Project Information

The project gives you the opportunity to explore your own research questions involving applied stochastic processes, or to investigate some aspect of applied stochastic processes that we do not cover. Your goals are to (1) show me that you've learned something (preferably a lot) about applied stochastic processes in this course, (2) show me that you can apply/extend your knowledge of applied stochastic processes (preferably substantially) beyond what we've studied.

You may work individually or in a team of two students for the project. If you work alone, you are still responsible for the same amount of work as a two-person team. If you work in a team, both students must collaborate contribute substantially to all aspects of the project. The project should involve about 6 hours of work. If you work in a team that's 6 hours of *collaborative work*, NOT 6 hours for each student.

A few general guidelines

- The project should involve both some simulation and some analytical solutions (similar to what you have done on many assignments). Note: analytical solution doesn't necessarily mean "by hand"; e.g., using software to solve a system of equations or compute an integral is an analytical solution.
- Ideally your project should involve both discrete and continuous time, but I realize this won't be feasible for all projects. Try your best to include at least one element of both discrete time and continuous time analysis, but don't worry if your main focus is either discrete time or continuous time
- The project must be original work for STAT 545. You can't just repurpose work you have done for another class/project.
- You will submit a project report in a reproducible document (Quarto, RMarkdown, Jupyter, Colab, etc)
- The target audience for your report should be students who have completed STAT545.

- **Option 1:** Apply some material that we have covered to investigate a problem of your choosing. The goal of this option is that you choose a context that is interesting *to you* in which to apply course material we have covered. Think of this option as writing your own Application assignment. You will:
  - Define the set up and assumptions
  - Decide which questions to investigate
    - One possible source of examples is the **538 riddler problems (https://fivethirtyeight.com/tag/the-riddler/)** , but be careful because we have seen some of them before and not all of them relate to STAT 545 material.

        - Remember that a goal is to go beyond what we have already done, so try not to overlap too much with previous applications. (It's fine if there is some overlap, but you should introduce at least some new wrinkles.)
    - Perform your own analysis, involving both simulation and analytical solutions
    - Write your conclusions
- **Option 2:** Investigate some aspect of applied stochastic processes that we did not cover in class. Your goal would be to produce a document like a class handout, with notes about definitions and theory, examples with questions and worked solutions, and relevant code and simulation. Some examples include:
    - More in depth investigation of queueing theory
    - Renewal theory
    - Martingales
    - Branching processes
    - Arcsine laws
    - Investigating an MCMC algorithm that we did not cover (if you already did this for STAT 415, you can't do it again here!)
    - With this option, the notes/definition/theory can be taken from a source, but you should try to synthesize them in your own words for a STAT545 audience. You should also write and solve your own examples; you should NOT copy examples/solutions from sources.
- **Option 3:** Complete **this project (https://bookdown.org/kevin_davisross/applied-stochastic-processes/app-project.html)** , which involves some of the topics we'll cover in the last few weeks of class. This isn't this most interesting project, so I encourage you to try the other options first and find something that is interesting to you. If you do choose option 3, you're welcome to just use this as a jumping off point; feel free to revise problems in whatever way you want, though be clear about your changes.
- **Option 4:** You tell me! The most important thing is that you do something that is interesting to you and worth your time, within the context of STAT 545 material. So if you have a project idea that doesn't fit options 1-3 above, please run it by me! For example, maybe instead of doing a report you want to create a Shiny app or video or something. Be creative!

Whichever option you choose, your work should be original. You should write your own computer code. You should create your own examples. You should write your own solutions. You can refer to sources, but be sure to cite your sources and clearly differentiate between your own original contributions and what you are obtaining from sources. If rely too much on sources, you won't learn anything. See **Syllabus 11: Academic Integrity (https://canvas.calpoly.edu/courses/117158/pages/syllabus-11-academic-integrity)** for more details. If you have any questions about what is allowed, ask!

Your project will be graded based on the following

- *Scope:* Did you demonstrate thought and creativity in the choice of your topic? Was the project appropriate for STAT545? Did the project go sufficiently beyond material covered in class?
- *Analysis:* Was the analysis, both simulation and analytical, correct and complete? Were code and output appropriate and correct?
- *Discussion:* Did you interpret results and concepts correctly? Did you draw appropriate conclusions?
- *Presentation:* Was your report well-organized and clear? Was it appropriate for the audience? Were the appropriate components emphasized?
- *Goals*: Did you demonstrate that you've learned something (preferably a lot) about applied stochastic processes? Did you demonstrate that you can apply/extend your knowledge of applied stochastic processes (preferably substantially) beyond what we've studied?