

Design-Thinking & Innovation Leadership for Engineers

H1 Final Exam

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Year: 2024

Question	Points	Score
1	5	
2	10	
3.1	10	
3.2	10	
3.3	10	
3.4	10	
3.5	10	
3.6	5	
3.7	10	
3.8	10	
3.9	10	
3.10	10	
Total	110	

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Question 1: Apple Watch Killer (5 points)

If we asked you to make a new smart watch that would be way better than the Apple Watch and push the Apple Watch out of the market, what would be the first thing you'd do?

Ask why we are making this new smart watch.
Why do we want to push the Apple Watch
out of the market ?

Question 2: From Class Lectures And Material (10 points total, 2 points each)

2A. Fill in the blank: "When evaluating if a design is good or bad, the most important thing to consider is the context."

2B. What is a morphological analysis?

A morphological analysis is a tool that helps examine and assess multiple facets of objects/products in the same category. and it could be used to help us better understand factors that make a product particularly successful.

2C. Briefly, in your own words, define ergonomics.

Ergonomics is the application of psychological and physiological principles to the engineering and design of products, it is human-centered and ergonomic products are more likely to increase their users' efficiency in a working environment.

2D. Why do we sketch?

Sketching helps articulate concepts and share ideas, and other people could quickly grasp the content and comment on the ideas.

2E. List the 10 steps of the 10-step design process that you learned in class, in correct order.

1. Needs & Assumptions Analysis
2. Research & Discovery
3. Stakeholder Analysis
4. Boundary & Hazard Mitigation
5. Specify Desired Outcomes
6. Concept Generation
7. Concept Downselection
8. Concept Articulation
9. Uncertainty Reduction
10. Stakeholder Testing

Question 3:

For the remainder of the test, you will be designing a solution for a given problem space (you have a choice of 3 design challenges to choose from). The objective is not to work on this exhaustively, instead you should aim to work on this exam for approximately 1 to 1.5 hours if you are working quickly and efficiently. However, if you would like to use more time you may feel free to do so. We are looking for you to demonstrate that you can effectively execute the design process using the tools we have given you in class.

Please choose from ONE of the following problem statements. You will be using this problem area as the context for the remainder of the test. If you are not familiar at all with a topic, you should choose the one that is the most familiar. **Please circle the problem statement that you will be using.**

1. **The Skiing Experience:** Redesign the skiing experience (from the perspective of owning and operating the mountain).

2. **Robot Companion:** Design a robot companion that works alongside the elderly to help them in their everyday lives.

3. **A Visit to the Doctor:** Redesign the experience of visiting a doctor. Consider how an improved visit to the doctor's office might look like in the future.

Question 3.1: Step 1 of the 10 Step Design Process (10 points)

What is Step 1: Needs & Assumptions Analysis

What are the underlying assumptions around the problem area you selected that you might challenge? What needs might a solution to this problem area address?

First ask why. Why do we need a robot companion to help the elderly? Why does the robot companion need to work alongside the elderly? Why can't we just have real people (ex. hiring professional helpers) to help the elderly?

- Assume the robot companion is being used to complete simple household tasks and provide company. What needs arise for such a robot?

Question 3.2: Step 2 of the 10 Step Design Process (10 points)

What is Step 2: Research & Discovery

How would you execute Step 2? (Be sure to consider how to leverage analogs).

Research what goes into designing such a robot companion, what would be the target customer for such a product?

How could we make this robot companion more intelligent and human-like? How do we make this robot companion actually helpful?

Will the elderly actually enjoy their companionship? Conduct market research and survey people to better understand the ideal robot type.

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Question 3.3: Step 3 of the 10 Step Design Process (10 points)

What is Step 3: Stakeholder Analysis

Conduct the analysis for this step for at least 8 items. Be sure to cover all 4 areas (2 items for each area minimally).

Users: the elderly,
kids, students, anyone who needs help and
companionship from a robot.

Approvers/Blockers: family members of those who
use our product,
law makers,
anti-tech people

Transformers: software engineers,
product design people,
robotics & HCI researchers

Suppliers: robot manufacturing factories,
big tech companies,

Question 3.4: Step 4 of the 10 Step Design Process (10 points)

What is Step 4: Boundary & Hazard Mitigation

List at least 4 items here (that is, 4 completed rows covering the 2 types).

Boundaries:

- ① pushback from interest groups that do not support robot companions
- ② additional training required for the elderly to "use" and work with the robots properly.

Hazard:

- ① Battery issue. Robots may not be able to work/help for a long time.
- ② Malfunction. Robots may cause physical harm to users when unexpected behaviors arise.

Question 3.5: Step 5 of the 10 Step Design Process (10 points)

What is Step 5: Specify Desired Outcomes

List at least 2 items for each category.

Intellectual objectives:

- ① robot companions function properly
- ② they are able to help with some of the tasks

Emotional objectives:

- ① the elderly enjoys the robot's companionship
- ② people become more accepting and welcoming of having robot companions at home.

Question 3.6: Concept Generation (5 points)

Vision Creation: Develop 2 concepts that could potentially be a solution to your problem, and briefly describe your 2 concepts in 2-3 sentences.

- ① A human-like robot that can converse with you and behave like an actual human being (think ex machina). It can do everything a human can and even more because it cannot feel pain.
- ② A simple 5-feet tall robot with four wheels and two "hands." It looks nothing like a human and it could perform basic tasks like chit-chatting, doing the dishes, folding the laundry etc.

Question 3.7: Step 7 of the 10 Step Design Process (10 points)

What is Step 7: Concept Downselection

Conduct an analysis of your 2 concepts here.

I'm leaning towards deploying my second concept because :

① having a human-like robot might be a little scary and confusing to the elderly. We don't want our customers to develop overt reliance and too much "emotional connection" with the robots. Also, developing such a robot would be extremely expensive.

② Deploying a simple design is economical and time-efficient. The robot-like robots can get the tasks done but also converse with the elderly like a friend. It's simple and efficient.

Question 3.8: Step 8 of the 10 Step Design Process (10 points)

What is Step 8: Concept Articulation

K-Script (10 points)

Think about a typical example of how people would experience your solution, then write a K-Script in the expected format to describe that example. The script should be approximately 10 lines. Label the columns.

User = U Robot Companion named Alice = A

who	Observable Action	Unobservable Action/Notes
U	"Hey Alice, good morning. How's the weather today?"	User gets up from bed, Alice slowly comes into the room
A	"Today is a sunny day with 5% chance of rain. The highest temperature is 45°F and the lowest is 23°F."	
U	"Could you help me do the laundry today? I have to go into the city to pick up some stuff later."	User walks into the bathroom and Alice stands outside of the bathroom
A	"Sure! Do you want your laundry ready by a certain time or should I go ahead and do it now?"	

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Question 3.9: Step 9 of the 10 Step Design Process
(10 points)

What is Step 9: Uncertainty Reduction

Construct a grid for step 9, provide at least 3 items for this step.

	(1-10) importance	(1-10) uncertainty	risk	mitigation strategy
battery life	9	3	27	more technical testing before launch
response from community	9	6	54	market research + survey to see the desired robot type
malfunction to cause physical harm	10	4	40	robust testing before launch + ask tech team to evaluate its safety and test it in a simulated environment.

Question 3.10: Step 10 of the 10 Step Design Process
(10 points)

What is Step 10: Stakeholder Testing

Describe how you would execute step 10 for your solution? Be specific about your plan, and the information you'd be looking to gather.

Test our robot companion^{model} in a simulated household environment and video-record its interactions with the elderly. Try to ask the robot to perform a variety of tasks and monitor failures. We'll also need to talk to the robot and have complex conversations to test its voice recognition and language generation abilities.

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Who	Observable Action	Unobservable / Notes
U	"Yeah that'd be great! Could you also start the car and heat it up for me? I want the car to be warm when I get in."	User is getting ready in the bathroom while Alice listens to their instruction.
A	"When are you leaving?"	
U	"In about 20 minutes."	
A	"Cool. I'll start your car in 15."	Alice goes into the laundry room and starts loading the clothes. 15 minutes later, Alice goes to the garage and starts the car.
U	"See you later, Alice."	After breakfast, User gets into the warm car and drives away.
A		Alice comes back to the laundry room and finishes doing the laundry. Alice goes

to her charging station
after the completion of
the task.

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