Lab Title: Defining Problem Statements, Needs Statements, and Requirements

Submission Type: Team Submission, 3-4 page memo

Learning Objectives:

1. Use interview data to write a problem statement and needs statements.
2. Define solution neutral system design requirements that will inform the design solution.
3. Develop a project management plan to guide your final project
4. Practice writing memos

Scenario:

For the final project, imagine that you are a research and development team that is part of a small medical device company or startup, and there are several other teams working on other products. You are hoping to get your project approved and funded by upper management (the ROB204 technical professors and your discussion leader). The company name, your budget, and the timeline for your project are up to you.

In the project's present stage, management is aware that you have done some initial research, and they would like more information about the needs and requirements of the robotic system you are working on, and about your project management plan.

Introduction:

The first goal of this lab/discussion is practice **collaborating effectively in diverse teams**. Students are expected to foster an inclusive team environment where all team members are heard and valued. This memo is an opportunity to 1) reach a consensus on your overarching goals for the semester, 2) practice communicating clear expectations for yourselves and each other, and 3) anticipate potential conflicts and establish a plan for handling them. Teams that articulate clear expectations, practice open communication, and establish accountability structures from the beginning will likely encounter fewer interpersonal problems later in the semester.
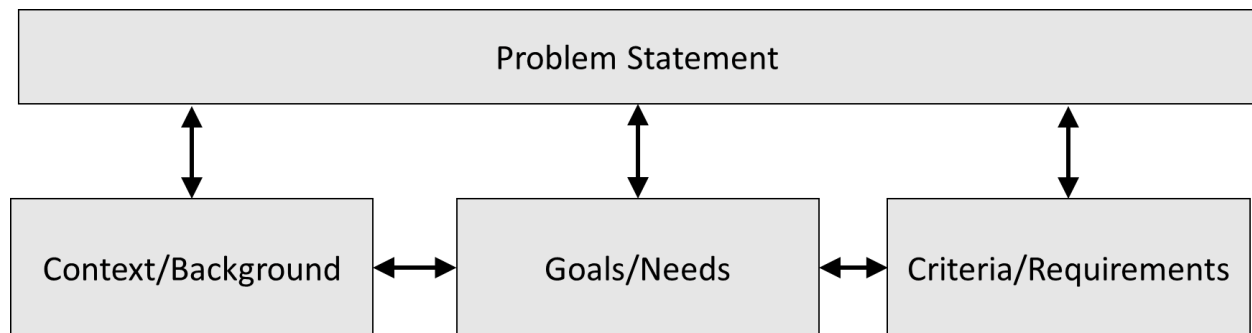
The second goal of this lab/discussion is to use your preliminary research and interviews of the nurses **to define needs statements, requirements, and a problem statement**.

Needs statements are solution-neutral. This means they define the needs of the system without indicating any elements of a solution. The needs statement balances breadth and specificity by considering the operational design domain, which is a description of the specific domain or domains in which a system is designed to properly and safely operate. Finally, needs statements describe

measurable outcomes. While they do not indicate a solution to the problem, they do define metrics that the solution should strive to meet.

Requirements characterize the criteria that an acceptable solution to the problem must meet. Requirements are solution-neutral, like needs statements. However, they describe characteristics that a potential solution must have. Examples of functional (behavioral) requirements could include that the user shall be able to transport a specific supply, or shall be able to input destinations. Examples of non-functional (non-behavioral) requirements could include that the solution shall be cost effective, portabile, durable, etc.

A problem statement describes the challenges within the system and the opportunity space. Problem statements are made up of one or more needs, while also considering the criteria and/or requirements of the system. Operational design domains are important to scope the needs statements and provide relevant contextual or background information. Creating problem statements from the emergent needs helps designers to start the ideation process. Embedded within the problem statement are the context of the problem (the background), the goals of a solution (the needs), and the criteria of an acceptable solution (the requirements).

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│                        Problem Statement                          │
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        ↕                        ↕                        ↕
┌──────────────────┐   ┌──────────────────┐   ┌──────────────────┐
│ Context/Background│←→│   Goals/Needs    │←→│Criteria/Requirements│
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Part 1: Begin your memo

The first part of responding to any rhetorical situation is making sure you understand it. With your team, read through the scenario described above, and perhaps skim the final project handout, and write the memo header and foreword for your memo based on what you understand to be the problem or opportunity you're responding to and the purpose of this memo.

Part 2: Develop a project management plan

As a group, discuss what you learned in the guest lecture on project management, and consider the following questions. For now, discuss things in terms of the real-life class project, rather than the project scenario.

- **Goals:** What are your teams overarching goals for this project? Are there minimum goals and stretch goals?
- **Meetings:** When and where will you meet? What are the attendance expectations? What will you do if a team member misses a meeting? How will you determine if additional meetings are

needed, and what will they be? What are appropriate and inappropriate behaviors during meetings and team work time?

- **Communication**: How will you communicate when you're not in the same place? What are the expectations around communication? What will you do if someone is not communicating as expected?
- **Decision making:** How will you make decisions as a group?
- **Task/role assignment:** How will you determine who does what? How will you hold each other accountable for completing tasks? What tools/software will you use to manage tasks?
- **Documentation:** How will you keep track of decisions, meeting notes, etc.?
- **Conflict resolution:** How will you handle disagreements? What will you do if disagreements turn into conflict?

Once you have discussed the above prompts and are satisfied that you agree on your major goals and addressed any potential challenges, add a section to your memo that explains, at a minimum, when and how you will meet, how you will communicate remotely, how you will make decisions, how you will assign and manage tasks, and how you will resolve conflicts.

Note: Everything in the memo should fit the scenario, so if, for instance you want to mention the teachers, you can refer to us by the titles you use to identify us in the To and cc. lines of the memo header. If you want to differentiate between your IAs and the faculty, for instance, you could give us different titles, and then use those titles accordingly.

Part 3: Define needs statements

Now begin discussing what you learned through your preliminary research and the interviews you conducted with the nurses. Look through the themes you identified in your Lab 8 submission. **Work as a group to decide on a theme you would like to work towards for your final project,** and then complete the following steps.

1. What is the operational design domain for your needs statements? I.e., where will the system be used? Who will be using it?
2. Draft five needs statements.
3. With your group, peer review the needs statements that you drafted.
   a. Are they solution-neutral?
   b. Do they balance breadth and specificity?
   c. Do they describe measurable outcomes?
4. Revise the needs statements.

In your memo, include the operational design domain, your original needs statements, a summary of your peer review discussion, and your revised needs statements. You should also cite at least three credible sources of information, and the needs statements are a place where it may make sense for you to do this (e.g., citing studies on problems that nurses face).

Part 4: Define requirements

In your team, select two of the needs statements to consider further. Specify design requirements that your solution must consider by reviewing the challenges communicated by the nurses. **For each needs statement:**

1. Write two functional requirements that specify what the system must do (behavioral requirements that start with "The user shall…").
2. Write two non-functional requirements that specify qualities the system must have (non-behavioral requirements that start with "The solution shall be…"). for at least 2 needs.

As stated above in Part 4, you should cite at least three credible sources of information, and the needs statements are one place to do that. However, you may also want to cite sources to support your requirements (for instance, if one of your requirements is that the solution must be under a certain width in order to fit through hospital doors, you could cite a source that gives the minimum door width in hospitals).

Part 5: Write a problem statement

With your team, formulate a problem statement. Work together to select the needs statements that you will include and the requirements that you will consider. Then write a problem statement in paragraph form that provides the **context** for your selected challenge, the **needs** you will address, and the **requirements** that should be met.

Part 6: Organize your memo, add graphics, write a summary, and add a letterhead

This handout is organized according to the order in which we would like you to carry out the lab/discussion, *not necessarily* the order in which you should organize your memo. At this point, decide on the order in which you want to present all of the parts of the memo; what section and subsection headings to use; where to add paragraph breaks; what content needs to be omitted, expanded, or made more concise; etc.

At this point, you should also consider what ideas in the memo could be supported by (or turned into/replaced with) graphics, and implement these graphics in the memo. You need at least one graphic (chart, table, or other) in the memo, but you are welcome to include more than one. Remember to reference the graphic by name somewhere in the text of your memo, and follow best practices for visual design from the lectures.

Once you're mostly done writing the rest of the memo, begin writing the summary of the memo. Make sure to include all relevant key information and that it matches the body of the memo. If you make any changes to the body of the memo later on, remember to check the summary and make sure it still matches.

Develop a letterhead that includes a graphic of some sort and your company name, and put it at the top of the first page.

Deliverables:

The following should be included in your 3-4 page memo:
1. From Part 1, provide a memo header and foreword.
2. From Part 2, provide a section documenting your project management plan.
3. From Part 3, provide your original needs statements, your selected operational design domain, a summary of the feedback you received, and the updated statements after group discussion.
4. From Part 4, provide the needs statements further assessed and the requirements you and your peers discussed. Justify why they were selected.
5. From Part 5, provide the final problem statement your team developed. Make sure the operational design domain is clearly articulated.
6. From Part 6, provide a summary, at least one graphic, and a letterhead

Ensure that your memo is effectively organized with your audience's interests in mind (i.e., not necessarily in the order you wrote them). Somewhere in your memo, provide citations to at least 3 sources of information and at least 1 graphic. Review the Formatting & Style Guide and the Citations & References Guide, which can be found in the Additional Resources folder in the Files in Canvas.

Technical Grading Rubric
The following rubric will be used to grade your submission.

Required Deliverables	Points
Part 1: There is no technical deliverable for this part	N/A
Part 2: A complete project management plan is provided.	6 pts for a project management plan that includes meetings, communication, decision making, task/role assignment, documentation, and conflict resolution.
Part 3: The operational design domain is described. The original needs statements are provided, with edits aligned with the group discussion. The needs align with the design domain.	4 pts for original needs statements (Must be written with the "How might we" phrasing) 4 pts operational design domain described and appropriate 4 pts for summarizing peer review

	discussion for own questions 4 pts for edits that align with the three stated goals (solution neutral, balance breadth/specificity, describes measurable outcomes)
Part 4: Functional and non-functional requirements are presented that are solution neutral and align with the needs. Justification provided for selection.	16 pts total - 2 pts for each requirement (1 pt for requirement, 1 pt for category justification)
Part 5: A problem statement in paragraph form is provided that contains context, needs, and requirements. The problem statement is solution-neutral and the operational design domain is clear and appropriate.	12 pts for problem statement (3 pts for problem statement context, 3 pts for problem statement needs, 3 pts for problem statement requirements, 3 pts for clear operational design domain)
Total Points Available	50 pts

Technical Communication Grading Rubric
The following rubric will be used to grade your submission.

Required Deliverables	**Points**
Overview: A memo header is provided that follows the scenario and includes a subject line which identifies the topic and purpose of the memo. A foreword is provided that effectively follows the problem-task-purpose format. The problem statement immediately identifies the problem or opportunity prompting you to write this memo, not the problem facing nurses or the mission of your company.	6 pts total: 1 pt for header 3 pts for foreword 2 pts for summary

A summary is provided that contains relevant key points from the memo and that matches the body of the memo.	
Organization: Memo shows evidence of thoughtful organization with readers' interests in mind. Section and paragraph breaks are used effectively.	2 pts
Graphic: At least one graphic is provided that is relevant, easy to read, and easy to understand, is properly captioned, and is integrated into the text correctly.	3 pts
Source use: Information from at least 3 high-quality sources is used in a way that is relevant, accurate, and unobtrusive. Citations and reference list are formatted according to course citation & reference guide.	5 pts total: 3 pts for citations 2 pts for reference list
Formatting: Memo is formatted according to course style guide.	2 pts
Clarity and sentence construction: Prose is clear and concise and shows evidence of editing and proofreading. Terms are used consistently.	2 pts
Total Points Available	20 pts