ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION — SUMMER SEMESTER, 2022-2023

DURATION: 3 HOURS — FULL MARKS: 150

CSE 4849: Human Computer Interaction

Programmable calculators are not allowed. Do not write anything on the question paper.

Answer **all 6 (six)** questions. Figures in the right margin indicate full marks of questions with corresponding COs and POs in parentheses.

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1. A metro rail system has recently been introduced in your city, solving traffic congestion to a great extent and allowing people to travel within a short amount of time. The metro rail system uses an automated ticket dispensing and pass recharging system. However, after using the system first hand and taking feedback from your acquaintances, you realized that the UI of the system is very unintuitive, hard to understand, and error prone.

   After gathering feedback from stakeholders following formal data gathering methods, you have designed a new UI for the system, hoping to improve the overall usability compared to the existing one. Now you want to carry out an usability test in the form of a research. You want to prove that your newly designed UI is more efficient, easy to learn, and less error prone compared to the existing UI. Consider that you have a replica UI of the existing system and you managed to get 8 participants for your test.

   a) Design a usability research based on the aforementioned scenario. Your design should contain brief descriptions and justifications for the following parts. — 3 + 10 +
      i. Research question and hypothesis (one-tailed or two-tailed) — 2 + 5 (CO4) (PO3)
      ii. Independent, dependent, control, random, and confounding variables for your experimental design.
      iii. Allocation of participants and counterbalancing (if required)
      iv. Statistical testing

   b) Considering you have already found 8 participants for your research, should you opt for a pluralistic walk-through for the comparison of the systems? Justify your answer with appropriate reasoning. — 5 (CO2) (PO2)

2. A parking garage in a developed city wants to introduce an automated parking process. Till now the plan is like the following:

   The cars will first arrive at the entrance and an automated system will check whether the car is registered with a pass or not. The pass comes with 3 different durations, daily, monthly and yearly. If the car does not have a pass or has an expired pass, it will be guided to a section where the driver can register for a pass based on preference. A car with a pass can access the different parking areas directly. In the case of a daily pass, the parking area is fixed by the system. For monthly and yearly passes, the driver can choose any of the available parking slots and switch it whenever necessary. The driver or the owner of the car can also select authorized personnel via drivers license number to drive/park the car on behalf. The selection of parking spots, choosing authorized personnel, or finding help is done via the frequently appearing kiosks within the garage. It should be noted that any pass holder car can drive in and out of the garage freely as long as the pass is valid.

   All the detection and safety is maintained via fully automated computerized systems with high grade cameras and sensors. The company advertises its garage to be safe and accessible by individuals from all walks of life with different levels of driving skills. There are other benefits as well, like discounts for students, special spots for larger cars, etc. The company expects their garage to be a huge success with a considerable amount of traffic during rush hour.

a) Based on the scenario, write 2 requirements for each of the following types. Provide brief reasoning for each of the requirements. You can make valid assumptions if necessary. 5 × 2 (CO2) (PO2)

   i. Functional Requirements
   ii. Data Requirements
   iii. Environmental Requirements
   iv. User Requirements
   v. Usability Requirements

b) Create a Hierarchical Task Analysis (HTA) depicting the process of a driver parking a car in the aforementioned garage. 10 (CO1) (PO1)

c) If you wish to explore the facilities expected from an automated parking garage, which kind of study would you choose between qualitative and quantitative? Justify your answer with appropriate reasoning. 5 (CO3) (PO2)

3. Consider the automated parking garage in Question 2. Suppose the drivers are intended to interact with the kiosks while sitting in their car. So the system would be designed accordingly.

a) What could be two major interaction metaphors for designing the system? Provide appropriate reasoning behind your answer. 2 × 3 (CO2) (PO2)

b) Based on the scenario, decide at least two primary, secondary, and tertiary users for the system. Provide brief justification to your decisions. 3 × 2 (CO2) (PO2)

c) With adequate reasoning, explain: among instructing, conversing, direct manipulating, and exploration, which interaction type would be ideal for the given scenario? You can combine two methods if necessary. 6 (CO3) (PO2)

d) How can the Star model be incorporated into the design of the automated garage? Explain by briefly analyzing how each of the stages and the overall cycle of the Star model maps to the different parts of the system. 7 (CO2) (PO2)

4. The library in your university wishes to introduce an AI based chat system to help students with their frequently asked questions and in searching or locating books. Along with serving the purposes, the agent also needs to be restricted in functionalities so that the users cannot prompt it to do something it is not supposed to do. However, the authority has not still figured out exactly what queries the students might have and which of the questions should not be answered. As a student of interaction design, you have been asked to help the authority.

a) Considering you have budget and time constraints, what kind of prototyping method would be ideal to find out exactly which kinds of questions the students might ask, what they expect in answer, and which questions should be avoided? Provide appropriate reasoning behind your choice. Provide a brief description of how you are going to design your proposed prototype. 9 + 3 (CO3) (PO2)

b) Draw a storyboard depicting the process of a student entering the library and utilizing the AI agent. You can make any necessary and appropriate assumption. 8 (CO4) (PO3)

c) How can UX mapping techniques help in designing the aforementioned AI system? Provide justification to your answer with the help of example(s). You do not need to explicitly draw any map. 5 (CO2) (PO2)

5. In a certain UI, in order to perform a certain operation, the user needs to hit five buttons one after the other in the sequence — A, B, C, D, E. The designers have come up with two different alternatives. The button coordinates and their respective radii in the two alternatives are given in Table 1. For the simplicity of calculation, the designers have considered all the buttons to be circular. You can consider that the mouse cursor will always start on top of button A.

Table 1: Button layout for Question 5

Button	Alternative 1		Alternative 2	
	Coordinate	Radius	Coordinate	Radius
A	(0, 0)	50	(0, 0)	50
B	(1024, 0)	64	(0, 512)	64
C	(768, 0)	32	(0, 768)	32
D	(768, 312)	32	(0, 1024)	28
E	(512, 512)	64	(512, 512)	24

a) Using Fitts law, calculate which of one of the aforementioned alternatives would be easier for the user to navigate on an average. 10 (CO1) (PO1)

b) Considering you wish to keep the movement time between B to C exactly the same for both the alternatives, what modifications can you make either to the distance or the radius in the case of alternative 2? Justify your answer mathematically. You can consider that the alternatives are being performed by the same user using the same device and the user is acting optimally. 10 (CO2) (PO2)

c) Explain the speed-accuracy trade-off in Fitts law with an appropriate example. 5 (CO1) (PO1)

6. a) Based on your own understanding, define what HCI is and how it contributes to the development of human centered products. 9 (CO1) (PO1)

b) "HCI is an interdisciplinary subject and there are multiple approaches to it" — do you support this statement? Explain your answer with the help of examples. 8 (CO1) (PO1)

c) Differentiate between slips and mistakes. Among these two, which one is harder to correct and why? Provide appropriate reasoning to your answer. 8 (CO1) (PO1)