1 Requirements Document

1.1 Problem Statement

What problem is your project trying to solve? Use non-technical jargon as much as possible.

The problem that the senior design team sdmay22-19 is trying to solve is to expand upon the existing Underground Cable Packing Tool with the primary focus of transitioning it to a web application. The existing tool is for streamlining billing for underground cable contractors as many companies are shifting to underground cabling to better withstand disasters. This new web tool will allow for more readily available functionality while also improving the existing tool in ways such as: enhanced algorithm, mobile support, and the addition of new features.

1.2 Requirements & Constraints

List all requirements for your project . This includes functional requirements (specification), resource requirements, qualitative aesthetics requirements, economic/market requirements, environmental requirements, UI requirements, and any others relevant to your project. When a requirement is also a quantitative constraint, either separate it into a list of constraints, or annotate at the end of requirement as **"(constraint)"**. Other requirements can be a single list or can be broken out into multiple lists based on the category.

Functional Requirements:

- Processing time targets, assuming a test case of one dozen cables/ducts or less
  - < 20 seconds if user must wait for results on page **(constraint)**
    - Stretch goal: < 5 seconds **(constraint)**
  - < 10 minutes if user can be emailed results asynchronously **(constraint)**
- Front end must run on common browsers, including desktop Chrome, Firefox, Safari and Edge (as time allows)
- Must be a web application
- Back end must run on target infrastructure (TBD)
- Capable of sharing recent results via URL
- Output a graphical visualization of the final packing, and of the attempted packing in the outer diameter one size smaller, in a portable format (PDF, PNG, JPG, etc.)
- Correct results must be achieved, with correct defined as:
  - All given cables fit in resulting outer diameter
  - All given cables will NOT fit in outer diameter one size smaller
  - Stretch goal: formally prove algorithm is correct

- Configurable:
    - Set of predefined cables/ducts
    - Set of outer diameters to check
    - Unit of measurement (in or cm)

Qualitative Aesthetics Requirements:

- The (User Interface) UI needs to use Iowa State University (ISU) Electric Power Research Center (EPRC) branding
- For the output - Cables should be packed to the center of the circle in this visualization

Resource Requirement:

- The use of Iowa State owned servers for hosting our application

UI Requirements:

- Clean and intuitive UI
- UI is functional and usable on mobile Chrome and Safari

Software Requirements:

- Web stack must be well-known and documented technologies expected to be maintained for at least 10 years **(constraint)**

1.3 Engineering Standards

What Engineering standards are likely to apply to your project? Some standards might be built into your requirements (Use 802.11 ac wifi standard) and many others might fall out of design. For each standard listed, also provide a brief justification.

Create and maintain a software design description or design document as indicated by Institute of Electrical and Electronics Engineers (IEEE) standard IEEE 1016. This document will be used for recording design information, addressing various design concerns, and communicating that information to the design's stakeholders in the form of data design, architectural design, interface design, and procedural design.

Create a software requirements specification (SRS) set forth by IEEE 830. This will entail a document that lays out functional and nonfunctional requirements. The requirements document will be updated as needed as the project progresses, and the requirements evolve.

When making software based tests of any component of this project, following the standard set by Internal Organization for Standardization (ISO), International Electrotechnical Commision (IEC) in ISO/IEC/IEEE 29119 any tests will be properly defined, operated, and documented. This will entail creating sound tests that will be recorded in documentation.

1.4 Intended Users and Uses

Who benefits from the results of your project? Who cares that it exists? How will they use it? Enumerating as many "use cases" as possible also helps you make sure that your requirements are complete (each use case may give rise to its own set of requirements).

Our primary users would be the users of the original cable packing application, our secondary users would be those involved in the process of packing and installing underground cable packages that have a use and access to this software, and anyone else that would be involved in or interested in the management of underground cable packing would be our tertiary users.

Alliant Energy and Iowa State University's Electric Power Research Center (EPRC) being the clients of the project; act as the primary users of the resulting software. Along with the secondary users of underground cable contractors, and anyone with access to the web tool that would want to use the product acting as the tertiary users of the resulting project.

Our application is designed to act as a standard for the cable packing industry to remove guesswork and create consistency. Our primary users would be able to reference our tool to calculate a consistent price based upon the cables involved that shows both sides how the calculation was made. Additionally, a by-product of showing the cable packing is that contractors would be able to determine the best fit for arranging the cables before they lay them down.