Matroids in Julia

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<u>Description:</u>
We intend to create a matroids package for Julia.

<u>Motivation:</u>
Matroids are an intriguing area of combinatorial mathematics with multiple applications. While Julia has many packages for different areas of mathematics (including graphs, differential equations, etc.), it currently has no package for matroids. As far as we have discovered, there are very few packages implementing matroids in any programming language; the one we are most familiar with is included as part of SageMath.

There is a lot of potential for computational investigations to benefit matroid research. In fact, some current results are limited by computational barriers, and by providing operations on matroids in a fast language like Julia may allow us to discover new and exciting results!

<u>Deliverables:</u>
- A Julia package `Matroids.jl` that implements a matroid structure and basic operations on matroids, including
    - Multiple methods of construction including validity checks
    - Rank
    - Duality
    - Isomorphism
    - Contraction and deletion
    - Characteristic polynomial
    - etc
- Full documentation of public methods included in the package, via HTML

<u>Tools:</u>
We plan to use:
- Github and git for version control.
- The Julia programming language.
- Documenter.jl for documentation and doctests
- LightGraphs.jl for integration with graphs
- Probably using packages like LinearAlgebra.jl and DataStructures.jl