CptS 443: Human-Computer Interaction
Take-home Midterm Exam
Spring, 2021

132 points possible; worth 20% of course grade

Please read the following guidelines and rules before you begin this exam:

1. **The exam is open-book, open-notes, and open-internet**. However, you are required to cite all external sources you use to complete the exam. Direct quotes must be placed in quotation marks, with full citation information included after the quote. If you were inspired by a particular source in one of your solution responses, cite the source at the end of your response. Course materials can be cited by identifying the name of the lecture slides file where you found the information and the slide number (e.g., "L02-Norman-Concepts, Slide 7"). Websites can be cited using URLs. Citations for books, magazines and other materials that are not readily available online should adhere to one of the following formats: ACM, IEEE, or APA.

2. You may **not** collaborate with anyone, including others in this class, on this exam. Discussing exam questions and solutions with others is prohibited. The thinking behind your solutions, and the solutions themselves, must be your own. **You are required to sign an honor pledge at the end of this exam to affirm that you have adhered to this policy**.

3. **Please download a copy of this exam and place your answers directly into the boxes provided in this Word document**. Do not feel constrained by the sizes of the boxes; they are meant only as starting points. You are free to expand the boxes as needed to accommodate your solutions. In places where you need to insert sketches or other graphics (including your signature in the honor pledge), convert them to a graphics file and insert them into this document. For example, you can take pictures of your sketches and then copy-paste the pictures into this document.

4. **Delete pages, check solutions, and sign honor pledge before submitting**. When you are done with this exam, make sure that you have filled in all solutions, and signed and dated the honor pledge at the end of the exam. After confirming that you have completed these steps, **delete pages 1-10 of this document**, which do not contain any solutions. Submit your solutions to the exam as a **Word document** through MS Teams by **11:59 p.m. on Friday, March 19**. Exams that are submitted after the due date will receive a 0.

Problem 1 (81 pts)

This problem focuses on the design of the web interface for making reservations at the WSU Student Recreation Center. All screenshots below were taken on a mobile device (phone). **When you write your solutions to this problem, assume that users are using the web site on a smart phone**.

1a. *Cognitive Walkthrough* (27 pts—1 pt per box). Perform a cognitive walkthrough of the task of reserving a 45-minute slot in the lap pool, as described above. To better understand the interaction, you should go to the WSU SRC's website and work through the task on your own, following the instructions above. To document the results of your cognitive walkthrough, fill in the table on the next page. *For your convenience, the subtasks and the screens they are associated with have already been identified for you*.

Task : **Reserve a 45 minute slot in the SRC lap pool**

Task Steps	Will the user know what to do next to make progress?	Will the user notice how to perform the correct action?	Will the user interpret the system response correctly?
1.1 Make a reservation (Screen 1)	The font of 'Make a reservation' is highlighted in red. So, users can easily see. And because the font is in the form of a hyperlink, the user can try to click on it.	There are no more prompts to remind the user, but the user can consider the role of the highlighted font through the content of the entire paragraph. After confirming that the font is a hyperlink. The user needs to click the font and get a response before they can know whether the operation is correct.	After clicking the font, the page jumps to the home page of the reservation operation. There is an explanation why you need to book content. And the link to the place where the user needs to book. There is no redundant operation, so it is convenient for users to understand and operate correctly.
1.2 Select the facility (Screen 2)	"Facilities Link" displays the list of facilities below and is highlighted in red font. Users can easily find. When the user asks about the facility, they should know something about the facility, so the users know what to do next to make progress.	No special prompts are needed. The words "Facilities Link" makes users understand that this is a link to a facility, and the following list of showcases makes it easy for users to understand that this is a different facility option. So, the user can perform the correct operation.	After clicking the required facility link, user will be redirected to the facility-related interface. The pictures and words on the interface let users know that their actions are correct. So, the user can correctly interpret the system response.

1.3 Select the SRC Lap Pool (Screen 3)	The comment below the facility font let readers know that they can access the reservations from the contents of the following list, and the contents of the list are in the form of hyperlinks, so users know what to do next.	The content of the list is the items that the user wants to make a reservation, so the user knows how to perform the correct operation.	After clicking the "SRC Lap Pool" link, the page will jump to the relevant interface for making an appointment. The interface contains the factors of access to reservation. So, the user can correctly interpret the system response
1.4 Choose a potential reservation slot (Screen 4)	There are not many clickable buttons on the interface. There is a "click for more information" button on each schedule. Users can accurately identify the time they want to make an appointment and view the details. So, users know what to do next to make progress.	No reminder is needed because each available time slot corresponds to a query details button. Therefore, the user knows that the user should click the button to check whether there is a free space in the time of the desired appointment.	The time for access to reservation is displayed in the form of a module, and the only detailed button limits the user's operating space. Therefore, the user can correctly interpret the system response after trying to press the button.
1.5 Check the status of the reservation slot and initiate a reservation (Screen 5)	This page displays detailed information about the reservation and a button showing the remaining locations. Click the button to perform the login operation. So, the user knows what to do next.	**This is the operation of a normal reservation. Reservations require free space. When there is a free space, the user who made the reservation needs to log in. These have hints on the buttons.**	**This page is used to confirm the reservation information. user can log in and make an appointment when there is free space. Therefore, user interpret the system response correctly.**
1.6 Log in to the WSU SRC reservation system (Screen 6)	The login page has the function of a general login page. If the user	The page has a text prompt, prompting the user which type of	The login interface has a text description of the login account, and

	has an account, he can log in directly. If not, he can create a "WSU Friend" account by registering.	account to log in. How to log in when there is no designated category account. Prompt the types of accounts that users can create.	the user usually understands the login interface. Therefore, the user can correctly interpret the system response.
1.7 Proceed to sign waivers (Screen 7)	The interface provides orders and related costs, and the two buttons are marked with explanatory text, so users know what to do next to make progress	The text on the button is the only prompt and the most direct prompt, the user can click the button to proceed to the next step.	The format of the waivers text is easy to recognize, so the user can correctly interpret the system response.
1.8 Sign waivers (Screen 8)	The text format and consent options included in the waivers screen are conventional, so users know that they need to agree to make progress	There is a text prompt at the bottom of the exemption interface "if you do not agree to the use of digital images, voice recordings or other information as set forth above, please inform UREC staff of your preference when a photographer is present", So that users can more likely click to agree.	After clicking agree, you will return to the order page, but the original "Proceed to sign waivers" button will become a "checkout" button. The proof has passed the waivers screen. So, the user interprets the system response correctly
1.9 Check out(Screen 9 and Screen 10)	The original "Proceed to sign waivers" button becomes the "Checkout" button. The checkout option of an order is always the last step.	The text "Having trouble making reservations? Find details about making reservations here" may help the user,	After clicking the "checkout" button, the order has been completed. Users can choose "Back to My Account "Return to the

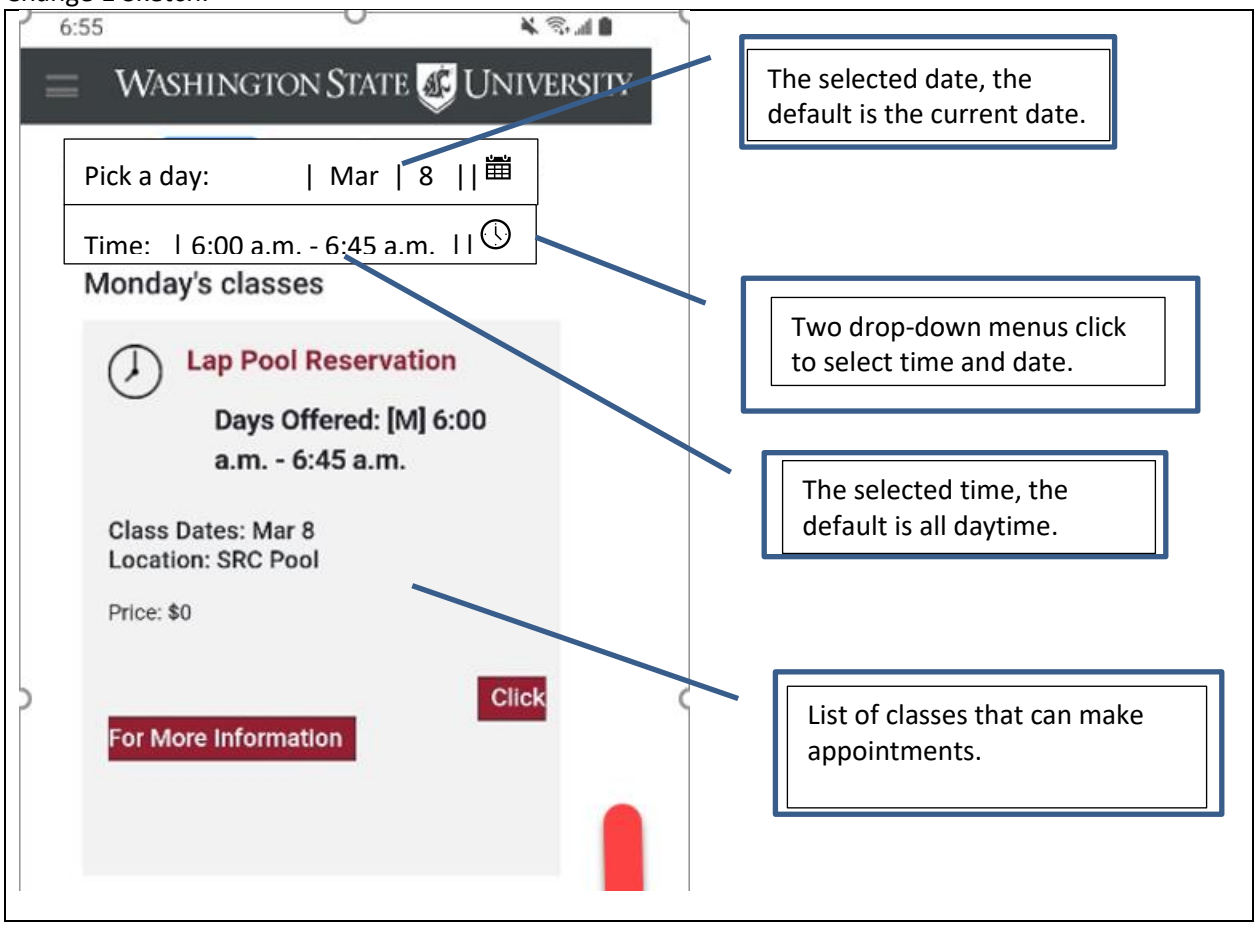
	So, users know what to do next to make progress	and the user can get help by clicking on the "here" hyperlink. This means that if there is not too much confusion, then the user can submit the order by clicking the "checkout" button.	personal page. Or "Cancel Reservations" to cancel the order. The text "This order is complete" in the interface indicates that the order has been completed. So, the user knows that his purpose has been achieved.

1b. *Apply Norman's Principles* (30 pts—5 pts per box). Fill in the following table by writing a few sentences that evaluate the goodness of the SRC's reservation mobile web interface relative to each principle.

Affordances	Different hyperlinks (icons, highlight words and function buttons with text prompts); web pages that can be pulled down; search bars that can search for related information.
Signifiers	The text description on the function button, the text description of the hyperlink itself. The image meaning of the Icon itself and the text description on the right. The picture shows the facility information.
Constraints	The web page has physical, semantic, and logical constraints. Regarding physical limitations, users can only click on buttons, icons, and text with hyperlinks; they will jump to the page when they are clicked and stay on the current page if they are not clicked. Screen sliding depends on the adaptability of the page. Regarding semantic restrictions, most of the searchable information in the search bar is text contained in web pages, and inaccurate spelling will cause no information to be searched. Finally, regarding logical constraints, the time that the user can access the reservation does not include the time when the facility is not open. The number of reservations will not exceed the upper limit of the location provided by the facility. The webpage does not seem to have any cultural restrictions.
Feedback	A hyperlink will connect to a web page related to its text. The function buttons represent the user's choice. For example, the query information button can query the information of the accessible appointment, and the "Proceed to sign waivers" button displays the waivers screen. The "Agree" button can continue the appointment, while the "Disagree" button cancels the current appointment. and many more. These function buttons help to complete the appointment or cancel the appointment.
Natural Mappings	General web icons and search bars are placed at the top, and most of the text content is placed at the bottom. The key content will be highlighted. The arrangement of time is from morning to night. The waivers page needs to be pulled to the bottom to display the "agree" or "disagree" button. The order button has options to cancel the order and continue to complete the order. The order information will be placed where users can easily see. These aspects of the mapping, the website has done a good job.
Conceptual Model	The main function of the webpage includes Make a reservation, so it has the time selection, check whether the number of people is full, whether the order regulations are agreed, whether to complete the order, etc. This webpage has a conceptual model of Make a reservation and placing an order.

1c. *Interface improvements* (24 pts—6 pts per box). Synthesize the results of your cognitive walkthrough and your application of Norman's principles to propose **two concrete changes** that will improve the SRC's mobile website for reserving time slots. For each suggested improvement, provide (a) an annotated screen sketch to illustrate the change and (b) a brief rationale for the change that explicitly cites one or more of your cognitive walkthroughs and/or Norman analysis results. Fill in the boxes below with your answers.

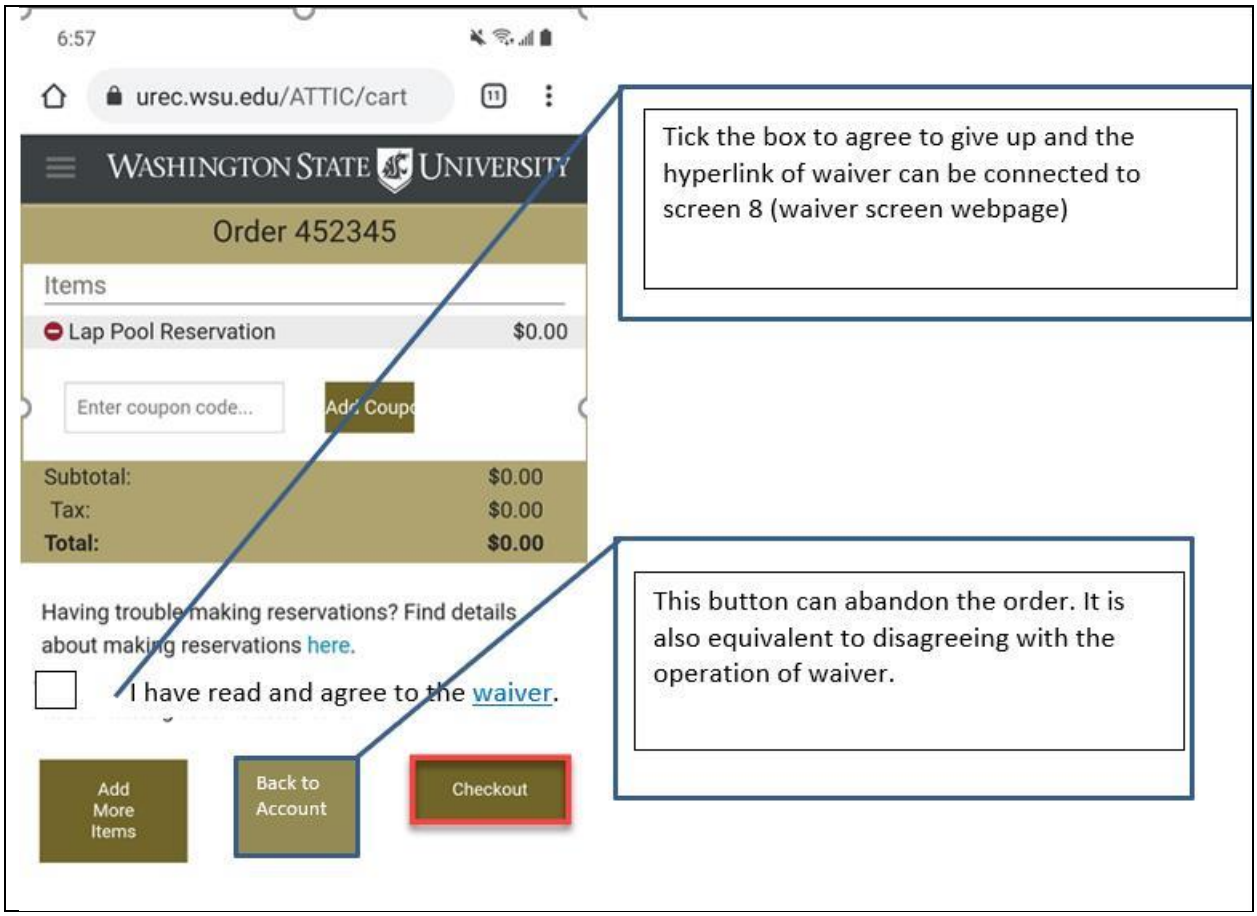
Change 1 Sketch:



Change 1 Rationale:

Two drop-down menus, one of which is the date setting and the other is the time setting. The content in the drop-down menu is set to the date and time available for booking. The following list corresponds to the selected time (the time is all day, and then all available appointment times for that day are displayed.
The content in the drop-down menu is the date and time when the reservation can be made. Slots that are already full will not be displayed. This can save a lot of time without having to query one by one.

Change 2 Sketch:



Change 2 Rationale:

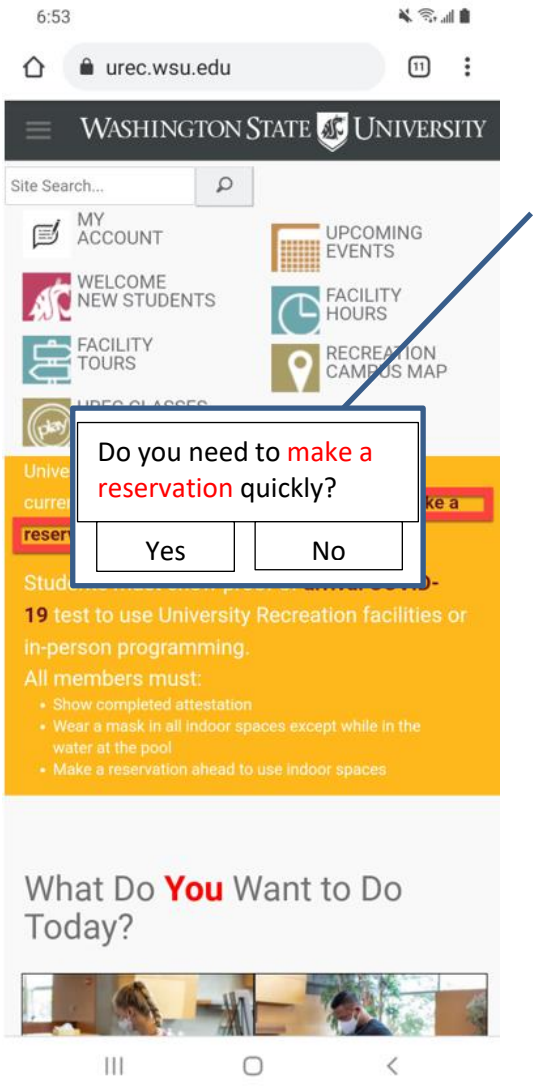
For some users who make regular appointments. It takes a certain amount of time to pull down the sign waiver interface. So, it can set the screen 8 link on the checkout interface. There is no need to perform screen 8 operations every time you make an appointment. Adding a return button on the checkout interface can facilitate users to end the order in a timely manner. You can even add some text to remind new users to read the importance of waiver.

Problem 2 (25 pts)

This problem focuses on analyzing the efficiency of locating and tapping on buttons and links in the SRC mobile web site described in the previous problem.

Scenario 1. Suppose that, based on user research, it is learned that the most common task from the home page of the SRC mobile web site (see **Screen 1**) is to make a reservation.

2a (5 pts). In the box below, sketch out a new design for Screen 1 that promotes the *lowest average time* to access the "Make a Reservation" functionality.



a pop-up window with "yes" and "no" button, and text "Do you need to make a reservation quickly?"

2b. (5 pts) In the box below, justify your redesign of **Screen 1** based on the laws, principles and/or concepts you have learned in this course that are most relevant to this problem.

Understand users' goals: Some users who use the webpage for the first time will not find the appointment interface because the webpage contains too much information. A simple one-time pop-up can help users achieve their desired goals faster. Users no longer need to spend more time viewing other information on the web page. This avoids a lot of useless operations. Played a role in guiding new users.

Impose visual structure on information displays: The pop-up window that can help users make appointments faster.

Avoid ambiguity in information display: Simple question sentence and highlighted "make a reservation". Let users know briefly that they can make an appointment by clicking the "yes" button.

Affordances: a pop-up window asks the user "Do you need to make a reservation quickly?" The "yes" button can go directly to the reservation interface or jump to the position where the word "make a reservation" is located, and the "No" button closes the pop-up window.

Mapping: The prompt box has basic text and "yes" and "no" buttons. Easy to understand.

Scenario 2. The WSU SRC reservation screen requires users to sign three waivers (see **Screen 8**). Each waiver is long: On a phone, the user must touch-scroll through multiple screens to reach the "I have read and agree to the above" button that must be tapped to advance to the next screen.

2c (5 pts) Using concepts and terminology learned in this class, *describe the sequence of movements* necessary for the user to reach and tap the "I have read and agree to the above" button.

Open waiver page ->
Swipe down the screen and find the highlighted words ->
Read these passages ->
After finish reading those passage, slide down to the bottom ->
Read the remarks section and try to understand. If user do not understand, return to the relevant content for reference ->
Confirm completion of reading waivers ->
tap the "I have read and agree to the above" button.

2d (5 pts) Analyze the efficiency with which the user can tap the "I have read and agree to the above" button when presented with Screen 8. Base your analysis on relevant material from this class.

Many users choose not to read the content of waiver because of the long text. Especially those text content without highlight. If the user wants to finish watching such a waiver, it must take a lot of time. These contents are not based on interest. So in order to make the "I have read and agree to the above" button more effective. Some important text content needs to be bolded. For Johnson text, Ch. 5: Peripheral vision is poor: use a combination of movement, color, different font to make things stand out in periphery and optimize visual search.

2e (5 pts) Based on material learned in this class, how can Screen 8 be redesigned to promote better task efficiency? Justify your redesign.

Important content should be highlighted and condensed as much as possible, with some explanatory text in normal fonts attached. And some less important text can be placed on the folded page, and then click on when you need to view it. This allows users to quickly read relevant information.

Problem 3 (Undergrad and Grad: 5 pts)

Consider the following login screen design:

The above screenshot shows the state of the login screen after a user has attempted to log in unsuccessfully. In the box below, critique this design in a few sentences, citing relevant facts and principles related to human perception.

Johnson text:
Ch. 1: Human perception is biased:
- **Understand users' goals:**
  The purpose of the user is using the app. Once the login fails, the user experience will be poor. And some users often forget their passwords. Therefore, measures such as recovering the password are required on the interface. Help users log in to the app.

Norman Text:
Affordances: Once the user clicks on the application, the login window can only be forcibly closed by other means.

Feedback: The "Login Failure" message displayed on the interface is ambiguous. The user does not know whether the password is wrong, or the username is wrong. It should first verify that the username exists. If you still cannot log in successfully even when the username exists, the password is wrong.

Problem 4 (12 pts)

This problem relates to design requirements and representations. *Pay particular attention to the format of your responses. For full credit, they must match the formats presented in class*.

4a (2 pts) In the box below, write down a possible **functional requirement** for the software you are developing in the team project.

The user must be able to enter the destination or mark the target location on the map.

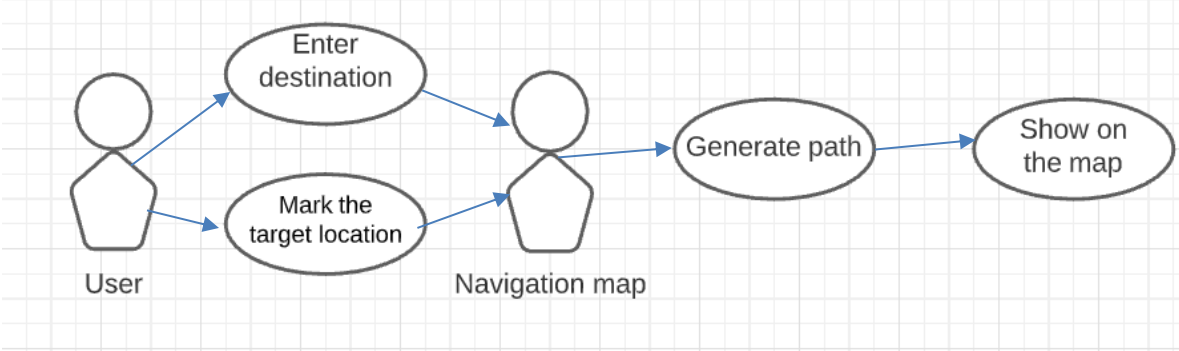
4b (2 pts) In the box below, write down a possible **usability requirement** for the software you are developing in the team project.

The user can dynamically see the unsafe path on the map and avoid it safely.

4c (2 pts) In the box below, write down a possible **user experience requirement** for the software you are developing in the team project.

Users can learn the basic operation of the software through the novice guide.

4d (6 pts) In the box below, present a **use case** related to the functional requirement you identified above.



Problem 5 (9 pts)

As discussed in class, a series of aviation accidents in the 1980s and 1990s (e.g., Northwest Flight 255 and Delta Flight 1141) were caused by pilots failing to extend the wing flaps prior to takeoff. Since the wing flaps were not extended, the planes failed to obtain sufficient lift at takeoff and crashed quickly after they became airborne.

Based on what you have learned in class about human errors, write short responses to the following questions.

5a. (3 pts) Based on the root cause analysis technique discussed in class (see Slide 8 in Lecture 12), were these accidents solely the fault of the pilots? Why or why not?

It is not just the pilot's fault. Both accidents have the cause of the early warning device failure, and this type of failure is very fatal. Just like when the human body is harmed by a virus, the body will warn. Once this early warning device fails. Then this person will die suddenly one day. Therefore, this is not entirely human error.

5b. (6 pts) In the box below, describe **one user interface improvement** to the cockpit that might have prevented these accidents. Justify your improvement by citing relevant principles related to human memory (Johnson 7-9, Norman 3), human learning (Johnson 10-11), human decision making (Johnson 12), and/or human errors (Norman 5).

human memory: The driver knows that the general red indicator light is faulty, so on the interface, the status of the uncompleted list can be set to the yellow indicator light state. The green light means there is no problem.
human learning: The interface can have an airplane model, and the alarm is placed on the airplane model corresponding to the part it is responsible for, and the status is marked. To ensure that there will be no problems during the operation of the aircraft. These alarms can be clicked on the interface to query details. Therefore, humans must learn how to use the interface to troubleshoot problems.
human decision making: The interface can mark the safety percentage of each alarm. Give some systematic evaluation. When the security is below a certain level, then you must pay attention. A large amount of data can support generating a safety percentage. The data is similar to when the alarm is maintained, what defects are currently present, what conditions may cause problems, and so on.

Honor Pledge

You are required to include and sign the following honor pledge in your submitted solutions document. *A failure to include and sign this pledge will result in an automatic 0 on the exam*. A violation of any of the policies in this honor pledge will result in an automatic "F" in the course.

I hereby verify and attest, under penalty of receiving an "F" in this course, that:

- I have **not** discussed the problems on this exam with anyone else.
- in preparing my solutions to these problems, I have **not** collaborated or consulted with anyone else.
- any outside materials I have consulted (e.g., course materials, websites, books, articles, blogs) are **properly cited** in my solutions; and
- the solutions I have submitted are **completely my own**.

Name

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11539324

Signature

Jihui. Sheng

Date

3.13.2021