MIME101 // CS160 Midterm and Final Report Assignment Guide

Fall 2018

Overview

Design teams are required to submit midterm design proposals and final design reports regarding their final pill sorting design. The midterm design proposal is due Week 7 of the Fall 2018 term, and the final report is due during Week 10. The purpose of this handout is to provide students with a comprehensive outline of both the midterm proposal and final report. Additionally, this handout outlines the grading rubric for the assignments, and provides students with section descriptions and general technical writing guidelines.

Required section outlines for both the midterm proposal and the final report can be seen below. Note, the structure of the final report should closely reflect that of the midterm proposal. However, as should be expected, the final report should have more in depth discussion of technical material. Additionally, the final report should include a completed test sheet (if teams decide to include one in the midterm), results and conclusions of final design, and a section for proposed design improvements on the project.

Midterm Proposal Outline

The outline listed below is the minimum requirement for the midterm design proposal. Meaning, the midterm design proposal must have **at least all of** the sections listed below (besides the experiment sheet which is not required). Teams may add sections or subsections they feel necessary.

1. Title Page
2. Table of Contents
3. Introduction
4. Background
5. Social Justice Design Criteria (Parts A and B)
6. Technical Descriptions
    a. Hardware
    b. Software
7. Gantt Chart
8. Design Economics (Bill of Materials)
9. Outline of Experiment Sheet (encouraged, but not required)
10. References
11. Appendices

Final Design Report Outline

The outline listed below is the minimum requirement for the final design report. Meaning, the midterm design proposal must have **at least all of** the sections listed below. Teams may add sections or subsections they feel necessary.

1. Title Page
2. Table of Contents
3. Introduction
4. Background
5. Social Justice Design Criteria (Parts A and B)
6. Technical Descriptions
    a. Hardware
    b. Software
7. Gantt Chart
8. Design Economics (Final Bill of Materials)
9. Completed Experiment Sheet (encouraged, but not required)
    a. Results and Conclusions of test (encouraged, but not required)
10. Results and Conclusions of Project
11. Future Work
12. References
13. Appendices

Outlined Sections and Grading Descriptions

Title Page:

Technical reports must include a title page. The title page should include a clear and relevant title, due date, section number and team number.

Table of Contents:

The Table of Contents is required for technical reports. The table of contents should be a clear and accurate list of page numbers pertaining to the required sections of the report. The table of contents is meant to give readers a fast and accurate reference to where information is within the report.

Introduction:

In a paragraph or two, describe the problem scope, list quantifiable (whenever possible) design requirements, and introduce the solution briefly. Note, it is required to provide quantifiable design requirements and objectives in a tabulated format with respective importance (see simply example below). Note, design teams will have to create their own design requirements and tabulate as shown.

Table 1. Example Boeing 787 Design Requirements

Design Criterion	Criterion Description	Importance
Fuel	Aircraft must be able to hold enough fuel to complete 9,032 mile (longest known non-stop flight) flight non-stop	Essential
Capacity	Aircraft must be capable of flying at least 242 passengers	Essential
Fuel Efficiency	Aircraft must operate at efficiency equal to or greater than 94 mpg per passenger.	Great Importance
Appearance	Aircraft must have aerodynamic appearance in order to satisfy investors and improve market share to greater than competitor Airbus A350	Important
Noise and Vibration	Aircraft must provide passengers with a 8/10 comfort level with regard to noise and vibration as dictated by statistically significant passenger surveys	Important

Background:

The background section of the technical report should first describe **why** the problem is important, and why the reader should care. Secondly, the background section should bring the reader up to speed on existing solutions to the problem; this may include existing pill sorting mechanisms on the market, and how the final project design improves the existing technology. The background discussion may include descriptions of commercial products, academic research, or patents.

Technical Descriptions:

This section describes, in great detail, the proposed design. This section will be more extensive than the brief introduction to the solution, therefore, it is recommended to use subsections to guide the reader through the solution most effectively. The technical description should start with a high-level view of the design, and then describe major design components and systems in detailed, but concise, subsections. This section should contain in-depth discussions of both the hardware and software components of the design.

Gantt Chart:

Teams are required to create and manage a Gantt chart throughout the term. The Gantt chart should designate action items to team members and set concrete timelines for completion of action items. Action items should cover all responsibilities from administrative tasks (meeting scheduling, time line manager, etc.), to major technical tasks (pill hopper designer, existing pill sorting technology researcher, etc.). Gantt charts should reflect the guidelines given in lecture. For Gantt chart support, see link.

Design Economics:

Economic analysis of the design work is required. Teams are required to submit a Bill of Materials to be turned in with their reports which should list the cost of **all materials** used including Lego and Cozmo components. In the case of the midterm proposal, the bill of materials should be as detailed and accurate as possible. Bill of materials are to be presented in a tabular and professional format. The final design report should include exact bill of materials data for final grading purposes. Both the midterm proposal and the final report should include discussion of major cost elements, and which areas the team may cut cost in future work. Please see the cost sheets uploaded to Canvas for specific material costs.

Experiment Sheet:

This section is **encouraged, but not required**. Students are encouraged to create original design test sheets. These test sheets should attempt to set quantifiable performance metrics with regard to the final design. For example, the final design competition requires students to successfully sort as many pills as possible into correct containers in three minutes. Therefore, a valuable metric to test and calculate would be average time required to sort a pill successfully into the correct colored container. Teams are encouraged to submit a blank test sheet with the midterm proposal in order to establish key metrics for the final test. Teams are then encouraged to perform tests (outside of lab time) and complete their experiment sheets for turn in with the final design report. Note, the test sheet within the final design report may be slightly different based on midterm feedback and overall design changes. The final design report should include results and conclusions based on test results, if the team decides to complete this portion. It is important for teams to review their design objectives (see *Introduction* section) when creating experiments and when discussing the experimental results.

Results and Conclusions:

The final design report must contain a section dedicated to results and conclusions pertaining to the final design. This section must address teams' design requirements and if/how well they were met by the final solution. This section should be an honest

description of the strengths and weaknesses of the final design, including a reflection of the design process. The results and conclusions should address the design criteria set by the team in the introduction section of the report.

Future Work:

Within the future work section, teams should state how the project would best progress if more time was allowed. These next steps should be concrete and descriptive, and should link to the shortcomings discussed in the *Results and Conclusions* section of the report. It is helpful for teams to imagine that they submitting these reports to their boss; answer questions such as where should the company take the design next, what portions of the design can be streamlined, etc.

References:

The references section should be a list of references cited in the report. Students are required to use ASME style referencing. Finally, references must be from reputable sources; teams will be penalized for using non-reliable sources such as Wikipedia.

Technical Writing Guidelines

Engineers and computer scientists are well-informed on a variety of complicated technical subjects. However, many struggle with communicating via technical documentation. Developing an expertise in technical writing is essential for today's professional. This section will outline strategies for successfully composing a technical document.

Writing Style:

1. Voice: reports should be written in either a passive or active voice; pick whichever sounds more natural and stay consistent with the voice selected. Additionally, personal pronouns such as "I" and "We" should **not be used**. Instead, substitute in "The project lead" or "the team", etc.
    a. Passive example: "The ultrasonic sensor was selected due to the…"
    b. Active example: "The team selected the ultrasonic sensor due to the…"
    c. Personal pronoun (Bad): "**We** chose to incorporate Cozmo because…"
    d. Alternative nouns (Good): "**The team** chose to incorporate Cozmo because…"

2. Tense: Use past tense to describe what you did or what you found. Use present tense to describe things that were known before the project.
    a. Past tense example: "The prototype was tested…"
    b. Present tense: "Lego Mindstorms are used today for various educational…"

3. Clear and Concise: Technical writing must be clear and concise.

4. Separating Ideas: Divide information into small manageable sections using headings and subsections where possible. This makes it easy for the reader to find specific information by way of an accurate table of contents.

5. Figures, Tables, and Equations: Technical reports almost always have figures, tables, and equations. Students are required to reference figures, tables, and equations in text in a professional manner; for an example, go open any engineering textbook in the library and find references. They say a picture is worth 1,000 words. This is true in engineering as well when a figure or table is introduced and explained clearly and concisely. Clearly sharing information using figures and tables is essential in almost all areas of technical industry. Titles for figures should be centered **below** the figure, whereas titles for tables should be centered **above** the table.

Format:

1. Page numbers: the main body of the reports should have continuous page numbers (title page through references). Additionally, appendices should reset the page count and should start with Appendix A on page A-1, and Appendix B on page B-1, etc. Page numbers should be centered on the bottom of the page.

2. Margins: 1-inch margins, single spacing, blank line between paragraphs, size 11 times new roman font.

Midterm Proposal Grading Breakdown:

Grading Criterion	Percentage of Total Grade
Title Page	5%
Table of Contents	5%
Introduction	10%
Background	10%
Technical Descriptions	20%
Gantt Chart	10%
Design Economics	20%
Outline of Experimental Sheet (Optional)	N/A
References	10%
Technical Writing Quality	10%

Final Report Grading Breakdown:

Grading Criterion	Percentage of Total Grade
Title Page	5%
Table of Contents	5%
Introduction	5%
Background	5%
Technical Descriptions	20%
Gantt Chart	10%
Design Economics	20%
Completed Experimental Sheet (Optional)	N/A
Project Results and Conclusions	10%
Future Work	5%
References	5%
Technical Writing Quality	10%

----------Final Report Grading Rubric for Instructional Use----------

Title Page:

- Title (1 %)
- Team number (1.5 %)
- Section number (1.5 %)
- Date of submission (1 %)

Table of Contents:

- Formatting and appearance (2.5 %)
- Consistency with report (2.5 %)

Introduction:

- What is the problem scope? (1 %)
- Includes Brief introduction to solution (1 %)
- Includes Design requirements table (3 %)
    - Formatting
    - Clarity and relevance of requirements—what defines a successful design?

Background:

- Why is the problem important? (2 %)
- Where does current technology stand related to the design? (2 %)
- Quality references (1 %)
    - Reference formatting

Technical Descriptions:

- High level view of the design (5 %)
- Descriptions of major design components/systems:
    - Hardware components (7.5 %)
        - Lego (if used)
        - Cozmo (if used)
        - Pill hopper
        - Any additional hardware material
    - Software systems (7.5 %)
        - Search algorithms high level view
        - Search algorithms in detail
        - Any additional programmed material

Gantt Chart:

- Formatting and appearance (5 %)
- Action items (5 %)
    - Administrative action items
    - Technical action items
    - Dates for action item completion

Design Economics:

- Bill of materials (10 %)
    - Formatting and appearance
    - All Lego components used
    - Cozmo
    - Final cost
- Where can the team cut cost? (10 %)

Experiment Sheet (Optional):

- Do the tested metrics relate to the design requirements set by the team?
- Results and conclusions of testing

Project Results and Conclusions:

- Does the design satisfy the design requirements? (5 %)
- Describe the shortcomings of the design (5 %)

Future Work:

- How can the team improve the design?
    - Economic improvements (1 %)
    - Hardware improvements (2 %)
    - Software improvements (2 %)

References:

- Formatting (ASME) (2 %)
- In text citations in line with references section (1 %)
- Valid references (i.e. not Wikipedia) (2 %)

Technical Writing Quality:

- Writing style (5 %)
    - Voice
    - Tense
    - Clear and concise
- Formatting (2.5 %)
    - Use of subsections
    - Page numbers
    - 1” margins
    - Single spacing

- Times new roman size 11

- Tables and figures (2.5 %)
  - Formatting
  - Relevant information
  - Clear and concise discussion of data

----------Midterm Report Grading Rubric for Instructional Use----------

Title Page:

- Title (1 %)
- Team number (1.5 %)
- Section number (1.5 %)
- Date of submission (1 %)

Table of Contents:

- Formatting and appearance (2.5 %)
- Consistency with report (2.5 %)

Introduction:

- What is the problem scope? (2.5 %)
- Includes Brief introduction to solution (2.5 %)
- Includes Design requirements table (5 %)
    - Formatting
    - Clarity and relevance of requirements—what defines a successful design?

Background:

- Why is the problem important? (4 %)
- Where does current technology stand related to the design? (4 %)
- Quality references (2 %)
    - Reference formatting

Technical Descriptions:

- High level view of the design (5 %)
- Descriptions of major design components/systems:
    - Hardware components (7.5 %)
        - Lego (if used)
        - Cozmo (if used)
        - Pill hopper
        - Any additional hardware material
    - Software systems (7.5 %)
        - Search algorithms high level view
        - Search algorithms in detail
        - Any additional programmed material

Gantt Chart:

- Formatting and appearance (5 %)
- Action items (5 %)
    - Administrative action items
    - Technical action items
    - Dates for action item completion

Design Economics:

- Bill of materials (10 %)
    - Formatting and appearance
    - All Lego components used
    - Cozmo
    - Final cost
- Where can the team cut cost? (10 %)

Experiment Sheet (Optional):

- Do the tested metrics relate to the design requirements set by the team?
- Results and conclusions of testing

References:

- Formatting (ASME) (4 %)
- In text citations in line with references section (2 %)
- Valid references (i.e. not Wikipedia) (4 %)

Technical Writing Quality:

- Writing style (5 %)
    - Voice
    - Tense
    - Clear and concise
- Formatting (2.5 %)
    - Use of subsections
    - Page numbers
    - 1” margins
    - Single spacing
    - Times new roman size 11
- Tables and figures (2.5 %)
    - Formatting
    - Relevant information
    - Clear and concise discussion of data