

Problem Definition Report Requirements

ES 1050: Foundations of Engineering Practice

Each team will prepare and submit a written report as described below.

1 Purpose of the Problem Definition Report

The Problem Definition Report will document your team's work and outcomes of Empathy and Define stages of the Design Thinking process setting the stage for Ideation, Prototyping and Feedback stages. A MS Word template is provided with the overall expected structure of the Report but **make sure to review the following material to be clear on the expected contents of each section.**

Students are expected to adhere to the layout and content guidelines even if an alternative word processor is used. An absolute requirement is that the team report shall be prepared using an 11 or 12-point font size, single line spacing and must have no more than **8 pages maximum** excluding title page. ***The report can be in the first or third person, so long as it is consistent throughout.*** Make sure you have a single person edit the final version to ensure a consistent writing style. Any figures included should be of high resolution and easy to understand.

2 Requirements

The report must have 3 sections (see the template):

1. Needs Statement and Insights
2. (Engineering) Design Criteria
3. Concept Selection Summary

2.1 Need Statements and Insights

A Need Statement Worksheet has been provided for use during the project. This worksheet is meant to guide your need statement iteration and **should not be submitted**. The Need Statement section of your report should capture some of the outcomes from the worksheet (and NOT restate the contents of the whole worksheet). In particular, we are looking for you to highlight the links between your insights, how your Need Statements evolved, and the current, best Need Statement:

- State 3 progressively more refined Need Statements underlining the change from the previous Need Statement
- Provide a 2-3 sentence description of the insight(s) and source of that insight (e.g. independent research, client meeting, client questions and answers forum, team reflection ...) that led to the change in the presented Need Statement
- Some teams may have multiple statements for clarity for different users; if so, stick to showing the evolution of one of the Need Statements.

2.2 Design Criteria

In this section you present the engineering criteria that is used to assess the merit of different concepts and the quality of your designed solution. Remember, collectively the objectives and constraints should not presuppose solutions, nor should they be so generic that they could apply to anything from how to support someone's head resting on a pillow to sorting coins. Make sure that the overall design criteria capture some essence of the

targeted outcome, e.g. something about reducing bird deaths from impacting windows or supporting winter crops. It should be clear how these belong to the Project Need Statement.

1. List your Design Objectives **and** include the normalized weighting for each (from your Objective Ranking matrix as covered in the Concept Selection workshop).
2. Indicate how the objective will be measured and compared across candidate implementations (e.g. temperature using a thermometer, response times based on video recordings, aggregate user ratings from surveys ...).
3. List Design Criteria, both Objectives and Constraints, and how they will be verified as satisfied.

Recall that:

In the preliminary stages, Objectives and Constraints should be solution independent yet still specific to the problem as they reflect all aspects of the Need Statement. This means that your team **should not** include “solution-specific” aspects (avoid the HOW) in the initial listing of objectives or constraints. Instead, your objectives and constraints should be driven by solution outcomes, i.e. performance or attributes, required to satisfy the NEED.

Design Objectives cover what the design solution will aim to accomplish (with various degrees of success). Objectives are attributes in a solution we want **more of** (faster, stronger, lighter, more powerful, cleaner ...) or **less of** (cheaper, less polluting, less noisy, smaller, lighter ...). **Note** that some objectives will be measured differently depending on the how solution concepts operated. In these cases, try to offer a couple of evaluation options to remain solution independent. Other objectives like “easy to hold” or “intuitive to use” will not be easy to quantify in general so consider higher level approaches for comparing which of two solutions better satisfies the objective.) Don’t forget things like convenience, efficiency, size, portability, cost, durability, etc.

Design Constraints cover what a solution **MUST** satisfy. Constraints are not ranked because they all must be met, otherwise the solution is not acceptable. Violation of any constraint eliminates a solution concept from consideration unless it can be remediated. Things like safety, cost, size, weight, speed all tend to have limits we cannot compromise. If you find your solution fails to meet a constraint, but it is still viable without alteration, that is a clue that your 'constraint' may actually be an 'objective'.

2.3 Concept Selection Summary

This section should document how your team settled on the concept they choose to go forward with to date, or rather, how the other concepts were filtered out. (Note: Future iterations may change your final conceptual approach and that is okay.) Complete the table in the report template to:

- List all your concepts (giving them descriptive labels – or use a simple illustration).
- Indicate the concept selection filter used to eliminate the concept **AND** give the reason the concept was eliminated or not selected.
- Close the section by indicating what the winning and second-best concept was and discussing how the winning choice was superior to the second best.

3 Report Evaluation Criteria

The following basic grading breakdown will be applied.

Section / Categories	Name	Weight
1	Need Statements and Insights	30
2	Design Criteria	30
3	Concept Selection	20
Format and presentation	Clarity and Grammar	10
	Format and Presentation	10
Total		100

For all sections see the template for more details of formatting, content details and presentation.

		Weight	Unacceptable [0, 1, 2, 3]	Below expectations [4, 5]	Meets expectations [6, 7, 8]	Exceeds expectations [9, 10]	Score [0-10]	Weighted Score
Need Statements and Insights	Progressive Need Statements	30	Needs Statements poorly stated, missing the highlights or other requested formatting. Little effort evident to clearly indicate the Users, Need(s) and Insights. Missing or unacceptable insights or sources of those insights.	Needs Statements are vague in stating user, need or insights. Requested formatting missing in some places. Insight(s) driving the change or its source vague or weakly presented.	Needs Statements presented as formatted (coloured) in the worksheet with changes underlined. Effort shown in generating Need Statements with clear indication of Users, Need(s) and Insights. Driving insights and their sources clearly presented.	Exceptional Needs Statements, coloured with clear and well stated indication of Users, Need(s) and Insights. Changes underlined. Insights and their sources exceptionally presented.		
	Supporting Insights							
Problem Definition	Design Objectives	30	Substantially incomplete, ambiguous, poor or unrelated to need design objectives and constraints. Missing or erroneous indication of how concepts would be assessed or compared based on objectives, or for measuring adherence to constraints.	Weak, somewhat ambiguous, incomplete, or poorly linked to the need design objectives and constraints. Poor or somewhat erroneous indication of how concepts would be assessed or compared based on objectives, or for measuring adherence to constraints.	Appropriate, need related, design objectives and constraints with minimal ambiguity. Acceptable indication of how concepts would be assessed or compared based on objectives, and clear measures for constraints.	Excellent and unambiguous, need related, design objectives and constraints covering even minor details with minimal ambiguity. Practical and clear indication of how concepts would be assessed or compared based on objectives, and clear measures for constraints.		
	Design Constraints							
Concept Selection Summary		20	Very weak concept labels or illustrations. Reasons for elimination are unacceptably vague or unconvincing. Missing or unsatisfactory comparison of the final surviving concept to the second-best concept.	Weak concept labels or illustrations. Reasons for concept elimination are often vague or unconvincing. Weak comparison of the final surviving concept to the second-best concept.	Concept labels or illustrations are generally evocative. Reasons for elimination are clearly and concisely stated. Effective contrast/comparison of the final surviving concept to the second-best concept.	Exceptionally concise yet understandable listing of solution candidates along with excellent reasons why eliminated. Outstanding comparison/contrast of the final two concepts.		
Format and Presentation	Clarity and Grammar	10	Numerous spelling or grammar errors. Ideas are incoherent with much material missing. Incorrect or unclear technical language or the use of significant jargon.	Some spelling or grammar errors. Ideas are not entirely coherent but cover the basics of the topic. Technical language is sometimes unclear or inappropriate and contains some jargon.	A few spelling or grammar errors. Ideas are coherent, and complete. Technical language is clear, succinct, jargon-free, and is appropriate to the audience.	No spelling or grammar errors. Ideas are clear and concise, flow of report is logical and provides all the details that the reader needs. Individuals with different technical background can follow all presented content.		
	Format and Presentation	10	So many format errors as to make report ineffective. Unacceptable appearance e.g., tables and figures cannot be read or understood, fonts difficult to read, style unclear.	Some format errors. Some figures are sloppy and difficult to read, style needs improvement. Fonts difficult to read; style is weak.	A few format errors. Text, tables, figures readable and understandable, style is acceptable.	Followed specified format. text, tables, figures so clear and understandable as to enhance report impact, style enhances readability.		