Welcome to Your Final Project! For this final project, you are to select a real-world problem and explore how programming can provide a solution. Your project will involve research, planning, and a conceptual design for a software solution.

Step 1. Research and Problem Selection:

- **Identify a Problem:** Choose a real-world problem that interests you. This could be anything from environmental issues to everyday inconveniences.
    - Use the **PCC Library tools** to explore topic ideas and find credible academic resources. Feel free to follow up with your favorite search engine after discovering topics.
- **Explore Existing Solutions:** Investigate current solutions to your chosen problem. What software solutions exist, and how effective are they?
- **Justify Your Choice:** Explain why this problem interests you and why it's important to find a solution.

Step 2. Design a Solution:

- **Propose a Software Solution:** Create your own program idea! Outline a basic software solution that addresses the problem you are researching. Describe how your idea improves on or differs from existing solutions, feel free to build your ideas based on software that already exists.
- **Pseudocode:** Write pseudocode or code-like statements that outline the logic of the critical behavior of your software. Don't worry if you don't know exactly how it might be done in a programming language, stay general and think about the steps needed to complete the task. This helps visualize the programming logic without getting into syntax specifics.
    - **Note:** Actual coding is not required. Please focus on the conceptual design rather than specific syntax.
- **User Interaction:** Visualize how users would interact with your software. Describe user interactions or create mock-ups of the user interface. Your design should be informative and engaging.

Presentation:

Prepare a Presentation: Use PowerPoint, Google Slides, or another tool to create a presentation document that summarizes your research, proposed solution, and design documentation. Be creative and have fun with your project!

Structure Your Presentation:

- **Introduction to the Topic:** Explain your chosen topic and why it interests you.
- **Summary of Findings:** Discuss the history, current software solutions, and future potential of the problem you are researching. Teach us what you've discovered during your research in Step 1.

- **Real-World Applications:** Discuss how the concepts can be applied in real-world scenarios.
- **Describe Your Design Approach:** Even though no actual software is being developed, describe your planning process while thinking through the potential software design.
- **Solution Design Proposal:** Share the elements of your proposed software design in Step 2.
- **Open Questions:** Highlight at least two unanswered questions from your research. What surprised you? What do you want to know more about?
- **Citations:** List all resources you used, such as articles, journals, and websites.

Important Tips:

- **Start Early:** Give yourself plenty of time to research, design, and refine your project.
- **Stay Curious:** Always be open to discovering new tools, techniques, and perspectives. Use your imagination, don't limit yourself. Describe your process, your uncertainties, and your discoveries.
- **Exploration Encouraged:** While actual coding is not required, feel free to explore the possibilities of how your software might be developed in Python. Consider creating a short text based mock-up of your program design idea.

Learning Objectives:

- Understand the application of programming and problem solving to real-world issues.
- Develop skills in researching technology solutions and planning software projects.
- Articulate and visualize software solutions through descriptions, flowcharts, pseudocode, and user-facing design.

Submission Guidelines:

- **Final Presentation:** Upload your presentation document as a .PDF to D2L assignment folder
- **Design Documents:** Include all research notes, design documents (flowcharts, pseudocode, user-facing design, code if any), and anything else developed while creating this final project.
- **GitHub:** Include your presentation document and all related design documents as a project in your GitHub repository. Organize the files and name them clearly. Include a link to your GitHub project in the comments of your submission.

Step 1:

Problem: lack of trees contributing to increased temperatures in Tucson (possibly other hot cities?) contributing to the city being an urban heat island (UHI).

Existing Solution: There already exists a Weather Research and Forecasting model and an urban canopy model (WRF-UCM) that models how UHI's are affected by trees, soil, and grass (Loughner 1775).

Justify My Choice: Urban heat islands are very dangerous, and will only increase in severity as climate change worsens. Therefore, while working to reverse climate change, we must also work to mitigate the effects of urban heat islands.

Step 2:

Software Solution: Like the WRF-UCM my program would model how green spaces affect UBIs, but would also find the best locations to place them, with the least amount of water usage.

Pseudocode:

Reads data from maps containing temperature, population density, building material, building density, and water systems.

Creates a temperature map that can be modified as needed as the model works.

Algorithm that uses research of most effective green space size and placement modifies map.

Models the changes to temperature and updates the map accordingly.

Displays map to user.

User Interaction: Users would enter in what temperature decreases are wanted, where they are wanted, and how much water use is acceptable.

Introduction to the Topic: Explain your chosen topic and why it interests you.

Urban heat islands (UHI) are a phenomenon where urban areas are hotter than the surrounding areas due to materials such as concrete and asphalt trapping, and then releasing heat, and the lack of evapotranspiration caused by a deficiency in green spaces. The issue of urban heat islands (UHI) is an important one, because as climate change intensifies, so will its consequences. The UHI's and climate change will work together to make our cities unlivable if we cannot fix both of them. While climate change is known about by the wider public, UHI's are not, and as such I chose them to focus on.

Summary of Findings: Discuss the history, current software solutions, and future potential of the problem you are researching. Teach us what you've discovered during your research in Step 1.

On April 11 of this year, according to a KVOA.com article, "Tucson officially hit 100 degrees at 1:09 p.m., marking the earliest triple-digit day since 1894." Record breaking high temperatures are likely to continue. In 2019, *Arizona Daily Star's* Tony Davis reported that, "Tucson is the Third-Fastest-Warming City in the U.S.," and that Tucson is one of ten cities that became more than 4 degrees Fahrenheit hotter during the last 48 years. The article explains that the heat island effect is the number one reason Southwestern cities are experiencing such spikes in temperature.

It is known that having more trees can lower the temperature in these areas. Currently, through the Tucson Million Trees initiative, the city plans to plant 1 million trees in the next five years (Khan). They use a Geographical Information Systems dashboard to determine which areas would most benefit from more trees in the most equitable way. Some factors that are considered are: "percentage of people of color, percentage of people living in poverty, the unemployment rate, and the population of seniors and children…" (Khan).

Although Tucson does not use it, there already exists a Weather Research and Forecasting model and an urban canopy model (WRF-UCM) that models how UHI's are affected by trees, soil, grass, and other factors (Loughner 1775).

Real-World Applications: Discuss how the concepts can be applied in real-world scenarios.

If the program was working on Tucson it would look at a heat map of the city, an

Describe Your Design Approach: Even though no actual software is being developed, describe your planning process while thinking through the potential software design.

After finding that a model of how green spaces affect urban heat islands already existed, my process of planning consisted of thinking about ways to improve that existing model.

Solution Design Proposal: Share the elements of your proposed software design in Step 2.

Open Questions: Highlight at least two unanswered questions from your research. What surprised you? What do you want to know more about?

There are several unanswered questions I'd like to know the answer to such as: how accurate this program would be, if something like this has been attempted before, and if it would be more effective than current solutions

Citations: List all resources you used, such as articles, journals, and websites.

Works Cited

Loughner, Christopher P., et al. "Roles of Urban Tree Canopy and Buildings in Urban Heat Island Effects: Parameterization and Preliminary Results." *Journal of Applied Meteorology and Climatology* 51.10 (2012): 1775-93. *ProQuest.* Web. 2 May 2025.

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Information on urban canopy model program
https://ral.ucar.edu/sites/default/files/public/product-tool/WRF-LSM-Urban.pdf

https://firststreet.org/city/tucson-az/477000_fsid/heat
Tucson has **severe risk** from heat. This is due to "feels like" temperatures increasing, and because **100%** of homes in Tucson have a severe Heat Factor®.
Graphics and facts about heat islands

https://tucson.com/news/local/subscriber/tucson-urban-heat-island-effect-climate-central-study/article_d3ff7284-3d70-11ef-a75c-8b765f0fa580.html#:~:text=Tucson's%20worst%20heat%20island%20impacts,and%20west%20of%20Houghton%20Road.
9.5 degree increase heat islands Tucson

They're found in four census tracts in midtown Tucson and on the east side, Climate Central's analysis found.

All four tracts had Urban Heat Island scores of 9.5, meaning their temperatures are 9.5 degrees hotter on average than they would be if the areas weren't developed.

Midtown Tucson and areas on the east side include four census tracts where the heat island effect raised temperatures by 9.5 degrees (Davis, 2024).

Davis, Tony. “Tucson’s Top Stories: July 13.” *Arizona Daily Star*, 13 July 2024, tucson.com/news/local/subscriber/tucson-urban-heat-island-effect-climate-central-study/article_d3ff7284-3d70-11ef-a75c-8b765f0fa580.html#:~:text=Tucson's%20worst%20heat%20island%20impacts,and%20west%20of%20Houghton%20Road.