  - Easy to feel disconnected with everyone compared to face-to-face
- Providing a comfortable environment for students to give feedback
  - Lecture setting gives priority to the speaker
  - As with classroom teaching, interrupting the speaker can be intimidating

What can we learn from the Internet Community?

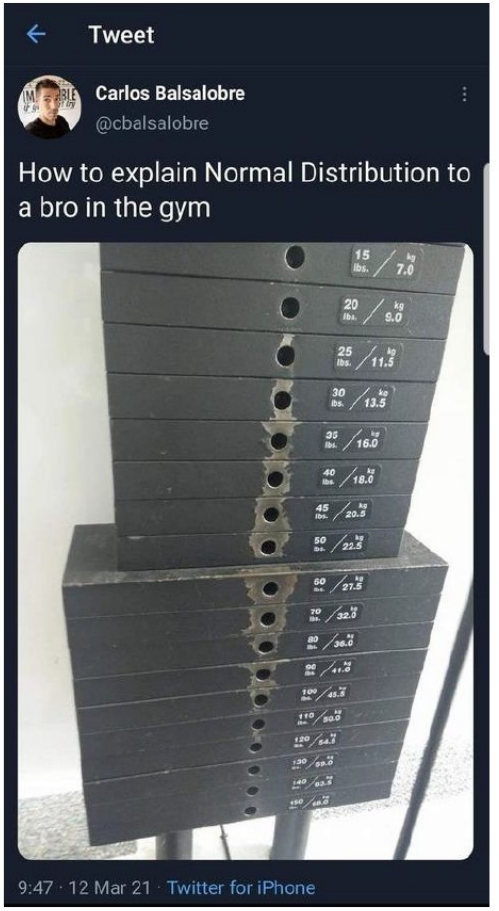
- Online streaming platforms, such as Twitch.tv, are very popular forms of modern entertainment
- An internet personality will live stream themselves partaking various activities, such as gaming, for an audience who actively interacts with them through the chat feature

What can we learn from the Internet Community?

- "Just Chatting" is a sub-category of streaming, where the hosts chat and interact with their audiences in real time
- This broad sub-category includes a variety of personal activities, such as casual conversations, online browsing, studying sessions, musical performances, etc…

“Twitch” stream tutorials

- Connect with the audience
  - Share my own interests and chat with students
  - Talk about school, careers, anime and games and share occasional memes
- Keeping things casual
  - Encourage students to use the chat to say anything – doesn’t have to be questions!
  - Respond to chat quickly, even if it’s just a random comment
- Do activities together
  - Streaming an episode of SpongeBob during break
  - Make tutorials feel personal and interactive



What can online-tutorials enable?

Course concept

Central Limit Theorem

If you have a population with mean μ and standard deviation σ and take sufficiently large random samples from the population *with replacement*, then the distribution of the sample means will be approximately **normally distributed**.

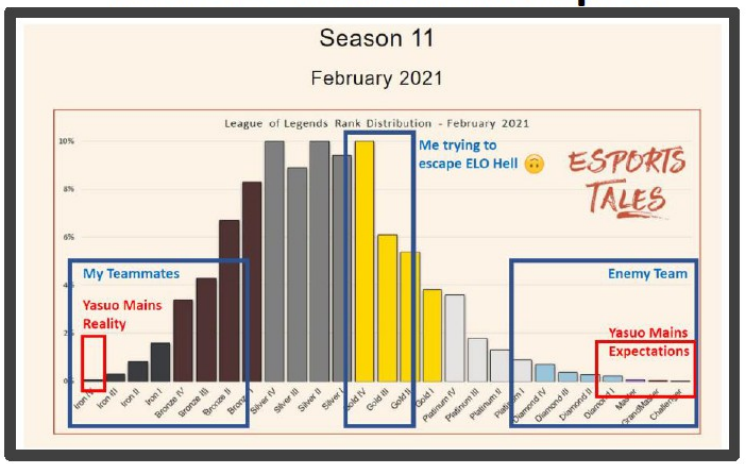
Theorem 8.2: **Central Limit Theorem:** If $\bar{X}$ is the mean of a random sample of size n taken from a population with mean μ and finite variance σ^2, then the limiting form of the distribution of

$$Z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}},$$

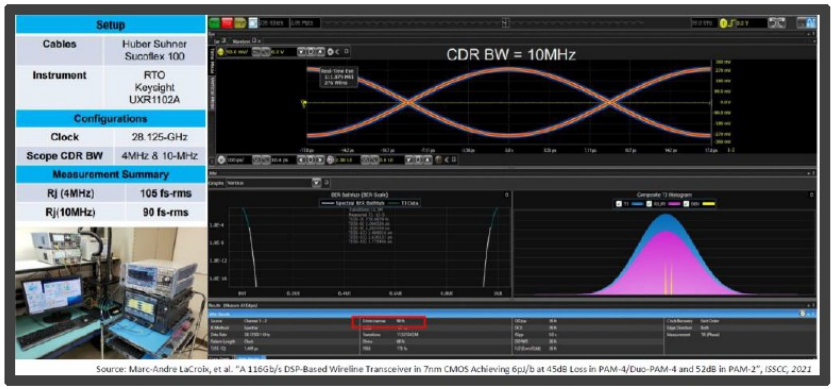
as $n \to \infty$, is the standard normal distribution $n(z; 0, 1)$.

=> Generally good if $n \geq 30$

Share relatable examples



Live and interactive demos



Summary

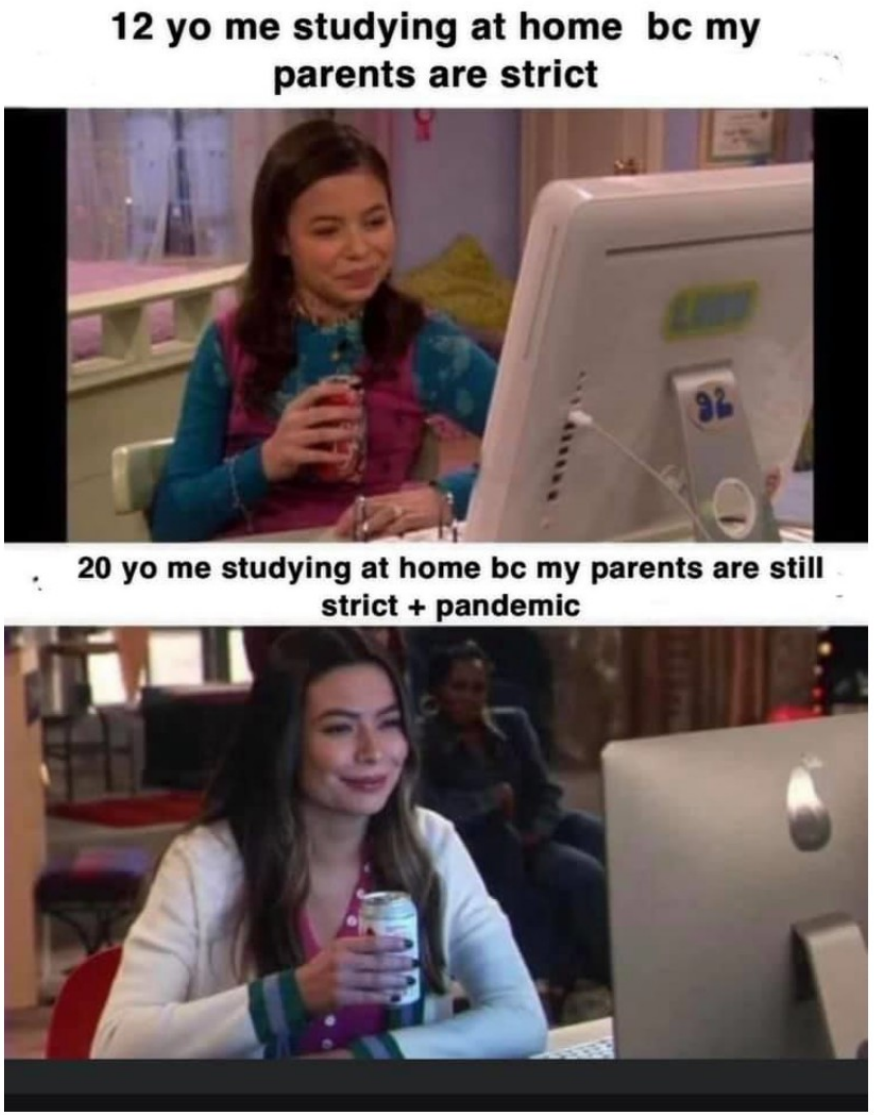
1. Treat tutorials like a “Twitch Stream”
   - Connect with the audience
   - Keeping things casual
   - Do activities together
2. Take advantage of what online learning can enable

<u>Not a perfect solution</u>

- Cannot encourage 100% participation, but it should help
- Cannot relate to everyone in the class. Not everyone will understand or be interested in gaming, anime or memes

End of part 3 out of 4

Thank you!



Overview

Tips on...

1. Course setup
2. Class engagement
3. Tutorials (Danny)
4. **Academic integrity**

4(a) Summarize submissions in a Google Spreadsheet

to rapidly group the online cheaters

For each test or exam, ask graders to complete:

Student	Booklet	Q1 final-line	Q2 style	Q3 (multiple choice)
Joe Blow	1	5.2	First principles	
John Doe	2	3.4	Covariance theorem	D
Jane Doe	3	3.4	Covariance theorem	D
Mark Ebden	4	5.2	skipped	

Also ask graders to flag suspicious papers,
e.g. answers to the *wrong version* of a question.
Then identify collaborators using the spreadsheet.

4(a) Summarize submissions in a Google Spreadsheet

to rapidly group the online cheaters

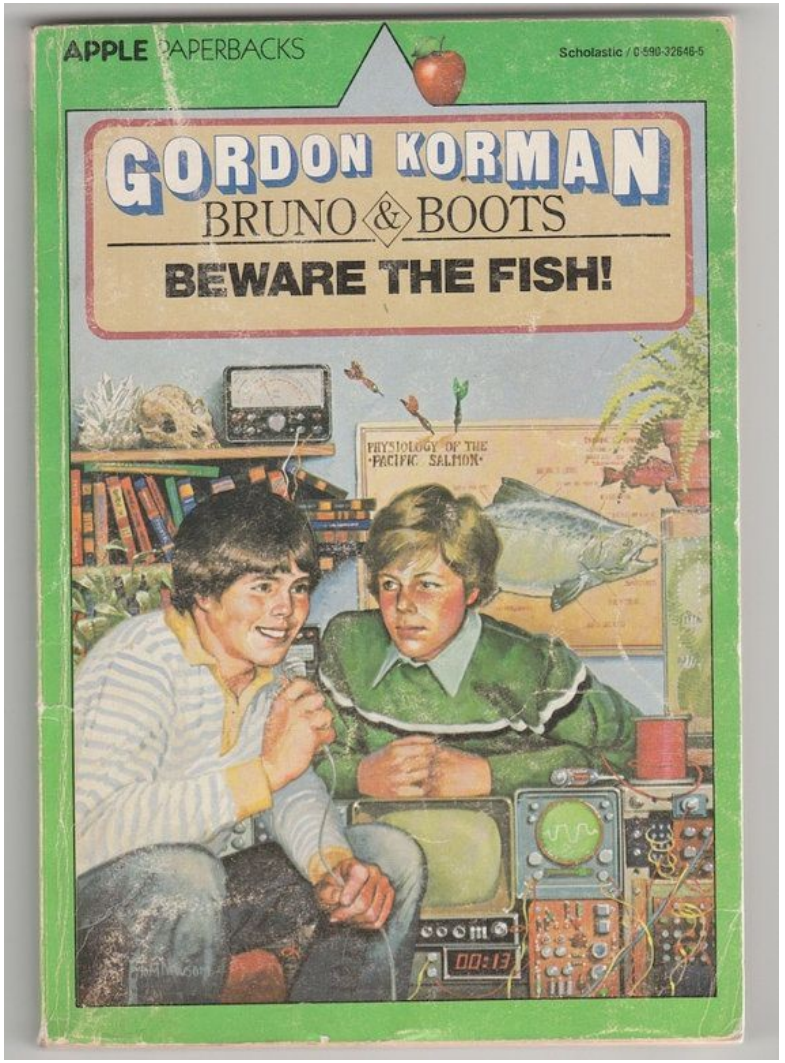
Each cell should summarize an important aspect of the solution that you and the grader decide on. e.g:

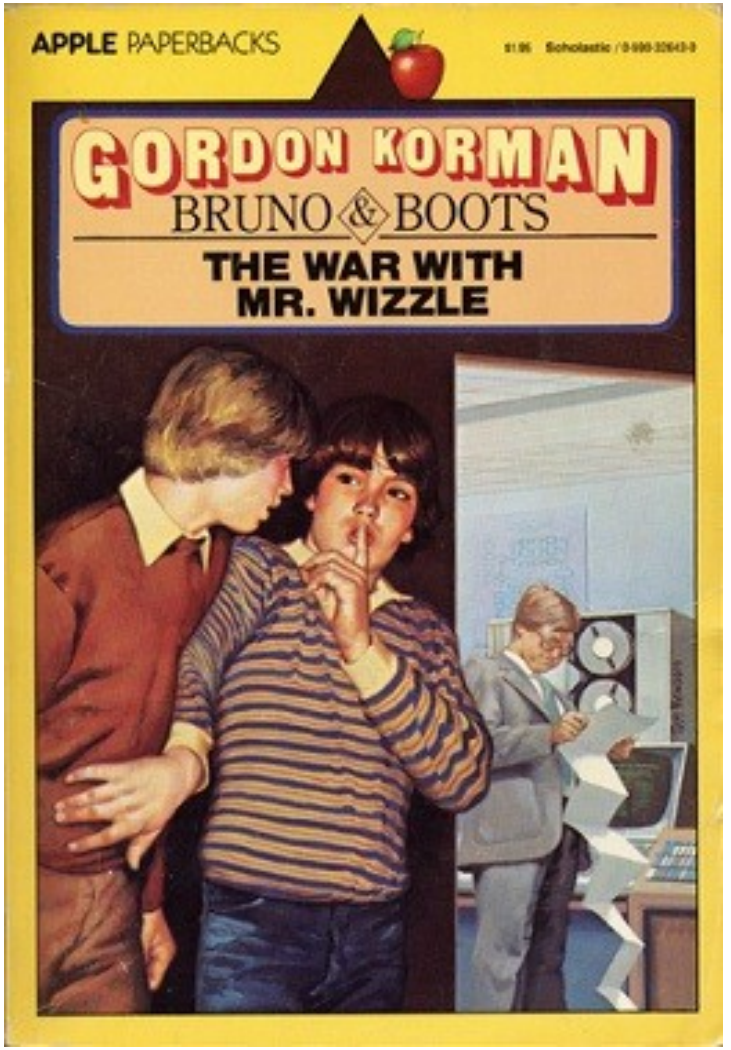
- Final-line answer. Or,
- The name of the student's approach.

Lacking TA hours? Focus on a subset of the assessment's questions.

4(b) Read fiction

for empathy, and to keep offences in perspective





www.pinterest.ca/pin/229965124696068192/

en.wikipedia.org/wiki/The_War_with_Mr._Wizzle#/media/File:The_War_with_Mr._Wizzle.jpg

Breakout room activity (3 min.)

A. What are your reactions to...

- 3: Tutorial tips
- 4(a)–(b): Academic integrity

B. What tips might you add, from your own experience of online teaching?

Summary of contributions

1. **Course setup** is an opportunity to give students agency and to get creative.
2. Use the virtual tools for **class engagement**.
3. Keep Twitch in mind for **tutorials** and use relatable examples.
4. To promote **academic integrity**, tailor your approaches to online assessments.