Guidelines for RenR 480/580 Course Projects

Deadlines to submit: (1) Ideas: **Sep 29**; (2) Draft projects: **Nov 3**; (3) Feedback: **Nov 10**; (4) Final project: **Dec 15**

General scope and objectives of the course project

The course project is meant to add a problem-based learning component for you. You will design a study that addresses any applied or scientific question that you are interested in. Pick any research field that you are passionate about, that you already know something about, or that you want to learn more about.

For your course project, you can work with real data, with simulated data, or with a mix of both. For example, if you have your data collection half finished, or if you are missing a critical replication, you may use some real data in combination with some simulated data. Other possibilities are publicly available data sets from government sources or scientific repositories. You may also use data from your own or your supervisors' past project.

You should develop a research project that has some degree of complexity and some real-world relevance. You should not do an analysis that is as simple as our lentil experiment from Lab 2, for example. We use very simple datasets to explore concepts, but for your course-project develop a more multi-faceted analysis.

I am reluctant to give you an example, because there is a tendency that I channel your ideas into exactly that example, and we just get minor variations of that example. I want to bring out your creativity in tackling a problem! But since nobody will likely do a project in epidemiology, here is an example about the scope of a project. Don't think of this as a template for anything else except as an example for scope:

Let's say you want to support public health officials to make decisions regarding roll-out of a vaccine. Your project should not just be testing the effectiveness and safety of one vaccine in a trial with a placebo control group. An appropriate project complexity would be to design a vaccine trial for a target group that reports effectiveness and safety of the three candidate vaccines for different age groups.

Then, put your results into a made-up real-world context: (1) The vaccines cost different amounts to produce, say: $1, $3, $8 per unit; (2) they will be available in quantity at different times, say in 8, 5, and 2 months; (3) you have high risk and low risks groups in the populations, e.g. health care workers. Given the safety and effectiveness results from your study, and given the certainties around your statements that you achieved, what would you recommend the government should purchase?

Any problem in forest resource management, wildlife conservation or land reclamation will have similarly complex issues. Managers and decision makers will be receptive for good advice that is based on data. Design a research project that could in principle support real-world decisions that they have to make!

How to get started

Coming up with a research project is actually way more fun if you can bounce around ideas with someone else. If you are enrolled in RENR 480, I recommend that you work in groups of three. If you are enrolled in RENR 580, you should do an individual project, but still work with someone else who can play the role of collaborator, stake-holder, or "devils advocate" to help you develop a good idea for a project. This may be a course-participant, one of your lab mates, or the supervisor for your thesis research.

Topic submission: let me know one of the following by the posted deadline:

- If you have already figured out who you want to work with, let me know by email (ahamann@ualberta.ca) who your group members are (2-3 group members). One email per group is fine. If you need to make contact with someone, your emails are listed on eClass under "Participants".
- If you have no partner(s) for a group project yet, email me a general topic that you are interested in (e.g. "Wildlife management"). Optionally, if you already have an idea, also let me know a more specific potential project topic (e.g., "Caribou conservation"). I will link you up with someone who has a similar interest.
- If you are enrolled in RENR 580, or if you are 480 participant and prefer to do your own individual project, also let me know a general topic area, and if you have someone to bounce-off project ideas. If not, I will find you someone with a similar interest.

How to obtain or develop a dataset for the course project

You have three options to obtain data for a course project.

(1) If you conduct thesis research or otherwise participate in a research project, I recommend that you use your project data. You may also ask your supervisor for a dataset that needs to be analyzed. If this data is still incomplete and you are missing variables, replications, or future years of data collection, you may simulate the missing data (see details below). For the purpose of this course project, I ask you to present a complete study.

(2) Simulate an entire dataset for a research study. I recommend this option if you are in the planning stages of a thesis project. Use this opportunity to develop and test experimental and sampling designs with simulated data before you go out and collect samples and take measurements. You can later just plug your real data in. For simulating data, you need to develop a sample or experimental design (http://tinyurl.com/rr480/video/designs), next create a layout for an empty data table (http://tinyurl.com/rr480/video/layouts), then fill the empty data table with simulated data: http://tinyurl.com/rr480/video/simulation.

(3) Use public datasets from open-access data repositories. You can search for datasets in the area of your interest with these search engines by keyword, topic area or location: https://datacite.org, https://www.frdr-dfdr.ca/, https://geo.frdr-dfdr.ca, https://datasetsearch.research.google.com, https://explore.openaire.eu. There are also journals that specialize in publishing high quality datasets. Browse their papers for inspiration, e.g.: https://www.nature.com/sdata. That said, the most effective way to find datasets is to use Google with the search words: “download”, “data”, plus a file format such as “csv”, “shapefile”, “excel”, “xls”, “xlsx” (one at a time) plus some general topic words like “forest fire canada”. Try various combinations (without quotes), like this.

Whatever your source of data, the next step would be to develop research objectives, questions or hypotheses. If you conduct your own research project (i.e., 1 and 2 above), this video will guide you how to formulate powerful objectives or hypotheses: http://tinyurl.com/rr480/video/hypothesisdev. If you use a sizable public dataset (i.e., 3), your question and objectives will more likely emerge during exploratory data analysis. You have to see what your data looks like first, in order to find out what questions may be feasible to answer.

I note that one specialty of my own lab is to make climate data easily accessible for analysis. Many students in the past have taken advantage of this resource to analyze previously published data in a new context, i.e. historical climate trends and projected climate change. Here is how: http://tinyurl.com/rr480/video/climate.

Draft project submission for feedback

For the draft project, I would like you to apply what you learned in eClass Units 1-4, including Lab 5, with an emphasis on graphical presentation of data. I expect a fairly complete project website and a 5-minute narrated PowerPoint presentation covering study background and rationale, project objectives, experimental or sampling design, data visualization and exploration, presentation of results, interpretation of graphs, and conclusions.

However, please **DO NOT** include any statistical analysis with the draft submission. You don’t have a good suite of analysis tools yet, and you are likely to misinterpret p-values. Focus on graphical data exploration, summary statistics, and graphs and tables from summary statistics. Interpret your results **WITHOUT** any p-values. This sequence also applies to real research. First: visualization and interpretation, only second: statistical analysis.

The draft project will include **two items** to submit: The first is a **5-minute narrated presentation** that provides an overview of your project. This really must be short and simple. Think no more than 10 slides. Submit this as link to a video (e.g. YouTube or Vimeo), which you can create by recording a Zoom session where you share a screen with your slides (to an audience of nobody). For a more sophisticated video recording, use the PowerPoint narration function, e.g.: https://youtu.be/jHeH05PKvHg and export your file as .mp4, which you can upload.

Secondly, present more detail and narrative in the form of **a simple 5-page website**. To generate a website, you can use any free on-line editor. I recommend Google Sites, which is simple and allows you to collaborate (tutorial here: https://youtu.be/5BhCVvFWEtE), or Weebly for fancier designs: http://tinyurl.com/rr480/videos/weebly. For inspiration, you can view previous student’s project here: http://tinyurl.com/rr480/projects.

You can use any of the scheduled lab sessions to ask questions and get help about any your aspect of your course project. If the scheduled lab sessions are not enough, we will schedule additional Zoom support sessions or offer individual/group appointments as needed.

Suggestions for your research project and website (5 web pages)

Scientific research can be defined as the collection, analysis, and interpretation of data with the purpose of (potentially) changing your mind on something that's important to get right. The primary communication tool of scientific research results are brief, peer-reviewed papers, and in this course I would like you to develop a similar but even more concise report in the form of a peer-reviewed project website. The research scope and analysis should be comparable to a scientific paper, but the writing should be much shorter, boiled down to the essence using plain language that is clear to anyone in this class, without using jargon or abbreviations of any kind. Use five pages, titled: Home, Intro, Methods, Data, Results, (optional: References, About) allowing for simple one-click navigation and everything being in plain sight (no further subpages, links to images or image carousels):

1. Home (~200 words)

Title – Aim for a short, descriptive and catchy title. Avoid "*The effect of this on that*" and other uninformative variations, such as: "*Is this related to that*?" or "*This influences that!*" Instead, step back from your statistical analysis and think about your broader goal. Generally, questions are good, as are concise 2-part titles following the general pattern of "*Result: implications*", e.g.: "*High inbreeding found in xyz: implications for captive breeding programs*". You can also show off strengths/unique aspects of your data: "*A 56-year analysis reveals* …", or follow the format "*Topic/result: a comprehensive evaluation of 143 provincial parks*". Clever wording and word-plays are effective: "*Phenomenon: proximate and ultimate causes*", "*Topic: dealing with uncertainty*" or "*Predicting something in the future: learning from the past*", etc. There are no real recipes - be genuinely creative.

Abstract – In plain words, describe what you want to accomplish with your study. Two or three sentences why your research is timely and important. Next, a general (i.e., non-technical) objective statement (see details below). Then, two or three sentences about your research approach: summarize your sampling procedure/experimental design/analysis. Two or three sentences about your key results (use numbers if you can). End with your main conclusions, applications or implications. These should be take-away messages that have value for a broad readership. Ask yourself: would people cite you for the take-away messages that arise from your research. Would somebody really say: "According to *insert your name* (2023), *insert your take-home message*"? For this to actually work, you can't conclude with technical or statistical statements, such as: "*This influences that*" or "*This is different from that*". To make an impact on what people believe or do in practice, say what the statistical relationships or differences mean scientifically or practically.

For the draft submission, your research and analysis should be at a stage where all the abstract elements can be written as described above, even if further analysis may change some of them later. Otherwise you will not be able to provide and receive useful and constructive feedback.

More generally for your future research work, the title and abstract are incredibly important to get read and cited, and for your research to have any practical or scientific impact. For every month of research you do, spend one day thinking about your title and abstract. If nobody reads your work, it will have been for nothing.

Visual Elements – Use a photo or another visual element that represents your research topic.

2. Intro (~500 words)

Background & Rational – Describe the context of your research (background), and explain why your research is important or interesting (rationale). Do include references here that can be added as a footnote or reference section, but note that *this is not a literature review*. Your goal here (as in a scientific publication) is to convince the reader that your research objective (next section) is timely and relevant. Use citations strictly as evidence for the points you make in explaining the value of your research. Keep this section as short as possible and aimed at your class-mates as peer-reviewers. Put yourself in their shoes: will they get it why your research has value?

Research Objectives – This is a key section that will take you some time to develop. Often, you will find that your initial objectives when you started the research sounded great, but you couldn't really accomplish any of that: Your experiment wasn't really suitable in hindsight, your study subjects didn't cooperate, a key measurement didn't work as expected, some of your results turned out too uncertain and uninterpretable, etc.

Nevertheless, you need to get this section right for a good grade in this class (and later to defend a thesis or publish). Rethink this section as your analysis progresses to arrive at feasible, valid research questions, applied objectives, or scientific hypotheses. Let this section be guided by the following: Are there practical applications of your research? Do you want to decide between two or more management options? Or do you have a true scientific hypothesis in a sense of two or more competing explanations that you want to investigate?

If you use the term "hypothesis" in this section (or in your corresponding thesis section), it should strictly be in a sense of a putative explanation for an observed phenomenon (https://en.wikipedia.org/wiki/Hypothesis and also explained here http://tinyurl.com/rr480/videos/hypothesisdev). You don't need to state a hypothesis. Stating an interesting research question or applied objective is just as good, but be sure you actually meet the objectives and answer those questions with your data in the end!

If you do state a scientific hypothesis, also state your expectations and reasons for those expectations. Further, expand on reasons for possible alternative outcomes. Alternatively, if you state applied objectives or research questions, then explain how different results would help you to decide between different management options.

Visual Elements – In this section, you may use simplified, conceptual graphs or diagrams to support your background narrative, or to illustrate what the possible outcomes of your study might be.

3. Methods (~200 words)

Data collection – Briefly describe your sampling procedure/experimental design/measurement protocols. If you are working with real data, only describe the data that you actually analyze as part of this course project!

Experimental or sampling design – Describe any sampling and statistical designs, replications, hierarchical or nested structures. Use diagrams or tables to show the number of replications, treatments, plots within treatments, etc. State what your predictor and response variable are.

Visual Elements – Probably most important in this section to keep your reader's, audience's, and my attention. Use maps of your study sites and diagrams of your experimental and sampling designs rather than trying to describe that in a lengthy narrative. Ground or aerial photos of your field sites with diagrams drawn on top of them (e.g., https://tinyurl.com/mv690/v/graphics (minute 4:40) showing transects, plots, treatments, etc.) can be very effective. If you have experimental treatments or site types in sampling designs, use photos to illustrate your treatments or sample sites. Most of what you generate here will likely not make it into research papers, but some of it can be used in your thesis, and it is great material for conference talks and other presentations.

4. Data (~500 words)

This section is unique to this course project report, and would not normally be part of a paper, thesis, or conference presentation. Nevertheless, data exploration and quality control, as well as raw data visualization is essential to get your final results right, and to not miss anything interesting and important. I would like you to document this activity here. Use graph types from Lab 3. These graphs can be busy and messy, but they should allow you to see outliers, distributions, data volume and gaps. In the subsequent results section, you would create simpler, cleaner graphs that summarize your raw data with means and standard errors (see Lab 5). Also, save your interpretation of the biological or applied meaning of what you see in your graphs for the next section. Here, you want to talk about your data quality, quantity, problems, errors, gaps, outliers, and how you deal with it.

Data table – Show and describe your simplified data table (i.e. include an abbreviated table displaying your variables in columns and a few sample rows of data. Describe the following: What are your sampling units or experimental units? What are the predictor variables? What are the response variables? Is the predictor variable manipulated in an experiment or simply observed? Is the predictor variable categorical or continuous? Again, strictly limit the description to what you analyze as part of this project.

Exploratory graphics – Explore your dataset with the graphical tools that we covered in Lab 3 (histograms, boxplots, scatterplots, plus line graphs applied to raw data). Describe what you did to check your data for errors. Document your data cleaning if applicable. Point data gaps and other our shortcomings in your data. You can be selective and show a small number of quality graphs and say you did the same for other variables. Also, don't forget to number your figures (so that they can be referred to by your peer-reviewers) and add figure captions and legends, so that the graphs are completely understandable without reading any of the text. [For the final submission, add residual plots, before and after data transformations].

5. Results (this page includes Discussion and Conclusion) (~500 words)

Sub-sections = Take-home messages: I recommend that you structure this section with sub-titles that represent the main take-home messages (e.g. "No evidence for long-term drought impacts"). Start with your most important finding and refer to the figures and tables as evidence for what you state is actually true. Figures and tables need to be designed to specifically serve this function (serving as evidence for what you say in the narrative). Elaborate with additional interpretation (i.e. discussion). Be selective and only show a reasonable number of take-home messages supported by quality graphs. Move any extra graphs that don't serve this purpose to the data page. On the other hand, if a graph on the data page serves as evidence for a take-home message, feel free to create a polished duplicate version of it for the results page.

Take the reader by the hand: In any results section, never say something like: "Correlations between climate and species growth are shown in Table 1". Instead, your job is to take the reader by the hand and point out what's interesting, referring to figures or tables as evidence. Instead of the above, you can say: "We could not find evidence for drought to affect the growth in any of the species (Table1)." When correctly formulated, references to figures and tables should always be in parentheses, and not outside parentheses like in the first example.

Visual elements, figure and tables: Consecutively number all visual elements across your web pages: maps, diagrams, photos like this: Fig.1, Fig. 2,…and tables like this: Table 1, Table 2 … (*This is especially important for the draft submission, so that your peers and I can give you feedback on specific graphs and tables !!!*) Further, use stand-alone and fully descriptive figure and table captions. The reader should be able fully understand the Figure or Table based on the caption and legend, without having to read any text. Table captions must be above the table, figure captions below. Start your figure and table caption with a short descriptive sentence that would read like a title for the Figure or Table, e.g. "Table 1. Pearson correlations between climate variable and species growth." This can then be extended with further detail, such as "Significant correlations at α=0.05 are indicated in bold". Avoid abbreviations not only in text but also in Figures and Tables. If you absolutely must use them due to space constraints, and there is no way you can change the design of your table or figure to accommodate longer labels, explain all abbreviations in the legend or caption of every figure and every table. All the above applies to any scientific report, publication, or thesis document as well, so you might as well practice it here!

[***Statistical Analysis*** **–** For the final submission, show the results of your statistical analysis on this page as well. **For the draft submission, DO NOT SHOW OR DISCUSS P-VALUES. Your results must make sense based on graphics without stats, first. Otherwise your interpretation of p-values will almost certainly be wrong.**]

6. References / 7. About – You may add these as an additional pages to list your references or to acknowledge collaborators and sponsors of your research, and/or to say something about yourself.

Suggestions for the project presentation (5 minutes)

Format – Use a narrated PowerPoint slide show that summarizes you study concisely. Please with threes (rule of threes), using three main components: an opening, a body, and a closing. You may also aim for three questions and three take-home messages. Do not use bullets, or written paragraphs on slides. Remember, you are talking, so this is not necessary. Many studies have conclusively shown that transmission is blocked if your audience simultaneously tries to read and listen to you. Also, speak freely. This may take a little longer but it's worth it. If you find you waste much time by searching for words, practice a little, but don't over-practice (i.e. don't memorize the exact wording), and don't read from notes. It sometimes helps to write down what you want to say concisely, but then DON'T use this as an aid when you speak. The words will come fluently once you have clearly formulated it for yourself. If you forget something, it doesn't matter. Nobody will know.

1. Opening: Hook, Backgound & Problem Statement – (2-4 slides / 1-2 minutes).

A "hook" is an opening technique to focus people's attention so that they don't miss the title and your opening statement, and hence the entire point of your talk. This is very effective at busy conferences where people already suffer from information overload. You can deliver your hook in 30 seconds or less, for example, while your title slide is up and people are still not quite focused on you. There are many options for an effective hook, but few work for a recorded presentation. Omit them or maybe consider:

- Something about yourself or something that connects you personally to the research
- Something you just "read in the news" (fine to fake it by elevating older news)

For in-person presentations, you have additional options, but they don't work well in video recordings:

- Perhaps you can ask the audience an interesting question based on a photo or a prop that you bring
- A good joke or cartoon that is related to the talk. If you can't stop giggling while thinking about it, it's good. If it does not pass that bar, leave it.
- The most powerful hook is to relate *ad hoc* to a previous presenter in some way. This way you truly connect to an audience and make this a conversation.

After your hook, briefly say what this presentation is about and state your research question/objective. You may say a few words about your species, your study site, and the context of your research: why is it important or exciting? State your questions, objectives or hypotheses. You can also take your conclusions to the front: “I will show you that…”. You don’t need an outline or overview slide for a presentation that’s less than 20 minutes. It’s better to have a good story than excessive structure and outlines.

2. Body: Methods, Results and Discussion – (4-8 slides / 2-3 minutes).

Briefly describe your data and experimental or sampling design using diagrams. Diagrams overlayed on photos are perfect for this. Limit the method description to what you actually analyze.

Use your results from either exploratory analysis of raw data, of from grapsh and tables of descriptive statistics Explain all graphs you show: What are the x and y axes? What do the points/lines/bars represent? Tell your audience what relationship or effect they see in the graph and explain how the findings can be biologically interpreted and/or what the practical applications are. Tell a complete story around a graph, if you can, including the interpretation and implication of the results. For the final presentation, add information from inferential statistical analysis.

3. Closing: Conclusion and take-home messages – (1-2 slides / 30 seconds to 1 minute).

Aim for a nice conclusion, e.g. going full circle back to your opening statement or linking back to your original hook is very effective, giving the audience a natural sense of closure. Alternatively or additionally, you can add some personal opinion, interesting speculation, or any kind of personal or scientific highlight of your study. For a short talk you don’t need to explicitly repeat and summarize your results at the end. You may want to drive your main points home again in a different way (aim for three messages) – but avoid a “word for word” repetition of the exact same thing that you just said a minute earlier.

Evaluation Criteria (Assuming Completeness)

The analysis and writing of your draft and final course project submissions MUST BE ORIGINAL (i.e., they must generated by yourself during this course). You may build on prior work by yourself and others, but THIS MUST BE REGISTERED and cleared with me before you submit your draft project. My evaluation will then primarily be based on added value generated during this class.

Website Layout (20%): High marks are given for effective use of headings, paragraphs, diagrams, photos, and graphs in your website. Everything should look polished with consistent fonts, font-sizes, colors, and symbols. Font sizes in your graphs and tables should be easily readable and about the same size in your figures (titles, labels, tickmarks) as in your website text (about 2mm height on a normal computer screen, like those in the lab). Resize anything significantly larger or smaller. Make use of white spaces between paragraphs. Use short paragraphs and group your graphs, tables, or diagrams with the paragraphs that refer to these visual elements. However, always start with your narrative and place the visual elements subsequently.

Writing (30%): High marks are given for concise and logical writing that makes plain sense. Write for an audience of your fellow students from various disciplines in the life and environmental sciences. Write as you would to a friend to explain your research project! They’d be interested in what you do, but they will not want to look up references, technical terms, and abbreviations.

Your content matters most for a high mark. As a summary of the above: • Your introduction should provide a rationale for your objectives, not a literature review. • Both general and specific objectives need to be ultimate goals, or you must clearly explain how they contribute to an ultimate goal. • Your results should be statements of important insights based on data (with tables and figures cited in parenthesis as evidence for what you say is true). • Your discussion should be an interpretation of your results, not a literature review. • Your conclusions (which can be part of the discussion), should clearly (not vaguely) meet your stated objectives (if they do not, state different objectives). • There has to be a straight forward, logical storyline from the first to the last page of your website (try to write science as you would write a story). • Do not use any abbreviations for example for treatments or locations. Only extremely common abbreviations like “GIS” may be used.

With artificial intelligence tools now available to draft, re-write, and polish your text, I expect near a perfect English grammar, spelling and writing style. Feel free to use ChatGPT, Quillbot, Grammarly and other AI-based tools. Note that generative AI tools can also easily create large amounts of original text that sounds great, but doesn’t actually make scientific sense, or that serves a direct purpose in the context of your analysis. Nobody needs this. Points get deducted for not being concise or for not making sense.

Figures & Tables (30%): I do expect high quality scientific graphs based on what you learned in this class. • Efforts in creative use of symbols and colors, leading to salient figures, is rewarded (i.e. it should be easy for the reader to see that what you state in the results is true). • Customizations and touch-up are rewarded. • Also, make sure all graphical elements (labels, titles, etc.) are easy to read, non-overlapping, and consistently sized. They should be about the same size as your paragraph text, but sans-serif fonts are preferred. • Tables need to conform to standard scientific layout. Take screen prints of tables to upload as an image to your website. • Every diagram, map, figure or table should be consecutively numbered throughout the website. • There must be a caption above Tables and below Figures that start with a short sentence that reads like a title, followed by additional detail for the reader to understand the figure and explain all abbreviations. Tip: whenever you are tempted to say: Figure 3 shows … in your results narrative, this should actually go into the figure caption. • Unless impossible to fit, labels and legends should NOT be abbreviated.

Presentation visuals (20%): Do not use bullets, or written paragraphs. Remember, you are talking, so this is not necessary. Many studies have conclusively shown that transmission is blocked if your audience simultaneously tries to read and listen to you. Never do this to your audience. Inexperienced presenters like bullets and text because they serve as speaking notes, but the presentation is not for you, it should be designed for your audience. A good score here will require that you use photos, diagrams, maps, figures and tables to support your narrative. For a scientific audience always use plain, high-contrast themes, simple graphical elements, easy-to-read labels, and NO abbreviations. Also, avoid distractions such as clip-art, crowded slides, or funky animations.

- Note that you are neither evaluated on your presentation skills per se (although you will get feedback), nor on the value of your results for science. Rather, I want to see that you can communicate a reasonable rationale and objective, and explain what your results mean to an audience that consists of your peers. As such, you do not need to explain what senior undergraduate or junior graduate students in an environmental and life science disciplines generally understand. Neither do you need to explain the statistical methods covered in this class.

Evaluation Criteria for final submission (Assuming Completeness)

Website Layout (20%): as above.

Writing (30%): as above.

Figures & Tables (20%): as above.

Analysis (20%): A full mark for this section requires that you choose the right method, recognize the assumption and limitations of the analysis for your dataset, and interpret the results correctly. A high mark requires good judgment. Both, overstating your results or being overly cautious with conclusions when the results are clear would lead to deductions.

Presentation visuals (10%): as above.

Author contributions for group projects

Aim for about equal contributions of each person to the group projects. However, this may sometimes not happen and for the purpose of somewhat fair grading, please tell me your contributions to the course project. In total, your report on author contributions should not be more than about half a page for the final project submission.

For the draft project submissions, I do not need a full report as described below. Instead report an overall contribution percentage of your group members. For example: EB: 25%, MM: 35%, JF: 40%. Unless there are serious imbalances, I will not use them to adjust individual grades for group projects. If there are serious imbalances, then please do communicate them at this time. It's important not to let problems fester.

Giving credit where credit is due is generally good practice in life, so we might as well practice it here. If I decide on a deduction on a draft project grade for lack of contribution by a group member, that deduction is reversible. If the group member contributes their share subsequently, that deduction will be removed for the final grade calculation.

For the final project submissions we follow a similar procedure as for any scientific publication. You can take a look at the standard categories for author contribution statements: https://casrai.org/credit/. I would like you to do something comparable, but with somewhat more detail and with categories that you may not find in most scientific papers, such as "Who made-up the data" ;-) You can use the following categories, but you may leave some out and add others that better capture the work you did:

Conceptualization: Ideas, formulation of objectives and research approach.

Experimental design: developing the layout of sampling design or experiments.

Data table: developing the standard data table, filling it with simulated data, fine-tuning the treatment effects and variances.

Data visualization: design, preparation, and creation of figures, diagrams, maps, photos, or other visualizations.

Statistical analysis: Development of methodology, programming of analysis; creation of tables with results.

Interpretation: Describing the meaning and application of results, and linking them back to the stated research objectives

Website and writing: design of the website, writing the first draft of each webpage, editing each webpage.

PPT presentation: design of slides, drafting narration, recording narration

Author contribution examples: You can state author contributions in various ways. For some categories, percentages may be good:

Conceptualization: Most of the main project ideas were developed by JT (80%), LM contributed the third objective and associated applications (20%).

You can be more specific where that is easy to do:

Data visualization: JT designed and programmed Figure 2, and 3, LM designed and programmed Figure 1, 4 and 5. JT also designed a first version of Figure 5, but it was replaced by a better version programmed by LM.

Or a combination of both:

Website and writing: JT designed and wrote most of the home page (70%) with edits by LM (30%). Intro: JT wrote a first draft, but mostly discarded. 90% revised by LM. etc.

Keeping track: Use a shared google doc, where you keep track of your joint contributions for the other person to see: "Oct 15 – JT working an hour on web layout", "Oct 17 – LM working an hour to develop Fig 2 and 3."

Should there be any problems or questions, don't hesitate to contact me.