Tutorial Questions (Go for More Questions from HCI recommended readings).

1) a) Briefly explain what is meant by the terms perception, physiology and cognition.

- Perception relates to the use of our five senses to detect changes in our environment. It plays a role in computer systems development because users must be able to detect and respond to changes in a display.

- Physiology relates to our physical characteristics, including height, reach and weight. It plays a role in computer systems development because users must be able to physically operate both input and output devices. Problems such as RSI and Carpal Tunnel Syndrome can reduce a user's physical ability to operate some devices.

- Cognition relates to the mental processes that can be used to analyse the information that we perceive in our environment. It plays a role in computer systems development because users may be able to read a warning or help message but may be unable to understand what it means.

b) Identify three different ways in which `functional ageing' can affect interface development.

Functional ageing relates to the way in which a user's cognitive, perceptual and physiological capabilities may degrade at a rate that is faster than might otherwise be

expected for their age. This form of ageing can be a particular problem for certain industries. For example, some commercial aviation pilots suffer significant sinus problems that ultimately may lead to hearing loss. Functional ageing can affect interface development in the following ways:

i. it can affect an entire workforce and so additional cues and prompts may be introduced for all users who suffer from this problem;

ii. it may only affect certain individuals within a population and so studies will have to be conducted to determine whether initial assumptions about user capabilities hold for the entire group;

iii. The rate of functional aging may vary from individual to individual and so further studies may be needed to determine the extent of the additional support that may be necessary. Ultimately, it may not be possible for some people to use the system even with significant enhancements to the interface, for example in safety-critical applications.

c) Environmental factors can impair users' ability to recall information that is necessary to operate complex, computer systems. Briefly explain how such disruptions can impair both short-term AND long-term memory.

Short-term memory, typically, requires concentrated effort on the part of the individual concerned. If they become distracted by environmental factors then that concentration

can be broken and the content of short-term memory may be lost. For instance, even a momentary distraction can cause a user to forget the name of a file or of a password that they haven't used before.

The impact of disruptions on long term memory is less easy to explain. Typically, it is less easier to remember information that has passed from short-term to long-term memory. In consequence, a greater source of distraction or disruption would be required to impair their memory. A, typical, example is that even expert computer users may make mistakes if they attempt to perform two familiar tasks in parallel. Both may draw upon long-term memory but there can be interference effects.

2) You have been asked to help in the development of a new computerized call centre. Customers from a national Bank will ring up if they wish to change the details of their account. For instance, they might want to open a new account, close an old account, they might want to change the address of the person who owns the account and so on. Briefly explain how you might use two different requirements elicitation techniques to identify the potential usability problems that might arise for people working with this new system.

There are many possible answers to this question.

   i.   You could propose questionnaires, interviews.

ii.   You could also use a summative evaluation techniques also known as post-implementation evaluation employing criteria-based evaluation technique as a how to evaluate technique and two what to evaluate techniques which are IS/IT as such and IS/IT in use to find out the weaknesses of the existing systems.

iii.   Analytical memos however, is very important and to be used together with each of the two above techniques. Analytical memos help converting your perceptions and thoughts as a designer into a visible form that allows reflection and further manipulation.

iv.   User requirements acceptance test should also be performed at earliest stage to ensure user acceptance to the new system so as to avoid failure expenses. This has to be done after the collection of user requirements aiming at helping designers and managers decide whether to go forward as planned, modify or refine requirements to improve acceptability, or abandon to avert major losses.

3) Describe three populations of users with special needs. For each of these populations, suggest three ways current interfaces could be improved to better serve them.

Disabled users – Have audio that reads text back to them, Braille on keyboards or output, have keyboard prompts that can perform same tasks as direct manipulation, have text associated with any audio

Elderly user – enlarge font size and contrast, reduce the amount of typing, reduce short time memory load by remembering their passwords and other information, enlarge width of buttons and controls so they are more easily clicked.

Children – colorful, attractive interface, minimize the syntax so its as easy to learn as possible, prevent errors and provide reversibility to encourage exploration of system, enlarge width of buttons and controls so they are more easily clicked, simpler vocabulary.

4) a) Briefly describe three forces shaping the nature of future computing as far as HCI is concerned.

    i.   Increasingly widespread use of computers, especially by people who are outside of the computing profession.

    ii.   Increasing innovation in input techniques (e.g., voice, motion, pen), combined with lowering cost, leading to rapid computerization by people previously left out of the "computer revolution."

iii.   Wider social concerns leading to improved access to computers by currently disadvantaged groups (e.g., young children, the physically/visually disabled, etc.).

b) human-computer interaction involves converters between humans and machines. While humans are sensitive to response times, practicable human interfaces are more technology-sensitive than many parts of computer science. So based on that trend briefly describe three characteristics expected for future HCI.

i.   **Unlimited communication**.

Computers will communicate through high speed local networks, nationally over wide-area networks, and portably via infrared, ultrasonic, cellular, and other technologies. Data and computational services will be portably accessible from many if not most locations to which a user travels.

ii.   **High functionality systems.**

Systems will have large numbers of functions associated with them. There will be so many systems that most users, technical or non-technical, will not have time to learn them in the traditional way (e.g., through thick manuals).

iii.   **High-bandwidth interaction**

The rate at which humans and machines interact will increase substantially due to the changes in speed, computer graphics, new media, and new input/output

devices. This will lead to some qualitatively different interfaces, such as virtual reality or computational video.
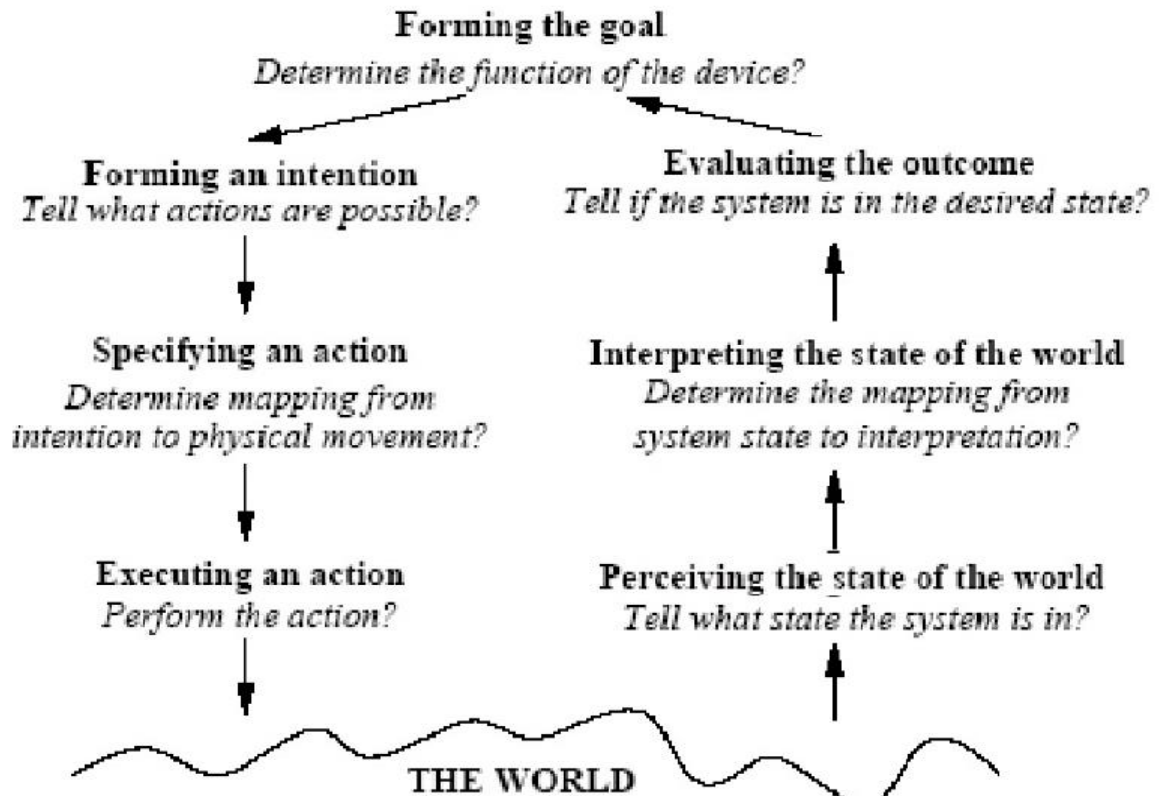
c) Mention seven things the designer requires to understand in order to become a better designer.

    i.   make use of affordances

    ii. make use of constraints

    iii. provide a good conceptual model

    iv. make things visible

    v. use a good mapping - a natural one if possible

    vi. provide feedback

    vii. keep the number of features, actions and controls balanced

d) According to Norman's psychology of everyday things, there are seven stages of which humans perform their tasks. Describe these seven stages when applied as design aid with specifying important questions to be asked in bridging the evaluation and execution gulfs. (Note: provide your answer in a diagrammatic form).
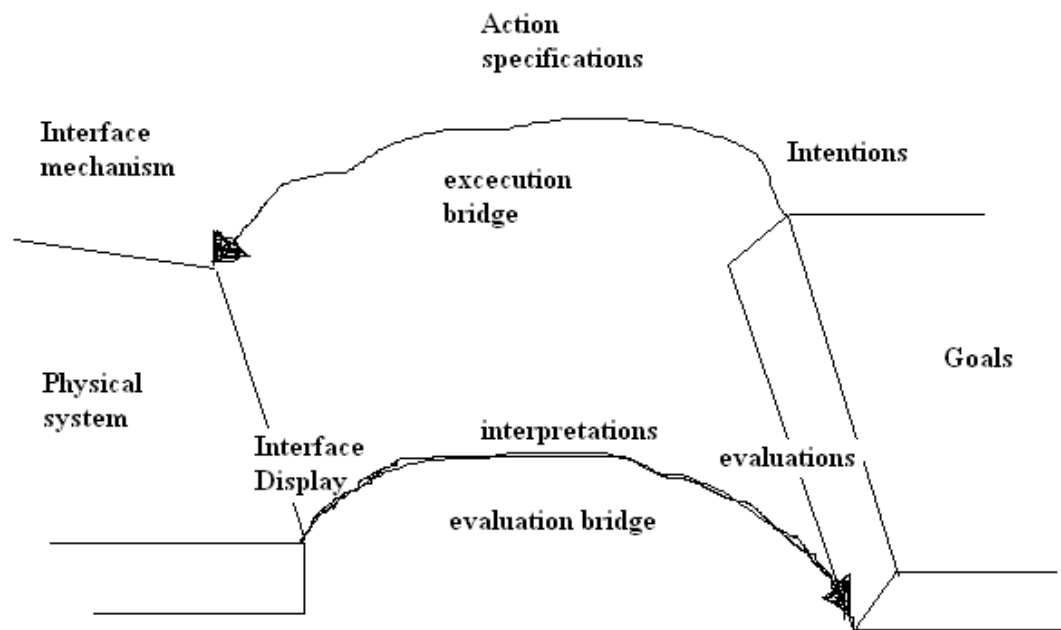
The Seven Stages as a Design Aid

- Questions we can ask to ensure the gulfs are "bridged":
  How easily can the user ...

Forming the goal
Determine the function of the device?

Forming an intention
Tell what actions are possible?

Evaluating the outcome
Tell if the system is in the desired state?

Specifying an action
Determine mapping from intention to physical movement?

Interpreting the state of the world
Determine the mapping from system state to interpretation?

Executing an action
Perform the action?

Perceiving the state of the world
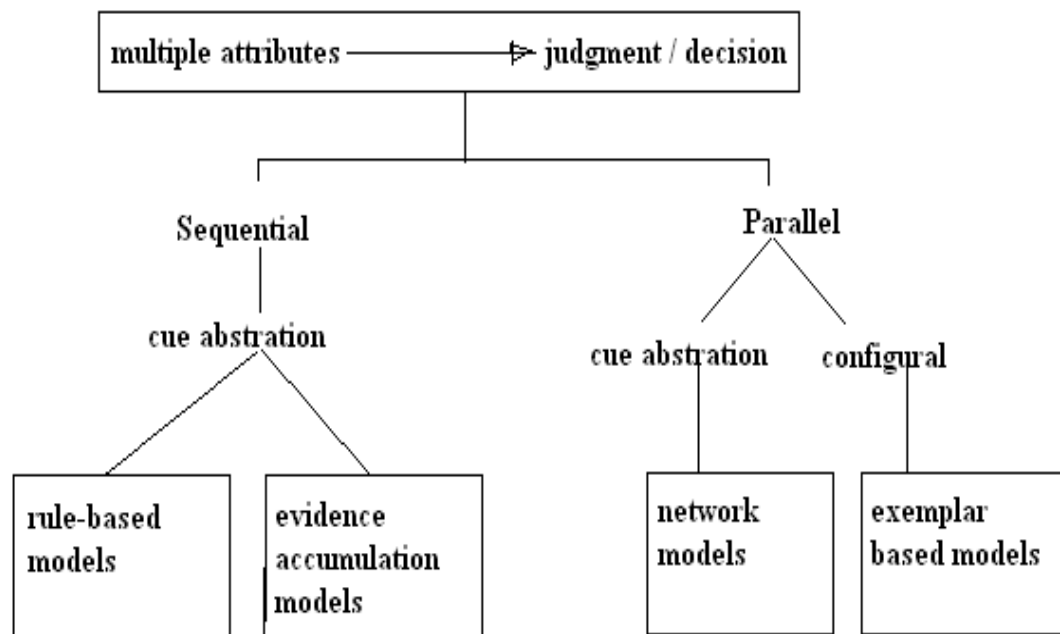*Tell what state the system is in?*

THE WORLD

e) Sketch a well labeled diagram describing the process of bridging the evaluation and execution gulfs aiming at bridging the chasm existed between ISs development and evaluation.

Action
specifications

Interface
mechanism

Intentions

excecution
bridge

Goals

Physical
system

Interface
Display

interpretations

evaluations

evaluation bridge

f) Sketch a diagram showing the relation between four cognitive models of multi-
attribute judgment

multiple attributes ⟶▷ judgment / decision

Sequential

Parallel

cue abstraction

cue abstration

configural

rule-based
models

evidence
accumulation
models

network
models

exemplar
based models

5) a) Briefly explain three primary interaction paradigms

i. The computer-as-tool paradigm extends human capabilities through a (very sophisticated) tool, just as the invention of the wheel allowed us to transport heavy loads over long distances. Direct manipulation and WIMP interfaces fall into this category.

ii. The computer-as-partner paradigm represents humanlike means of communication in the computer, such as natural language, so that users can delegate tasks. Agent-based interaction and speech-based interfaces fall into this category.

iii. The computer-as-medium paradigm uses the computer as a medium by which humans communicate with each other. Email, chat and videoconferencing fall into this category.

b) Mention the two sets of skills that distinguish humans from other species as far as interaction paradigms design is concerned.

i. The ability to create and use artifacts (computer-as-tool and computer-as-medium), and

ii. The ability to communicate with each other through language (computer as partner and computer-as-medium).

c) Describe three important dimensions along which interaction models can be evaluated.

i.   Descriptive power: the ability to describe a significant range of existing interfaces.

ii. Evaluative power: the ability to help assess multiple design alternatives.

iii. Generative power: the ability to help designers create new designs.

d)   There are various principles guiding interaction design, briefly define three design principles inspired by programming languages.

i.   **Reification** turns concepts and abstract commands into user interface objects that the user can manipulate directly. For example, a scrollbar is the reification of the concept of navigating a list or document.

ii. **Polymorphism** states that tools should operate in as many different contexts as possible, as long as this makes sense to the user. For example, copy and paste work across a wide range of object types, including text, drawing and sound.

iii. **Reuse** may involve either user input or system output. Redo and macros are examples of input reuse, enabling users to replay earlier commands in a new context. Copy-paste is an example of output reuse, enabling users to reuse results from earlier command sequences.
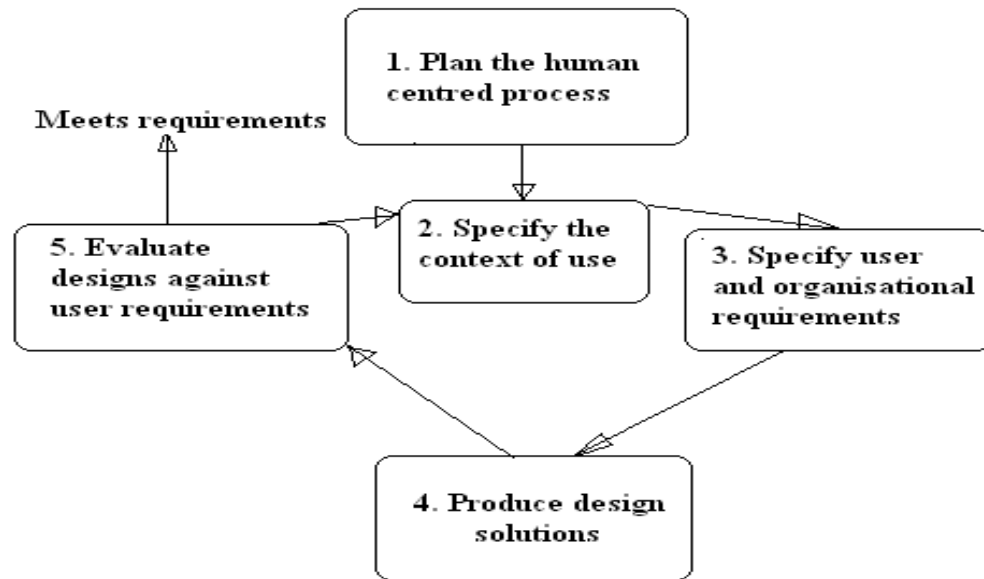
e)   Briefly describe three properties of interaction architectures.

i. **Reinterpretability** is the ability of a system to be used in contexts and by users it was not designed for. Like any other technology, computer systems are inevitably reinterpreted by their users.

ii. **Resilience** is the ability of a system to resist to change. This might seem contradictory with reinterpretability, but in fact is a condition for it. in order to withstand changes and reinterpretation, critical components of the architecture must resist changes in their environment. Web browsers are a good example: they are very tolerant of incorrect syntax in the HTML documents they display.

iii. **Scalability** is the ability of a system to withstand scale effects.

6) a) Mention two important standards governing the human-centred design process.

i. ISO 13407: "Human centred design processes for interactive systems" standard.

ii. ISO 9241: For Quality of use applicable for the design of interactive computing systems.

b) Draw a very well labeled User centred design process diagram

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                           ┌─────────────────┐
                           │ 1. Plan the human│
                           │ centred process  │
Meets requirements         └─────────────────┘
        ⇧                            │
        │                            ▼
┌─────────────────┐       ┌─────────────────┐     ┌─────────────────┐
│ 5. Evaluate     │──────▷│ 2. Specify the  │     │ 3. Specify user │
│ designs against │       │ context of use  │     │ and organisational│
│ user requirements│      └─────────────────┘     │ requirements    │
└─────────────────┘                               └─────────────────┘
            ▲                                            │
             ╲                                          ╱
              ╲         ┌─────────────────┐            ╱
               ╲        │ 4. Produce design│◁─────────
                ────────│ solutions        │
                        └─────────────────┘
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c) In a tabular form describe a Human-Centred Systems Development Life Cycle (HCSDLC) methodology.

Problem Identification	Problem Identification
Project selection & planning	Project Selection, Project Planning
Analysis	Preliminary Requirements Determination and Analysis Process Analysis, Data Analysis, Logic Analysis	User acceptance test, Context analysis, User analysis, Task analysis, Evaluation metrics Alternative Selection
Design	Database Design, Program Design	Interface specification Metaphor, Media, Dialogue, Presentation design, Formative Evaluation
Implementation	Prototyping Program & System testing, Installation, Documenting, Support, Maintenance	Summative Evaluation

d) Briefly describe six important HCI principles.

    i.   Improve users' task performance and reduce their effort.

    ii. Prevent disastrous user errors.

    iii. Strive for fit between the tasks, information needed, and information presented.

    iv. Enable enjoyable, engaging and satisfying interaction experiences.

    v.   Promote trust.

vi. Keep design simple.

e) Context analysis is one of the major information systems analysis methods. Clearly describe this method and state the outcome(s) of the complete context analysis method.

Context analysis includes:

i. Physical context: where are the tasks carried out, what entities and resources are implicated in task operation, what physical structures and entities are necessary to understand observed task action?

ii. Technical context: which is about the technology infrastructure, platforms, hardware and system software, network/wireless connection? Palm PDAs, or Mobile phones.

iii. Organizational context: what is the larger system where this information system is embedded, what are the interactions with other entities in the organization?

iv. Social and cultural context: what are the social or cultural factors that may affect users attitude and eventual use of the information system?

The outcomes: Overall, context analysis method can provide ideas for design factors such as metaphor creation/selection, pattern of communications between users and between users and the system, distribution of users and objects they use.

7) a) In a tabular for describe the usability goals and user experience goals as far as general HCI evaluation metrics are concerned.

General HCI Evaluation Metrics	
Usability goals	**User experience goals**
• **Fewer errors**	• Tasteful pleasing
• **Efficient**	• Enjoyable, entertaining, fun
• **Easy to learn**	• Motivating, engaging
• **Easy to remember**	• Trustworthy

b) Describe two major ISs' evaluation approaches.

i. **Quantitative evaluation approach**: The evaluation process is based on technical and economical aspects of the system designed and the fulfillment of goals is expressed in terms of quantitative numbers.

ii. **Qualitative evaluation approach:** The evaluation process is based not only on technical and economical aspects of the system designed but also on social and human aspects and the fulfillment of goals is expressed in qualitative terms. This means that qualitative approach provide richer descriptions than quantitative approach.

c) Describe briefly three "how to evaluate" strategies and two "what to evaluate" strategies. Provide well labeled diagrams where necessary.

The three how to evaluate strategies are:

i. **Goal-based evaluation**: Means that explicit goals from the organizational context drive the evaluation process. These goals are used to measure the IT/IS system.

ii. Goal-free evaluation: Means that no such explicit goals are used. Goal-free evaluation is a situationally driven strategy.

iii. Criteria-based evaluation: Criteria-based evaluation means that some explicit general criteria are used as an evaluation yardstick.

The two what to evaluate strategies are:

i. IT-system as such: Evaluating IT/IS-systems as such means to evaluate the IT/IS-system without any involvement from users.

UDCIMO System

Documentation
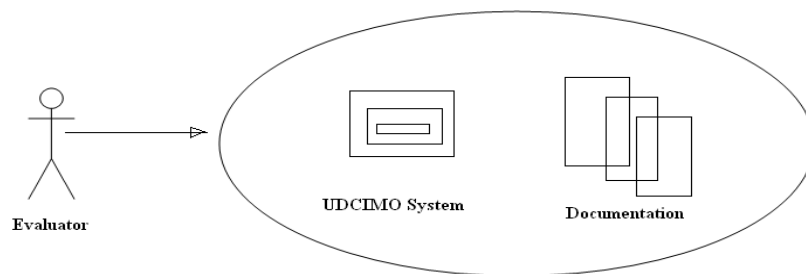
Evaluator

Diagram showing evaluation of IT/IS-system as such

ii. IT-system in use: Evaluating IT/IS-systems in use means to study a use situation where a user interacts with an IT/IS-system.
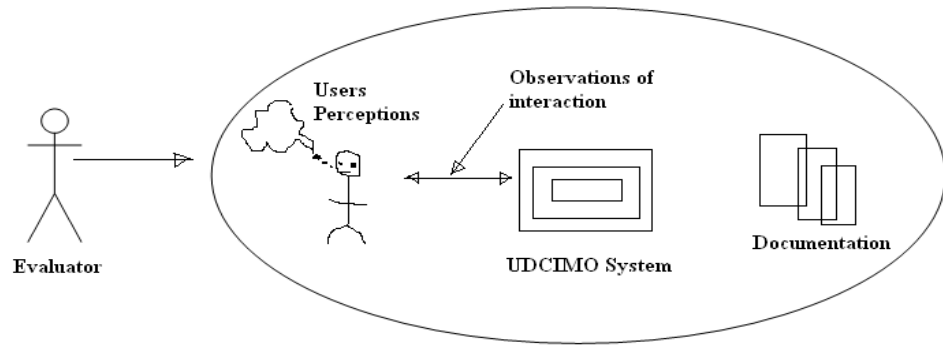
Diagram showing evaluation of IT/IS-system in use

d) How can a purchaser judge whether a product supplied by the supplier is usable?

    i.   The supplier could state the results of a usability test, but it can be difficult for the purchaser to know whether the results are valid or relevant.

    ii.   Another approach is to provide evidence that a user centred design process was used when developing the product.

8) a) Mention eight golden rules for the design of user interfaces.

    i. Strive for consistency.

    ii. Cater to universal usability.

    iii. Offer informative feedback.

    iv. Design dialogs to yield closure.

    v. Prevent errors.

vi. Permit easy reversal of actions.

vii. Support internal locus of control.

viii.   Reduce short-term memory load.

b) Cleary examine the bellow interface and state at least four things wrong with the interface.

Some mistakes in the above interface are:

i.   Text box size are not uniformed or aligned. The size of the box seems to have very little to do with the intended content.

ii. The list of medicines in the combo box has no apparent organization.

iii. The picture on the submit button only provides distraction, has seemingly nothing to do with the interface.

iv. The date box does not prevent errors – it has a label describing valid input that is extremely far away, and should make use of a calender, automatic entry of today's date, or drop down boxes for month, date, year.

9. a) Briefly describe the notion of **User-interface independence**.

User-interface independence: the decoupling of the user-interface design from the complexities of programming.

b) Briefly describe how the designers, user manual writers, and software engineers have benefits that stem from this notion. Be sure you have an explicit description for each of these three populations.

This decoupling allows the designers to lay out sequences of displays in just a few hours, to make revisions in minutes, and to support the expert-review and usability-testing processes. The programming needed to complete the underlying system can be applied once the user-interface design has been stabilized.

The user-interface prototypes can serve as specifications, from which writers create user manuals,

And from which software engineers build the system using other tools. The latter are required to produce a system that works just like the prototype.

10. What are the two important levels for analyzing and designing interaction?

      i.   High level conception of interaction phenomena described by interaction paradigms.

      ii. Operational Level describing how interaction proceeds. This is described by interaction models.

11. There are many advantages to using user interface software tools. These can be classified into two main groups. What are those groups?

      i.   The quality of the resulting user interfaces might be higher.

      ii. Second, the user interface code might be easier and more economical to create and maintain.

12. With the help of a well labeled diagram, describe briefly the five components of user interface software. (5 Marks).

13. With reference to Toolkit Intrinsics, toolkits come in two basic varieties. With one example in each mention these two basic varieties.

14. There are three important things an evaluator needs to do in order to bridge the gap that exists between Information Systems development and evaluation. Briefly describe them.

15. Why are dialogs a useful HCI component?

Dialogs are important due to the fact that:

      i.   Not all user input can came from components in a main application frame.

      ii.   Natural for the main window to holds primary content of the program,

      iii.   Not possible for the user to accomplish all of their tasks from the main window.

For example dialogs help:

    i.   To inform the user that a file is not available for loading

    ii.   Request further/alternative input

16. What common guidelines should be applied to Dialog design?

Common Guidelines state:

- Use dialogs only for actions that deviate from the primary task flow.

- Any dialog pauses the interaction of an application with the user.

- Dialogs should ideally be designed such that they could be ignored altogether, without disrupting the user's ability to complete their job.

- This implies that it is best to minimize the use of dialogs and emphasize direct manipulation within interface. However, there are times when Dialogs cannot be avoided.

- Request further/alternative input

17. Though Human-computer interaction is, in the first instance, affected by the forces shaping the nature of future computing, the future of HCI is expected with certain characteristics. Mention only six of those expected characteristics.

Unlimited communication.

Computers will communicate through high speed local networks, nationally over wide-area networks, and portably via infrared, ultrasonic, cellular, and other technologies.

High functionality systems.

Systems will have large numbers of functions associated with them.

Mass availability of computer graphics.

Computer graphics capabilities such as image processing, graphics transformations, rendering, and interactive animation will become widespread as inexpensive chips become available for inclusion in general workstations.

Mixed media.

Systems will handle images, voice, sounds, video, text, and formatted data. These will be exchangeable over communication links among users.

High-bandwidth interaction

The rate at which humans and machines interact will increase substantially due to the changes in speed, computer graphics, new media, and new input/output devices.

Large and thin displays

New display technologies will finally mature enabling very large displays and also displays that are thin, light weight, and have low power consumption.

Embedded computation

Computation will pass beyond desktop computers into every object for which uses can be found. The environment will be alive with little computations from computerized cooking appliances to lighting and plumbing fixtures to window blinds to automobile braking systems to greeting cards.

Group interfaces

Interfaces to allow groups of people to coordinate will be common (e.g., for meetings, for engineering projects, for authoring joint documents). These will have major impacts on the nature of organizations and on the division of labor.

User Tailorability

Ordinary users will routinely modify applications to their own use and will use this power to invent new applications based on their understanding of their own domains.

18. Describe the difference between reading on paper and reading on a computer display. Be sure to list at least three disadvantages for each method.

The potential disadvantages of reading from displays include these:

• Fonts may be poor, especially on low-resolution displays. The dots composing the letters may be so large that each is visible, making users expend effort to recognize the character. Monospace (fixed width) fonts, lack of appropriate kerning (for example, adjustments to bring "V" and "A" closer together), inappropriate interletter and interline spacing, and inappropriate colors may all complicate recognition.

• Low contrast between the characters and the background, and fuzzy character boundaries also can cause trouble.

• Emitted light from displays may be more difficult to read by than reflected light from paper; glare may be greater, flicker can be a problem, and the curved display surface may be troubling.

• Small displays require frequent page turning; issuing the page-turning commands is disruptive, and the page turns are unsettling, especially if they are slow and visually distracting.

• Reading distance is easily adjustable for paper while most displays are fixed in place, and display placement may be too high for comfortable reading (optometrists suggest reading be done with the eyes in a downward-looking direction); the "near quintad" are

the five ways eyes adjust to seeing close items (Grant, 1990): accommodation (lens-shape change), convergence (looking toward the center), meiosis (pupillary contraction), excyclotorsion (rotation), and depression of gaze (looking down). Users of tablet computers and mobile devices often hold their display in a lower position than desktop displays to facilitate reading.

• Layout and formatting can be problems, such as improper margins, inappropriate line width (35 to 55 characters is recommended), or awkward justification (left justification and ragged right are recommended). Multi column layouts may require constant scrolling up and down. Page breaks may be distracting and waste space.

• Reduced hand and body motion with fixed position displays as compared to paper, may be more fatiguing.

• Unfamiliarity of displays and the anxiety of navigating the text can increase stress.