Project 4 [12 FP "Fluency Points"]

Create an animated GIF showing the effect of r (frequency ratio) on the vibration response of a wine glass when it is subject to a harmonic excitation, for 0 ≤ r ≤ 1.

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Description:

An opera singer is singing near a wine glass while varying the pitch of their voice, from very low pitch ("bassy") to a pitch when resonance occurs which results in the glass shattering. In this project, you are tasked with educating the reader about the effect of the singer's pitch (i.e., the driving frequency) on the vibration response of the glass.

- Begin your work by modeling the wine glass as a 1-DOF, undamped vibration system
  - Present this theoretical modeling via either handwritten or typed analysis, complete with sketches, assumptions and math
  - Assume initial conditions of zero displacement and zero velocity at $t = 0$
  - Derive two solutions for the vibration response, one for $r \neq 1$ and another for $r = 1$
- Then, write a code, in any programming language of your choice, and plot the vibration response solutions for $0 \leq r \leq 1$, starting with $r = 0$. Save and merge all plots into a single animated GIF from within your code
- Finally, reflect on your learning and journey of working on this project

Deliverable:

Present your work in a Google Doc and submit the Google Doc link to Gradescope.

Rules and Format:
- File requirements
  - Your Google Doc must contain the entirety of your work for this project, including vibration modeling and derivation, the animated GIF, and your code
  - The theory, GIF and code must <u>not</u> be submitted separately from your Google Doc
  - Your entire Google Doc must be in portrait orientation and has a vertical page flow
  - Your Google Doc must be publicly accessible, i.e., no permission required (see Appendix A below for how to set up and share your Google Doc)
  - Your Google Doc must not be edited after you have submitted it to Gradescope (your Google Doc will show the last edit date to any viewer)
- Theory/analysis requirements
  - Your theory presentation (sketches, assumptions, equations), either handwritten or typed, must be signed and dated on each page
- GIF requirements
  - Your GIF must display the same axis range, for both x and t axes, for all frames of the GIF
  - Your GIF must contain an annotation (text box) showing your name and other identifiers
  - Your GIF must dynamically display the r value for each frame of the GIF (either as an annotation, title, or some other plot element)

- ○ Your GIF must contain a title and axis labels
- ○ Your GIF must display a plot background color different from the default white
- ○ Your GIF must be infinitely looping
- Code requirements
  - ○ Your code must be self-contained, i.e., once executed, it must create the animated GIF file without the need for any post-processing
  - ○ Your code must contain comments throughout, including
    - ▪ a "header" stating the programming language, project number, course number, semester, your name, date, etc.
    - ▪ an explanation of each section or line of the code
  - ○ Your code must allow the user to easily modify parameters, such as m, k, F_o, and initial conditions, near the top of the code
- This is an individual project
- Violation of *any* of these rules will invalidate your submission altogether – read this document carefully (srsly)!

Tips:
- Be sure to use the correct equation for non-resonance ($r \neq 1$) vs. resonance ($r = 1$)
- Attend our Matlab workshops and review past workshop recordings

Submission:

Submit your Google Doc link (URL) on Gradescope only. Submissions by email or other means will be disregarded.

Due ~~March 8~~ March 19, 2021 (~~Monday~~ Friday) 11:59 pm.

Late submissions will be subject to the "half-life" reduction policy according to the syllabus.

Grading Rubric:

	Fluency			Scaling	Max Possible
	2	**1**	**0**		
Theoretical Rigor	Assumptions are reasonable and not oversimplified; sketches are clear and consistent with assumptions; physics and math are accurate and convincing	Some obvious details missing	Incorrect physics, or missing most details	2	4
Animated GIF	GIF rules are all satisfied; and looks professional, well-formatted, and informative	Has a plot that satisfies the rules but contains obvious issues with content and/or formatting	Missing; or violates any of the rules	2	4
Code Explanation & Usability	Code rules are all satisfied; code is clearly and comprehensively commented and explained; contains safety checks and other good coding practices	Has a code that satisfies the rules but has obvious issues; insufficient comments and explanation	Missing; or violates any of the rules	1	2
Reflection	Thoughtful and authentic; acknowledges limitations/inaccuracy and suggests future (self-)improvements	Insubstantial or vague	Missing altogether	1	2
				Total	12

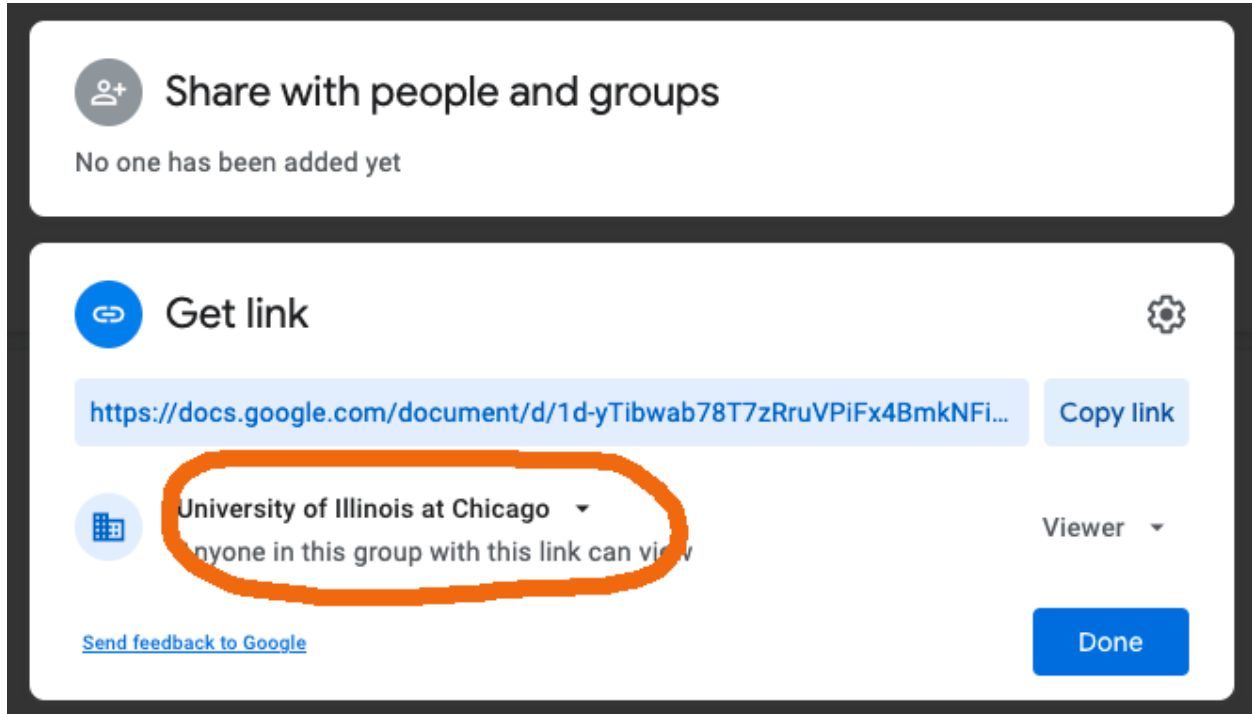# Appendix A: How to Share and Submit Your Google Doc

1. Sign in to your UIC account on Google. On your Google Doc, click "Share":
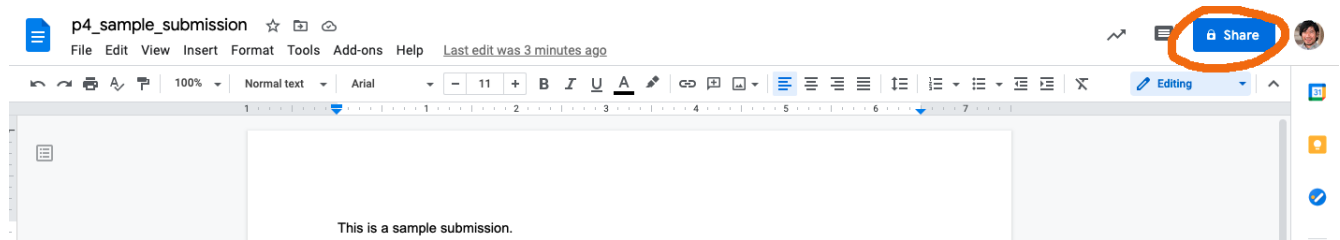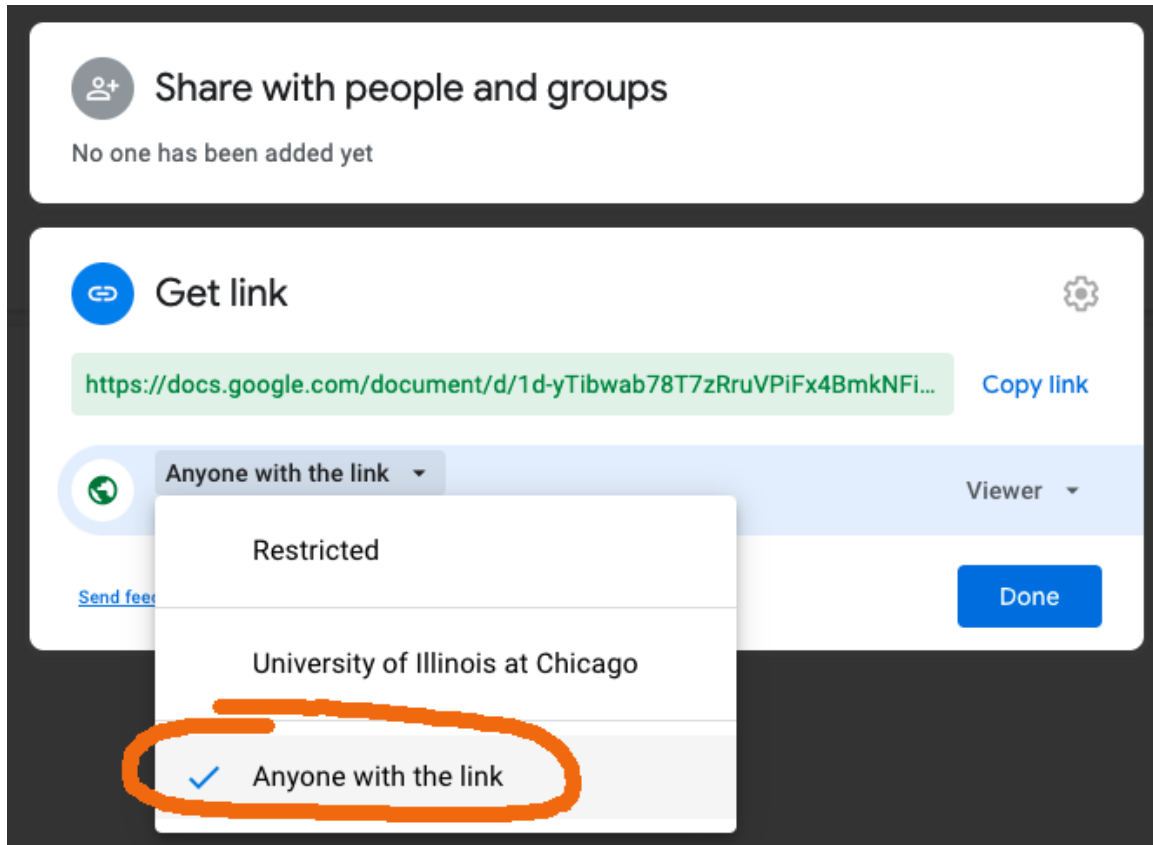

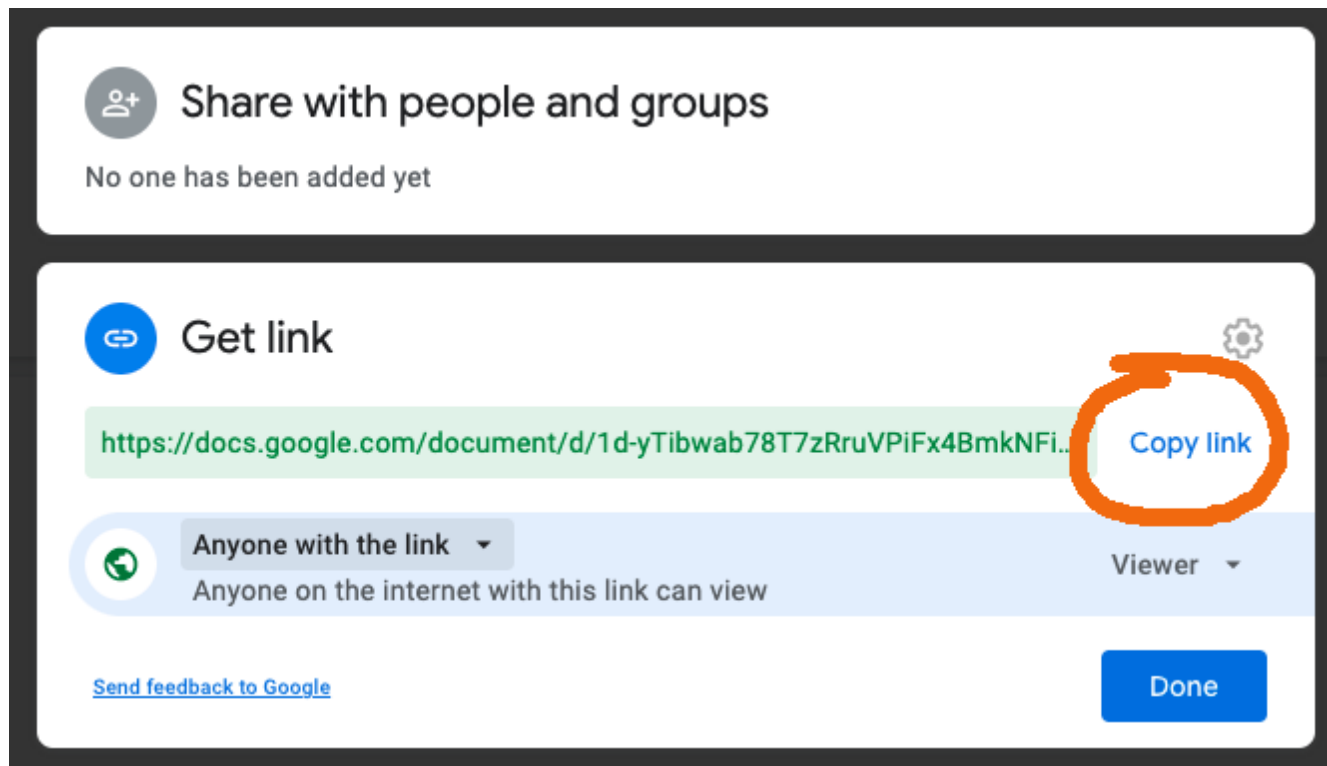2. Under "Get link," click "Change link to University of Illinois at Chicago":
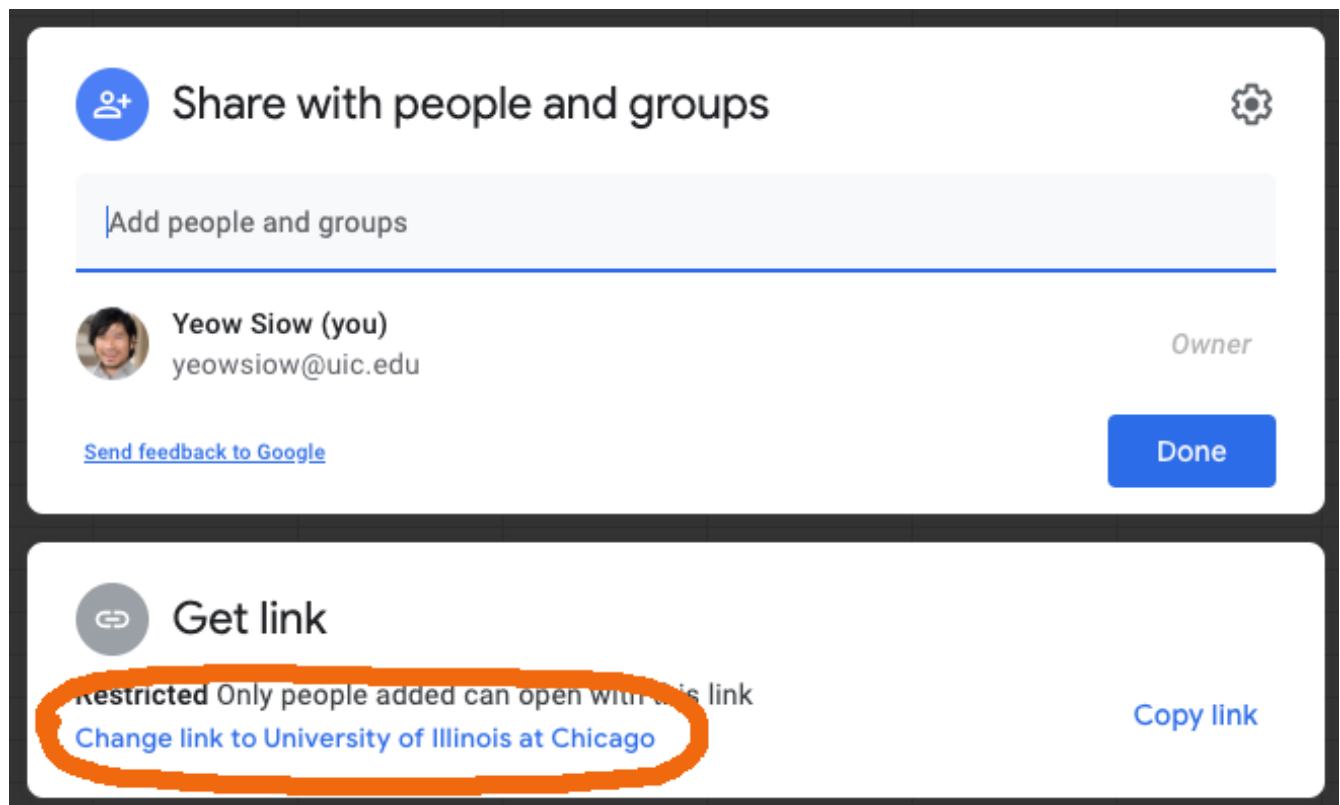
3. Click "University of Illinois at Chicago":

4. Select "Anyone with the link":

5. Click "Copy link" then "Done":

6. Paste the link in Gradescope.