

# Final - 2022

1. a) With respect to the scenario, extract 3 requirements for each of the following cases that could have been used to build the system. Give a 1 or 2 line justification for each of them.
  - i. Functional Requirements
  - ii. Data Requirements
  - iii. Environmental Requirements
  - iv. User Requirements
  - v. Usability Requirements

Based on the scenario provided about the "Seasonal Platter" restaurant's software system, here are three requirements for each of the categories specified:

## ### 1. Functional Requirements

1. **\*\*Dish Submission and Approval Workflow:\*\*** The system must allow chefs to submit new dishes and also re-offer previously successful dishes, following a specific approval process. This supports the seasonal offering dynamics of the restaurant.
2. **\*\*Automatic Dish Removal:\*\*** Dishes not selected for the current season must be automatically removed from the display, ensuring the menu remains relevant and up-to-date.
3. **\*\*Ingredient Listing:\*\*** The system should enable chefs to list all ingredients for each dish, which is crucial for transparency and for catering to dietary preferences and restrictions.

## ### 2. Data Requirements

1. **\*\*Chef Profiles:\*\*** The system must store profiles for chefs, including their specialties and historical dishes offered. This supports personalized management of dishes.
2. **\*\*Dish Database:\*\*** A comprehensive database storing existing dishes, their status (active or inactive), ingredients, and seasonality to facilitate easy searching and validation.
3. **\*\*Customer Feedback Mechanism:\*\*** Data collection tools for customer feedback on dishes to inform future offerings and modifications.

## ### 3. Environmental Requirements

1. **\*\*Hardware Compatibility:\*\*** The system should be compatible with interactive displays at tables, facilitating a seamless digital menu browsing and ordering experience.
2. **\*\*Network Reliability:\*\*** The system requires a stable and secure network environment to ensure real-time updates and interactions are efficiently handled.
3. **\*\*Integration Capabilities:\*\*** The system should integrate smoothly with existing restaurant management software for inventory, billing, and customer relationship management.

## ### 4. User Requirements

1. **\*\*Chef Access:\*\*** Chefs need unique access credentials to offer dishes, emphasizing security and accountability in the dish offering process.

2. **\*\*Customer Interaction:\*\*** Customers should be able to browse dishes, submit orders, and provide feedback through the interactive display, enhancing their dining experience.
3. **\*\*Managerial Oversight:\*\*** Managers require administrative access to modify, update, or remove dishes as needed based on performance and seasonal appropriateness.

#### ### 5. Usability Requirements

1. **\*\*Ease of Use:\*\*** The system must feature an intuitive user interface for both chefs and customers, minimizing learning curves and potential errors.
2. **\*\*Responsive Design:\*\*** The interface should be responsive and visually appealing on various devices, particularly the interactive displays used at tables.
3. **\*\*Accessibility:\*\*** The system should accommodate users with different levels of tech-savviness and physical abilities, including features like text resizing, voice commands, or simplified navigation options.

These requirements aim to ensure the system is effective, user-friendly, and supports the operational and strategic goals of "Seasonal Platter".

- b) Based on the user story written above, create a Hierarchical Task Analysis with Plans and Graphs for *offering a new/existing dish by a chef*.

### **Main Task: Offering a Dish by a Chef**

#### **Task 1: Log in to the Chef Account**

- 1.1. Open system interface on device.
- 1.2. Enter username and password.
- 1.3. Navigate to chef-specific dashboard.

**Plan 1: If login fails, retry or reset password; if successful, proceed to Task 2.**

#### **Task 2: Decide Whether to Offer New or Existing Dish**

- 2.1. Review previous dishes and their feedback.
- 2.2. Decide if offering a new dish or re-offering an existing dish.

**Plan 2: Based on the decision in Task 2, choose Task 3 (new dish) or Task 4 (existing dish).**

#### **Task 3: Create a New Dish**

- 3.1. Select "Create New Dish" option.

- 3.2. Enter dish name and description.
- 3.3. List all ingredients.
- 3.4. Attach images of the dish.
- 3.5. Submit dish for approval.

**Plan 3: Ensure all fields are complete and validated; if errors, correct and resubmit; otherwise, proceed to Task 5.**

#### **Task 4: Re-offer an Existing Dish**

- 4.1. Select "Re-offer Dish" option.
- 4.2. Choose dish from the list of previously offered dishes.
- 4.3. Possibly update ingredients or preparation details.
- 4.4. Resubmit dish for this season's approval.

**Plan 4: Check if the dish requires any updates; if yes, update and submit; if no updates, just submit.**

#### **Task 5: Await Approval**

- 5.1. Monitor status of dish submission.
- 5.2. Receive notification of approval or revision request.

**Plan 5: If dish is not approved and revisions are requested, return to Task 3 (if new dish) or Task 4 (if existing dish) to make required changes.**



2. a) Briefly elaborate on two data gathering methods that you would find suitable in the above context if you were asked to implement the system from scratch. For each of the methods, explain how the specific method's advantage is going to fit the system and how the disadvantage needs to be overcome.

To implement the system for the "Seasonal Platter" restaurant from scratch, focusing on the process of chefs offering dishes, two appropriate data gathering methods could be **Interviews** and **Focus Groups and Workshops**. Here's how these methods can be beneficial and what challenges they may face:

#### ### 1. Interviews

##### #### Advantage:

Interviews with chefs, managers, and IT staff who will interact with the system can provide detailed insights into the specific requirements and preferences for the system's functionality. This method allows for a deep understanding of the users' needs, expectations, and potential issues with current processes.

##### #### How to Fit the System:

Interviews can help gather detailed user stories and functional requirements directly from the end-users. They can uncover nuanced needs such as the complexity of dish approval processes or specific functionalities that are critical for the user, like ease of updating dish ingredients or re-offering past popular dishes.

##### #### Disadvantage and Overcoming It:

Interviews can be time-consuming and may not always represent the views of all user groups if not carefully planned. To overcome this, a structured interview guide should be prepared, and participants should be selected from diverse roles within the restaurant to ensure comprehensive coverage of all user perspectives.

#### ### 2. Focus Groups and Workshops

##### #### Advantage:

Focus groups and workshops can foster interactive discussions among different stakeholders, such as chefs, managerial staff, and IT developers. This setting encourages brainstorming and can lead to innovative solutions for system design, particularly for collaborative features like dish feedback mechanisms or integration with other restaurant management software.

##### #### How to Fit the System:

These methods are particularly useful for refining system requirements and design through collaborative discussion. For example, a workshop could be used to prototype the user interface

of the system, ensuring it meets the usability requirements of all users, including chefs who may not be as technologically adept.

#### #### Disadvantage and Overcoming It:

The main challenge with focus groups and workshops is the potential for dominant personalities to overshadow quieter group members, which could skew the data collected. To mitigate this, facilitators must ensure that all participants have equal opportunity to contribute. Techniques such as round-robin feedback or breakout sessions can be employed to give everyone a voice.

- b) What are the different personas that can be taken into consideration while designing the aforementioned system based on the three roles, customers, chef and manager? Mention 6 personas with just their abilities or shortcomings with respect to the system in 2-3 sentences. You can choose your own distribution of persona under each role, for instance, 3 personas under customers, 2 under chefs and 1 under manager etc. 6

### **Persona 1: Emily, The Tech-Savvy Diner**

#### **Goals:**

- Quickly browse and order from a digital menu.
- Access detailed descriptions and reviews of dishes.

#### **Pain Points:**

- Frustration with slow or outdated digital interfaces.
- Annoyance at the lack of real-time updates or incorrect dish availability.

#### **Personality:**

- Curious and always seeking new culinary experiences.
- Impatient with inefficiencies and appreciates modern, streamlined processes.

### **Persona 2: Chef Marco, The Innovative Chef**

#### **Goals:**

- To showcase his culinary creativity through new and exciting dishes.
- To receive immediate feedback from customers to refine dishes.

#### **Pain Points:**

- Hindered by slow approval processes for new dishes.

- Frustration with limited ability to modify dishes based on real-time customer preferences or ingredient availability.

#### Personality:

- Creative, always experimenting with new flavors and techniques.
- Somewhat impulsive, preferring rapid execution over prolonged deliberation.

### Persona 3: Linda, The Proactive Restaurant Manager

#### Goals:

- To efficiently manage the restaurant's menu and staff.
- To utilize customer feedback and sales data to make informed decisions about menu changes and marketing strategies.

#### Pain Points:

- Overwhelmed by the complexity of managing multiple tasks and data sources.
- Concerns about the time it takes to implement changes based on feedback.

#### Personality:

- Organized and detail-oriented, with a strong focus on efficiency.
- Decisive, with a keen ability to prioritize tasks and delegate responsibilities effectively.

c) Can the process of affinitization help the development of the aforementioned system? Give proper reasoning behind your answer within 10 simple sentences.

1. **Organize Data:** Affinity diagramming helps organize large amounts of data into logical groups, making complex information easier to manage and analyze.
2. **Identify Patterns:** By categorizing feedback from interviews, surveys, and observations, affinity analysis reveals patterns and common themes, which can inform the system design to better meet user needs.
3. **Enhance Collaboration:** This process encourages team members from different disciplines to collaboratively sort and understand data, fostering a unified approach to system development.
4. **Focus on User Needs:** It prioritizes user-centered design by directly addressing pain points and preferences that emerge through the grouping of data.
5. **Problem Solving:** Affinity diagramming aids in solving problems by visually breaking down the issues into manageable parts, which can be addressed systematically in the system's features.

6. **Drive Innovation:** Insights gathered through this process can lead to innovative solutions that might not have been considered in a more linear or conventional data analysis approach.
7. **Simplify Communication:** The visual nature of affinity diagrams makes it easier to communicate findings and decisions to all stakeholders involved, including non-technical team members.
8. **Validate Requirements:** It helps validate and refine system requirements by aligning them with the actual needs and desires of users, as identified through the data.
9. **Reduce Overlooked Areas:** This process reduces the risk of overlooking crucial aspects of the user experience by ensuring all data points are considered and placed into context.
10. **Improve Decision Making:** By providing a clear structure and overview of user data, affinity diagramming supports more informed and effective decision-making throughout the system development lifecycle.

3. a) Different prototyping techniques are suitable for different tasks. For instance, the above story can be represented using storyboarding or a series of sketches. Now, for the following tasks, mention a suitable prototyping method with 3 sentences explaining each why they are suitable.
  - i. Creating UI for the chefs for offering recipe
  - ii. Describing the interaction sequence of voting to the users
  - iii. Taking feedback from the users on the system

#### ### 1. Creating UI for the Chefs for Offering Recipe

**\*\*Prototyping Method: Wireframes\*\***

- **\*\*Explanation\*\*:** Wireframes are a quick and cost-effective method to layout and iterate on the user interface design. They allow for focusing on usability and functionality without getting distracted by visual design elements.
- **\*\*Applicability\*\*:** For chefs, who need straightforward and efficient interfaces to input recipes, wireframes help in refining navigation and interaction without the complexities of detailed design.
- **\*\*Advantage\*\*:** They facilitate easy modifications based on feedback from chefs, ensuring that the final design is both functional and user-friendly.

#### ### 2. Describing the Interaction Sequence of Voting to the Users

**\*\*Prototyping Method: Interactive Prototypes\*\***

- **\*\*Explanation\*\*:** Interactive prototypes allow designers to create functioning models of the system that users can interact with, providing a realistic experience of how the voting feature will work.
- **\*\*Applicability\*\*:** By simulating the voting process, users can understand and navigate the interaction sequence, allowing designers to observe and correct any usability issues.



- **\*\*Advantage\*\***: This method helps in validating the flow and functionality of the voting process, ensuring it is intuitive and engaging before final implementation.

### ### 3. Taking Feedback from the Users on the System

#### **\*\*Prototyping Method: Usability Testing with Mockups\*\***

- **\*\*Explanation\*\***: Conducting usability testing with high-fidelity mockups that resemble the final product can provide detailed insights into how users interact with the system and where they encounter problems.

- **\*\*Applicability\*\***: Mockups are detailed enough to give users a close-to-real experience, enabling effective collection of comprehensive feedback on various elements of the system.

- **\*\*Advantage\*\***: This approach not only tests the aesthetic aspects but also the functionality, helping to gather actionable feedback that can be used to enhance the system before full-scale deployment.

b) Represent a chef offering a new dish using storyboarding. The drawings need not be very good, but clear and understandable drawings are required.

c) Explain the sentence, "Though prototyping might prove to be costly in the initial phase, it may save valuable time and resources in the long run".

The sentence "Though prototyping might prove to be costly in the initial phase, it may save valuable time and resources in the long run" highlights the trade-off between upfront investment and long-term benefits. While creating prototypes can incur expenses initially, they serve as valuable tools for evaluating, refining, and communicating design ideas. By uncovering potential issues early in the development process, prototypes help prevent costly mistakes and iterations later on. This aligns with the central role of evaluation and feedback in interaction design, as prototypes facilitate stakeholder understanding, effective team communication, idea testing, reflection, and decision-making. Despite the compromises inherent in prototyping, such as limited functionality or detail, leveraging prototypes strategically can lead to more efficient and successful design outcomes.

4. a) With respect to the scenario and aforementioned questions, illustrate how the Star Model can facilitate a user centric design process.

- Evaluation at the Center: This approach places evaluation activities, such as user testing and feedback collection, at the core of the design process. It emphasizes continuously gathering and incorporating feedback to improve the user experience.
- No particular ordering of activities: Unlike linear design processes, this method allows for flexibility in the sequence of activities. Designers can start with any



phase, depending on project needs and constraints, enabling iterative and adaptive development.

- Features derived from empirical studies: These features are informed by real-world observations and studies of interface designers. They reflect best practices and techniques that have been validated through empirical research, ensuring effectiveness and relevance in the design process.

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- b) Suppose the owner of the restaurant wants to find an answer to the research question, “Does the color of the customer's UI influence the purchase decision and amount of a specific type of food (appetizer, main course and/or dessert)?”. With respect to the research question,
- i. Describe an experiment with steps that may facilitate the answer to the question.
  - ii. Formally construct the independent, dependent, control, random and confounding variables of the experiment.
  - iii. Choose and justify a proper evaluation approach for the experiment.

To answer the research question regarding the influence of UI color on purchase decisions and order amounts for different types of food (appetizer, main course, and dessert), an experiment could be designed as follows:

1. **Hypothesis Formulation**:

- Formulate clear hypotheses regarding the expected effects of UI color on purchase decisions and order amounts. For example, hypothesize that warm colors (e.g., red, orange) may increase appetizer orders, while cool colors (e.g., blue, green) may increase dessert orders.

2. **Experimental Design**:

- Randomized Controlled Trial (RCT): Divide participants into different groups, each exposed to a different UI color (e.g., warm, cool, neutral). Ensure random assignment to mitigate bias.
- Control Group: Include a control group with a standard UI color to compare against experimental groups.
- Manipulation of UI Color: Design the restaurant's UI with varying color schemes for different experimental groups.
- Dependent Variables: Measure purchase decisions (e.g., whether participants order an appetizer, main course, or dessert) and order amounts (e.g., number of items ordered, total bill amount).

3. **Participant Recruitment**:

- Recruit a diverse sample of participants representative of the restaurant's customer base.
- Ensure participants are unaware of the experimental manipulation to prevent biases.

4. **Experimental Procedure**:

- Participants visit the restaurant or access the online ordering system with the assigned UI color.

- Allow participants to browse the menu, place orders, and complete transactions as they normally would.

5. **Data Collection**:

- Record participants' order choices and order amounts accurately.
- Collect demographic information (e.g., age, gender) and other relevant variables for potential analysis.

6. **Data Analysis**:

- Analyze the collected data using statistical methods (e.g., ANOVA, regression analysis) to determine if there are significant differences in purchase decisions and order amounts across different UI color conditions.
- Conduct post-hoc tests to identify specific effects of UI color on different types of food orders.

7. **Interpretation of Results**:

- Interpret the findings in the context of the research question and hypotheses.
- Discuss implications for restaurant UI design and potential strategies for optimizing the UI to influence customer behavior positively.

8. **Conclusion and Recommendations**:

- Summarize the experiment's findings and provide recommendations based on the results.
- Suggest practical implications for the restaurant owner to optimize UI color choices to enhance customer experience and increase sales.

By following these steps, the experiment can provide valuable insights into the impact of UI color on purchase decisions and order amounts for different types of food, helping the restaurant owner make informed decisions regarding UI design and customer engagement strategies.

5. Suppose you want to design a command line application for a certain task. The application has upto 30 configurable parameters. In your current design, the user may pass the value of each of the arguments or parameters while calling it from the terminal. Though 'help' can be called to list down all the possible parameters, novice users still find it difficult to properly use the application. And in many cases, for a certain user or environment, a lot of the parameters remain the same. For the simplicity of understanding, invocation of a command line tool, *gcc* for compiling a single C file is given below.

```
$ gcc Filename.c -o Application
```

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The program takes 3 arguments, first one being the file name to compile, then '-o' to indicate that the next argument would be output file name/path and then accordingly, the output file name. Now based on this scenario, answer the following questions.

- a) Point out how human memory, both short term and long term, can affect the usability of the aforementioned application.

Human memory, particularly short-term memory, is limited in capacity, typically able to hold about  $7 \pm 2$  items at once. When users are required to remember and use up to 30 configurable parameters in a command line application, it overloads this short-term memory capacity. This can lead to errors, as users might forget or misremember parameters, especially if they are not regularly used.

Long-term memory plays a role when users engage with the application repeatedly over time. While long-term memory has a much larger capacity, the complexity and sheer number of parameters can make it difficult for users to retrieve information accurately and efficiently without regular use or practice. Therefore, users might frequently need to refer back to documentation, which can slow down the workflow and degrade the user experience.

- b) Propose an ideal solution (a single one based on your decision) to the problem of having 30 parameters in the aforementioned program. You cannot decrease the number of parameters

One effective solution to handle the complexity of having 30 parameters is to implement a configuration file approach. Users can set up a configuration file where they can define all the parameters in a more readable and manageable format. This file would then be passed as a single argument to the command line application. Here's how this could work:

- **Configuration File:** Users create a file (e.g., `config.txt`) where parameters are defined in key-value pairs or a structured format like JSON or YAML. This allows users to document and organize parameters logically, and even include comments to explain each parameter's purpose.
- **Command Line Usage:** Instead of inputting each parameter in the command line, users simply pass the configuration file as an argument, for example: `app_name --config config.txt`. The application reads this file at runtime to retrieve all the necessary parameters.

This approach reduces the cognitive load on the user, as they do not need to remember all parameters or their correct order and syntax every time they use the application. It also makes it easier to reuse configurations and share settings with others.

- c) Exemplify how the characteristics of reading text of human beings should influence the design of terminals and the output of command line programs.

## 1. Clear and Structured Output

Humans typically scan text rather than reading it word for word, especially when dealing with large blocks of text. Therefore, command line outputs should be structured in a way that is easy to scan:

- **Use whitespace:** Adding blank lines between sections of output or entries can help users differentiate between parts of the output more easily.
- **Indentation and Alignment:** Properly aligned text improves readability and helps in quickly locating relevant information.

## 2. Highlighting Important Information

To help users quickly locate the most important information, different colors, bold text, or underlining can be used. This visual differentiation aids in guiding the reader's eye to critical data or warnings:

- **Color Coding:** Use colors to indicate different types of information (e.g., errors in red, warnings in yellow, and successful messages in green).
- **Typography:** Bold or italicized text can emphasize important points or commands.

### 3. Consistency

Consistent layout and predictable text placement enhance readability and user familiarity with the outputs, which reduces cognitive load and error rate:

- **Consistent Command Syntax:** Commands and options should follow a consistent naming and formatting scheme.
- **Regular Output Patterns:** Similar commands should produce outputs that are structured similarly, so users learn where to look for specific information.

### 4. Concise and Meaningful Output

Outputs should be concise to avoid overwhelming the user with too much information at once. Each piece of information displayed should add value:

- **Brevity:** Use short, clear sentences or phrases that convey essential information succinctly.
- **Relevant Information Only:** Avoid cluttering the output with unnecessary details that can distract or confuse the user.

### 5. Pagination and Scrolling

For outputs that involve large amounts of data, consider implementing pagination or scrolling mechanisms to avoid flooding the user with too much information at once:

- **Scrollable Outputs:** For very long outputs, ensure the terminal window or the program supports scrolling.
- **Pagination:** Commands like `more` or `less` in Unix allow users to navigate through paginated data comfortably.

### 6. Searchability

Since users may look for specific information within a larger output, incorporating search features or allowing easy integration with tools like `grep` can significantly enhance usability:

- **Search Features:** Allow filtering of command line output through built-in search or query functions.

6. a) Based on your understanding from the classes, define what HCI is and where it is used under 15 simple sentences.

b) Note down and describe at least 3 domains that you think contributed in making this question paper. It was written in Google Docs. Each domain description should not exceed more than 5 simple sentences.

**1. Software Engineering:** This domain focuses on the principles and methodologies for designing, developing, and testing software. It provides a foundation for structuring complex software systems and understanding user interaction with command line interfaces.

**2. Human-Computer Interaction (HCI):** HCI studies how people interact with computers and designs technologies that let humans interact with computers in novel ways. This domain influences how command line interfaces should be designed to enhance usability and accessibility.

**3. Cognitive Psychology:** This field examines how people perceive, remember, think, speak, and solve problems. Understanding cognitive psychology is crucial for designing interfaces that are easy to use and reduce cognitive load, which is particularly relevant for command line applications with numerous parameters.

c) Define interface metaphors and how they influence the design of user interface in computer science under 7 sentences.

Interface metaphors are conceptual tools borrowed from familiar activities or objects in the real world to represent data and actions in a user interface. They help users understand the functionalities of a computer system by relating them to their existing knowledge. For example, the desktop metaphor used in graphical user interfaces mimics a physical desk, making it intuitive to understand icons as documents and folders. Metaphors can simplify complex operations by leveraging familiar concepts, reducing learning curves and making interfaces more intuitive. By aligning digital interactions with real-world experiences, interface metaphors enhance usability and accessibility. However, **poor**

**metaphor choices can lead to misunderstandings** if the users' cultural or personal backgrounds do not align with the metaphor's base context.

4(b)

To address the research question "Does the color of the customer's UI influence the purchase decision and amount of a specific type of food (appetizer, main course and/or dessert)?", the restaurant owner can design an experiment as described below:

### 1. Describe an Experiment with Steps that May Facilitate the Answer to the Question

- **Step 1: Designing the Experiment**

- Create multiple versions of the UI for the digital menu, each with different color schemes (e.g., red, blue, green, and yellow) but identical layout and content.

- **Step 2: Participant Selection**

- Select a diverse group of participants who frequent the restaurant to ensure variability in preferences and dining behavior.

- **Step 3: Random Assignment**

- Randomly assign participants to different UI color groups to use when ordering their food.

- **Step 4: Data Collection**

- Monitor and record the type and amount of food ordered (appetizers, main courses, desserts) by each participant using the different colored UIs over a defined period.

- **Step 5: Data Analysis**

- Analyze the data to identify any statistically significant differences in the types and amounts of food ordered across different UI colors.

- **Step 6: Reporting Results**

- Compile the findings into a report discussing the impact of UI color on food purchasing decisions.

### 2. Formally Construct the Variables of the Experiment

- **Independent Variable**: UI Color (Red, Blue, Green, Yellow)

- **Dependent Variable**: Type and amount of food ordered (measured in number of dishes ordered and total cost)

- **Control Variables**: Menu content, pricing, time of day, day of the week

- **Random Variables**: The individual differences among participants such as age, gender, and personal preferences

- **Confounding Variables**: External factors like weather, special offers or events happening during the experiment which might affect dining out choices

### 3. Choose and Justify a Proper Evaluation Approach for the Experiment

- **Evaluation Approach**: Statistical Analysis using ANOVA (Analysis of Variance)

- **Justification**:

- **Applicability**: ANOVA is suitable for comparing means across more than two groups, which is necessary given the multiple UI colors being tested.



- **\*\*Advantages\*\***: It can help identify whether there are significant differences in the amount and type of food ordered based on UI color while accounting for variance within and between these groups.
- **\*\*Execution\*\***: After collecting data, the average expenditures and number of dishes ordered per UI color can be analyzed to see if there are statistically significant differences.

By conducting this experiment and using ANOVA for analysis, the restaurant owner can scientifically determine if and how the color of the customer UI influences their purchase decisions, providing actionable insights for optimizing menu presentation to boost sales and customer satisfaction.

## Final - 2023

Google Maps is one of the top most apps used for online navigating. Google Maps designs its affordances for the users to interact with a certain, perhaps playful, attitude. Google Timeline, Google Local Guides, and Google Earth thus contain affordances that allow for a certain interaction, in order to be used for different purposes. Google Timeline could be seen as a take-over of an analogue diary, Google Local Guides serves as a social network, and Google Earth shows similarities to a travel guide.

- a) How are the interface metaphors and conceptual models related to each other for conceptualizing interactions?
- b) Identify and explain the interface metaphors used in various Google applications mentioned in the scenario and discuss how they create a conceptual model that is based on familiar real-world objects or concepts.
- c) Find out and explain the types of interaction to support the conceptual models you have identified in the scenario.

Let's tackle each part of the question regarding the interface metaphors and conceptual models in Google Maps and its related services.

### a) How are the interface metaphors and conceptual models related to each other for conceptualizing interactions?

**Interface metaphors** and **conceptual models** in user interfaces like Google Maps are closely related as they both aim to simplify and make intuitive the interaction with digital information by borrowing from the physical world. In the context of the mentioned Google applications:

- **Google Maps** uses the metaphor of a physical map, enriched with interactive features like zooming, panning, and street viewing, making the digital navigation resemble navigating with a physical map.
- **Google Timeline** employs a diary-like metaphor where it logs and displays locations visited over time, much like entries in a diary but with spatial data.
- **Google Local Guides** resembles a social network where users contribute reviews and photos, akin to social interactions in **community gatherings or clubs**.
- **Google Earth** offers a travel guide metaphor, providing a virtual tour of the globe, which mimics the experience of flipping through a travel guide book.

These metaphors help conceptualize interactions by making the software more intuitive to users who are already familiar with maps, diaries, social networks, and travel guides.

#### b) Identify and explain the interface metaphors used in various Google applications mentioned in the scenario and discuss how they create a conceptual model that is based on familiar real-world objects or concepts.

- **Google Maps**: As mentioned, it uses the map metaphor. This provides a conceptual model where users can explore an interactive surface that corresponds to geographical locations. This is similar to using a physical map but with enhanced functionalities like route planning and real-time traffic updates.
- **Google Timeline**: This uses the metaphor of a diary or journal. It automatically records places you've been to, like a diary entry. This allows users to reflect on their travel history and patterns in a chronological manner, mimicking how one might look back through a diary.
- **Google Local Guides**: Operates on a social networking metaphor. Users contribute information and reviews about places, similar to how one might share experiences in a social setting or on social media platforms.
- **Google Earth**: Acts like a digital travel guide or globe. Users can virtually visit and explore places around the world, providing a sense of exploration and travel without leaving home.

#### c) Find out and explain the types of interaction to support the conceptual models you have identified in the scenario.

- **Google Maps**: Supports direct manipulation interactions where users can drag the map, zoom in/out, and select specific locations or icons. This mimics the interaction one might have with a physical map, enhanced by the ability to instantly obtain detailed information about a selected place.

- **Google Timeline**: Uses a timeline-based interaction, where users can scroll through time to see their location history. This model supports interactions akin to flipping through pages of a diary, with visual cues that represent temporal changes.
- **Google Local Guides**: Emphasizes community interaction through content creation and rating systems. Users can post reviews, answer questions, or add photos, fostering a sense of community engagement similar to social networks.
- **Google Earth**: Provides exploratory interactions, allowing users to "fly" to different parts of the globe and explore geographic and cultural information. This interaction is akin to browsing through a travel guide book but with a dynamic, immersive experience.

These types of interactions help bridge the gap between the digital and physical world experiences, making these tools more accessible and intuitive.

2. Suppose you need to design a chat application to help users monitor their mental health by analyzing their text messages in Bangla. The application utilizes machine learning algorithms to analyze the messages and returns a depression score based on the severity of the user's mental health condition. The scoring system has been developed based on extensive research and data analysis, ensuring that it provides accurate and reliable results. Users can also receive personalized recommendations for mental health resources and treatment options based on their scores.

To ensure that the application is user-friendly, the design team has to conduct extensive user research to understand the needs and preferences of the target audience. The team also needs to conduct usability tests and gather feedback from beta users to refine the design and ensure that it meets the requirements of the users.

Overall, the chat application aims to provide a user-friendly and effective tool for users to monitor their mental health and seek appropriate treatment and resources.

Based on the scenario, answer the followings:

- a) What are the key principles of User-Centered Design (UCD), and how can they be applied in the design process of the mental health monitoring chat application described in the given scenario?
- b) Briefly describe how you will generate alternate design solutions for the scenario and on which basis you will choose among the alternatives.

Let's address each part of the scenario based on the development of a mental health monitoring chat application:

### a) What are the key principles of User-Centered Design (UCD), and how can they be applied in the design process of the mental health monitoring chat application described in the given scenario?

User-Centered Design (UCD) is a design philosophy and a process in which the needs, wants, and limitations of end users are given extensive attention at each stage of the design process. UCD can be characterized by the following key principles:

1. **\*\*Understanding User Needs:\*\*** Extensive user research should be conducted to understand the cultural, emotional, and functional needs of the users. For this chat application, understanding how users express emotions and concerns in Bangla, and what mental health issues are most prevalent or taboo, can inform the design.

2. **\*\*Involving Users Throughout Design and Development:\*\*** Users should be involved throughout the development process through interviews, usability testing, and feedback sessions. This ensures the application meets their expectations and is user-friendly. For instance, conducting focus groups with potential users to gather feedback on usability and the effectiveness of the depression scoring system.

3. **\*\*Accessibility and Usability:\*\*** Designing for accessibility ensures the application can be used by people of varied abilities, which is crucial for a mental health application. Ensuring the application is usable on common devices and platforms used by the target demographic is also key.

4. **\*\*Iterative Design:\*\*** The design process should be iterative, meaning that design decisions are continually revisited. Each iteration should refine and improve upon the previous based on user feedback and testing results. For the chat application, this might mean iteratively testing and refining the machine learning algorithms that analyze text messages.

5. **\*\*Evaluate Use in Real Context:\*\*** UCD stresses real-world evaluations to ensure the product performs well in real usage scenarios. Deploying a beta version of the application and studying how it is used in daily life would provide valuable insights for further refinement.

### b) Briefly describe how you will generate alternate design solutions for the scenario and on which basis you will choose among the alternatives.

To generate alternate design solutions, the following steps can be taken:

1. **\*\*Brainstorming Sessions:\*\*** Involve diverse teams (including designers, developers, linguists, mental health professionals, and user representatives) in brainstorming sessions to come up with various design ideas based on the functional requirements and user needs.

2. **\*\*Storyboarding and Scenarios:\*\*** Create different scenarios and storyboard ideas that illustrate how users might interact with the application. These can include variations in interface layout, interaction styles, and response mechanisms.

3. **\*\*Prototype Development:\*\*** Develop low-fidelity prototypes for each of the alternative designs. These can be as simple as sketches or more detailed wireframes. Later, develop high-fidelity prototypes that are closer to the final product.

4. **\*\*Usability Testing:\*\*** Conduct usability tests with actual users for each prototype. These tests should assess ease of use, satisfaction, and effectiveness of the application in helping users monitor their mental health.

5. **\*\*Analyzing Feedback and Data:\*\*** Collect and analyze user feedback and interaction data from the tests. Look for patterns in how users interact with different designs and note any common issues or points of praise.



6. **\*\*Selection of Final Design:\*\*** Choose the design solution that best meets the criteria established for usability, effectiveness in mental health monitoring, user satisfaction, and technical feasibility. This decision should also consider the cost of implementation and the ability to maintain and update the application.

By following these steps, you can ensure that the selected design solution is not only based on theoretical principles but is also empirically proven to meet user needs in practical, everyday contexts.

### 3. **Case Study A:**

Children with Down Syndrome (DS) may suffer from an intellectual as well as physical and social disability. Physical disability falls into two categories, fine motor skill (e.g. picking, grasping, holding small objects - that use the small muscles of the fingers, toes, wrists, lips, and tongue) and gross motor skill (e.g. walking, kicking, jumping, and climbing stairs - that use the large muscles in the arms, legs, torso, and feet) deficiency. Research shows that Game Therapy has a positive effect on improving the motor skills of children with DS. Suppose you have to conduct research and design a game therapy system for the children with DS to improve gross motor skills.

- a) Describe how you are going to identify the list of requirements of the system. Which data gathering technique will you follow? Give example.
- b) Write at least two measurable usability requirements for each of the following usability goals:
  - i. Having good utility
  - ii. Effectiveness
  - iii. Efficiency
- c) How will you represent those requirements to your teammates for analysis? Give example.

## **a) Identifying the List of Requirements & Data Gathering Techniques**

To identify the requirements of a game therapy system aimed at improving gross motor skills for children with DS, the following data gathering techniques can be used:

1. **Observational Studies:** Observing children with DS during their physical therapy sessions, daily activities, and playtime to understand the specific challenges they face with gross motor skills. Observations can provide insights into the types of movements that are most difficult for these children and the kind of support they need.
2. **Interviews with Experts:** Conducting structured interviews with pediatric physical therapists, occupational therapists, and pediatricians who specialize in DS. These

experts can provide detailed insights into the specific gross motor skills that should be targeted and effective therapeutic approaches.

3. **Focus Groups with Caregivers and Parents:** Organizing focus groups with parents and caregivers to discuss their observations, the children's needs, and their experiences with existing therapeutic modalities. This helps gather emotional and practical input on what they believe would be helpful or enjoyable for the children.

## b) Measurable Usability Requirements

For each of the usability goals listed, here are two measurable usability requirements:

### 1. Having Good Utility

- **Requirement 1:** The system should allow the therapist to choose or customize games based on specific motor skills like balance or leg strength.
- **Requirement 2:** The system should provide feedback to the user and therapist on the child's performance and progress.

### 2. Effectiveness

- **Requirement 1:** Children should be able to complete the intended game tasks correctly at least 80% of the time after an initial learning period.
- **Requirement 2:** Improvement in targeted motor skills should be observed over a period, say a 10% improvement in task completion speed after 3 months.

### 3. Efficiency

- **Requirement 1:** The system should minimize the setup time for each therapy session, not exceeding 5 minutes from startup to game start.
- **Requirement 2:** Response time of the system should be quick enough to keep the children engaged, with system feedback provided within 2 seconds of the action performed.

## c) Representing Requirements for Team Analysis

To represent these requirements to your team for analysis, you can use the following approach:

1. **Use of Requirement Specification Documents:** Create a detailed document listing all the requirements with their justifications and expected impacts. This document should be accessible to all team members and stakeholders for review and feedback.
2. **Visual Aids and Flowcharts:** Develop flowcharts or wireframes showing how each part of the game therapy system will work, linking back to the requirements. For example, a flowchart could visually represent the process from game selection to feedback provision.
3. **Prototyping:** Early prototyping, even if only conceptual or using basic tools like PowerPoint or specialized software like Balsamiq. This helps team members visualize how the application might function and interact with users



Example: Presenting a flowchart in a team meeting that outlines the user journey from logging into the system, selecting a game, playing the game, and receiving feedback, with notes on how each step meets the listed usability requirements.

4. a) Which prototyping technique will you follow for the system as described in the **Case Study A** in Question 3? Explain why.
- b) Construct a prototype for the system using an appropriate prototyping technique for the scenario in **Case Study A**.
- c) Write one main persona and corresponding scenario capturing how the user is expected to interact with the system as described in **Case Study A**.

#### ### a) Which Prototyping Technique to Follow

For the game therapy system described in Case Study A, which aims to improve gross motor skills in children with Down Syndrome, the most appropriate prototyping technique would be **\*\*Rapid Prototyping\*\***. Here's why:

- **\*\*Iterative Feedback and Development\*\***: Rapid prototyping allows for quick creation and iteration of prototypes based on continuous feedback from therapists, parents, and even children when possible. This is crucial for addressing the unique needs and immediate responses of users.
- **\*\*Flexibility\*\***: Changes can be made quickly without substantial costs or delays, which is vital when designing for children with special needs, as adjustments might need to be frequent and based on hands-on trials.
- **\*\*Focus on User Experience\*\***: This method allows the design team to focus on the user experience early in the development process, ensuring that the system is engaging and suitable for children with varying levels of motor skills and cognitive abilities.

#### ### b) Constructing a Prototype

To construct a prototype for the system using rapid prototyping, follow these steps:

1. **Sketching**: Begin by sketching the interface and key components of the game therapy system on paper or using digital tools like Sketch or Adobe XD. Focus on the main screens and interactions, such as game selection, gameplay, and feedback screens.
2. **Low-Fidelity Prototyping**: Create a digital low-fidelity prototype using tools like Balsamiq or wireframing features in Adobe XD. This should include navigation flows and basic elements of the gameplay interface.
3. **High-Fidelity Prototyping**: Develop a more detailed prototype with interactive elements using tools like InVision or Axure. This prototype should mimic the final product in terms of design, interactions, and transitions between different parts of the application.
4. **Usability Testing**: Conduct usability tests with therapists and parents initially, and with children if deemed appropriate, to gather feedback on the prototype's effectiveness and engagement.
5. **Iteration**: Refine the prototype based on the feedback received, adjusting gameplay mechanics, interface elements, and interactions as necessary.

### ### c) Main Persona and Scenario

#### **Persona:**

- **Name**: Ayesha Rahman
- **Age**: 8 years old
- **Condition**: Down Syndrome
- **Needs**: Requires improvement in gross motor skills, particularly in balance and coordination.
- **Preferences**: Enjoys colorful animations and music, responds well to visual rewards.

**\*\*Scenario:\*\***

Ayesha attends a special education school where her therapist has introduced a new game therapy system to help improve her motor skills. The session starts with the therapist selecting a balance game designed to help Ayesha practice standing on one foot.

**- \*\*Interaction\*\*:**

- Ayesha logs into the system using a simple touch interface with her therapist's help.
- They select a game designed to improve balance. The game involves Ayesha mimicking an animated character on the screen that balances on one foot while reaching for stars appearing at different heights.
- As Ayesha interacts with the game, her movements are tracked via a motion sensor, and feedback is provided on the screen in real-time. She earns points for each successful attempt, which are displayed as stars collected by the character.
- The session lasts for about 10 minutes, after which the system displays a summary of her performance, showing her progress over time and encouraging words for her efforts.

**- \*\*Outcome\*\*:**

- The therapy session using the game helps Ayesha remain engaged and motivated. Her therapist is able to observe improvements in her balance and provides immediate positive reinforcement, making the session enjoyable and beneficial.

This scenario illustrates how the system is used in a real-world setting, providing insights into the user's interaction with the application and the potential benefits it offers for therapy.

6. a) Suppose you as a researcher want to investigate whether using a new assistive mouse controller that is operated with a head-mounted device affects computer input speed and accuracy. The experiment involves entering data into a computer using the new assistive mouse controller and a traditional mouse.
- What are the independent variables and confounding variables you would test? Explain.
  - Explain how you would conduct between-subjects and within-subject experiment.
  - Do you need any ethical approval to conduct the research experiment? Explain your answer.
- b) Write an example application scenario where you can use Augmented Reality (AR)/ Virtual Reality (VR) technologies in the field of Computer-Supported Collaborative Works (CSCW).

### ### a) Variables in the Experiment

#### \*\*i. Independent and Confounding Variables\*\*

- **\*\*Independent Variables\*\***: These are the variables manipulated by the researcher to observe their effect on the dependent variable. In this case, the independent variables would be:

1. **\*\*Type of Mouse Controller\*\***: Using the new assistive mouse controller vs. using the traditional mouse.

2. **\*\*Task Complexity\*\***: Simple vs. complex data entry tasks could also be considered if varying the difficulty level of the tasks is part of the experiment.

- **\*\*Confounding Variables\*\***: These are variables that could influence the outcome inadvertently. For this experiment, potential confounding variables might include:

1. **\*\*Participant's Experience with Technology\*\***: Different levels of familiarity with head-mounted devices or traditional mice could affect speed and accuracy.

2. **\*\*Participant's Physical Abilities\*\***: Variability in participants' motor skills or any physical disabilities.

3. **\*\*Environmental Factors\*\***: Differences in the testing environment, such as lighting or noise, which might affect the concentration or performance of participants.

## **\*\*ii. Conducting Between-Subjects and Within-Subject Experiments\*\***

- **\*\*Between-Subjects Design\*\***: Each participant uses either the assistive mouse controller or the traditional mouse, but not both. This method helps in controlling learning effects; however, it requires more participants to ensure variability among groups is minimized.

- **\*\*Procedure\*\***: Randomly assign half of the participants to use the new assistive mouse and the other half to use the traditional mouse. Compare the speed and accuracy of data entry between these two groups.

- **\*\*Within-Subjects Design\*\***: The same participants use both types of controllers in different sessions. This design controls for individual differences in ability and preference because each participant serves as their own control.

- **\*\*Procedure\*\***: Have all participants perform tasks with both types of mice in separate sessions, ensuring a sufficient time gap or randomizing the order to mitigate order effects (fatigue, practice). Compare each participant's performance with each type of controller.

## **\*\*iii. Ethical Approval for the Research Experiment\*\***

Yes, ethical approval is required to conduct this research experiment because it involves human participants. Ethical review will ensure that:

- **\*\*Informed Consent\*\*** is obtained from all participants, making sure they are aware of the study's purpose, their role in it, and that they can withdraw at any time.

- **\*\*Privacy and Confidentiality\*\*** are maintained, ensuring that personal data is protected and results are anonymized.

- **\*\*Risk Assessment\*\*** is performed to identify any potential harm or discomfort resulting from the experiment, with measures in place to minimize them.

## **### b) Application Scenario for AR/VR in CSCW**

## **\*\*Scenario: Augmented Reality for Remote Collaborative Machine Repair\*\***

Imagine a scenario where technicians in different geographic locations collaborate to troubleshoot and repair complex machinery using Augmented Reality (AR). Each technician wears AR glasses that overlay digital information and visuals onto the physical machine components they are viewing.

- **\*\*Use Case\*\***: A technician in Germany and another in Japan are working together to fix a malfunction in a large printing press. The German technician, being near the physical location of the machinery, sees real-time data and diagrams overlaid on the machinery parts through AR glasses. The Japanese technician, participating remotely, views the same visual field through a connected AR device.

- **\*\*Interaction\*\***: They use a shared digital workspace where both can annotate, highlight, and manipulate 3D models of the machinery parts. The AR system helps them point out specific issues and simulate repairs, guiding them through complex procedures step-by-step.

- **\*\*Benefits\*\***: This AR-enabled collaborative setup reduces the need for physical presence, speeds up the repair process, enhances precision through shared visual aids, and provides a dynamic platform for real-time problem-solving and learning.

This application leverages AR to enhance collaboration, making remote assistance as effective as being physically present, which is critical in global industries requiring high precision and expertise.