CS433, Spring 2025
Homework: Matter

This is an **individual** assignment. Submission is through Gradescope. You can submit a scanned version of this document, a computer edited version, or simply paper with the answers. Please be careful to ensure that answers are labeled and legible.

The goal of this homework is to interact with the Matter specification, particularly the Application Clusters, and consider how they would apply to IoT devices. Some of this is going to be subjective and will be graded based on effort, rather than exact answers.

This shouldn't be too bad, but you're definitely going to need to skim through the table of contents first and then some of the sections that seem to apply. If you run into issues on this homework, please reach out to the professor!

Matter Resources

- Overview of Matter data model: https://developers.home.google.com/matter/primer/device-data-model

- Matter specifications
    - The Matter Application Cluster Specification v1.4 holds most of the information you need for this homework. It contains chapters collecting related Clusters, and sections describing each of those Clusters in detail.
        - You should skip the "General" Clusters in Chapter 1, but the rest of this is very useful!

    - The Matter Core Specification v1.4 explains the Matter standard in great detail. It's long, but luckily, you're not going to need almost any of it.
        - Chapter 7 describes the Data Model Specification. The most useful subsections are 7.2 "Data Qualities" and 7.3 "Conformance" which help you interpret the information in the Application Cluster specification.

    - For completeness, the final matter specification is the Matter Device Library Specification v1.4, which documents required Clusters for certain device classes. While it sounds useful, it mostly just specifies that the device uses the Cluster that shares the name with it.
        - You won't need this document for this assignment.

Q1: Example Matter Device [40pts]

Given the following device design, determine the Clusters, Features, and Attributes that would apply to it.

Product:

A roll-up window shade that is controlled by a motor with an encoder such that it can sense how much it has turned (and therefore the position of the shade). For example, something like this: https://www.theverge.com/2019/10/3/20893709/ikeas-smart-blinds-review-fyrtur-kadrilj (which Ikea has annoying recently retired)

The window shade additionally has a light sensor capable of measuring the external light. (The Ikea one doesn't, but it makes this more interesting.)

1. What Cluster(s) should the product support as a server? Do not include "General" Clusters from Chapter 1 of the documentation.

2. Within each Cluster, if that Cluster has features, determine which features are supported given the actual, real-world capabilities of the device.

3. Within each Cluster, determine which Attributes MUST be included. Only include Attributes which are either mandatory by default or mandatory due to configuration.

4. For any three of the attributes above, determine a possibly valid value the attribute could take.

Q2: Example Matter Controller [20pts]

Consider a controller for the device described previously.

1. Which commands MUST the controller support?

Q3: Choose-your-own Matter Device [40pts]

Given the following device design, determine the Clusters, Features, and Attributes that would apply to it.

Product:

This time you choose a real-world product. It can't be a window shade again. Don't feel like you've got to pick something too complicated.

Some places for inspiration:

- Ikea Smart Home Devices: https://www.ikea.com/us/en/cat/smart-home-hs001/
- Lutron (go to "Products" drop-down): https://www.lutron.com/en-US/pages/default.aspx
- Resideo: https://www.resideo.com/us/en/products/
- Some random Smart Home device you already own

1. What Cluster(s) should the product support as a server? Do not include "General" Clusters from Chapter 1 of the documentation.

2. Within each Cluster, if that Cluster has features, determine which features are supported given the actual, real-world capabilities of the device.

3. Within each Cluster, determine which Attributes MUST be included. Only include Attributes which are either mandatory by default or mandatory due to configuration.

4. For any three of the attributes above, determine a possibly valid value the attribute could take. (If you have less than three attributes, do whatever you have.)