Scheme of Evaluation

Internal Assessment Test 1 – October 2023

Sub:	User Interface Design							**Code:**	18CS734
Date**:**	31/10/2023	Duration:	90mins	Max Marks:	50	**Sem:**	VII	**Branch:**	ISE

Note: Answer Any five full questions.

Question #		Description	Marks Distribution		Max Marks
1	a)	Define User Interface Design. Describe good design benefits Definition Any 5 benefits	1M 1M*5	6M	10M
1	b)	Explain the concept of direct manipulation for graphical system Explanation	4M	4M	
2	a)	Explain graphical systems Definition	2M	2M	10M
2	b)	List and discuss any ten advantages of graphical systems. Any 10 advantages	8M	8M	
3	a)	List and of graphical user interface in detail. Any 10 characteristics	1M * 10	10M	10M
4	a)	Describe in detail, the important human characteristics in user interface design Any 10 characteristics	1M*10	10M	10M
5	a)	Define usability. Explain the common usability problems Definition Any 5 problems	1M 5M	6M	10M

5	b)	Briefly explain a different human interaction speeds Any four interaction speed	4M	4M	
6	a)	Illustrate the five commandments to eliminate the pitfalls in designing the user interface. 5 Steps	2M*5	10M	10M

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Q. 1 a) Define User Interface Design. Describe good design benefits

User interface design is a subset of a field of study called *human-computer interaction* (HCI). Human-computer interaction is the study, planning, and design of how people and computers work together so that a person's needs are satisfied in the most effective way.

The user interface is the part of a computer and its software that people can see, hear, touch, talk to, or otherwise understand or direct. User interface **has 2 components: Input, Output**. Input is how a person communicates his or her needs or desires to the computer. Ex. Keybord,mouse. Output is how the computer conveys its results of its computations and requirements to the user. Ex. Display screen.

Importance of good design:

With today's technology and tools, and our motivation to create really effective and usable interfaces and screens, why do we continue to produce systems that are inefficient and confusing or, at worst, just plain unusable? Is it because:

1. We don't care?
2. We don't possess common sense?
3. We don't have the time?
4. We still don't know what really makes good design?

A well-designed interface and screen is terribly important to our users. It is their window to view the capabilities of the system. To many, *it is* the system, being one of the few visible components of the product we developers create. It is also the vehicle through which many critical tasks are presented. These tasks often have a direct impact on an organization's relations with its customers, and its profitability.

Benefits of good design:

- Training costs are lowered because training time is reduced.
- Support line costs are lowered because fewer assist calls are necessary.
- Employee satisfaction is increased because aggravation and frustration are reduced.
- Customers benefit because of the improved service they receive.
- Based on an actual system requiring processing of 4.8 million screens per year and illustrated in
- Table 1.1

Table 1.1 Impact of Inefficient Screen Design on Processing Time

ADDITIONAL SECONDS REQUIRED PER SCREEN IN SECONDS	ADDITIONAL PERSON-YEARS REQUIRED TO PROCESS 4.8 MILLION SCREENS PER YEAR
1	.7
5	3.6
10	7.1
20	14.2

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Q. 1b) Explain the concept of direct manipulation for graphical system

The Concept of Direct Manipulation

Direct manipulation systems, suggesting that they possess the following characteristics:

The system is portrayed as an extension of the real world: It is assumed that a person is already familiar with the objects and actions in his or her environment of interest. The system simply replicates them and portrays them on a different medium, the screen. A person has the power to access and modify these objects, among which are windows. A person is allowed to work in a familiar environment and in a familiar way, focusing on the data, not the application and tools.

Continuous visibility of objects and actions : Like one's desktop, objects are continuously visible. Reminders of actions to be performed are also obvious, labeled buttons replacing complex syntax and command names. Cursor action and motion occurs in physically obvious and intuitively natural ways.

Actions are rapid and incremental with visible display of results : Since tactile feedback is not yet possible (as would occur with one's hand when one touches something), the results of actions are immediately displayed visually on the screen in their new and current form. Auditory feedback may also be provided. The impact of a previous action is quickly seen, and the evolution of tasks is continuous and effortless.
Incremental actions are easily reversible : Finally, actions, if discovered to be incorrect or not desired, can be easily undone.

Q. 2a) Explain graphical systems.
A *user interface*, as recently described, is a collection of techniques and mechanisms to interact with something. In a *graphical* interface, the primary interaction mechanism is a pointing device of some kind. This device is the electronic equivalent to the human hand. What the user interacts with is a collection of elements referred to as *objects*. They can be seen, heard, touched, or otherwise perceived. Objects are always visible to the user and are used to perform tasks. They are interacted with as entities independent of all other objects. People perform operations, called actions, on objects. The operations include accessing and modifying objects by pointing, selecting, and manipulating. All objects have standard resulting behaviors.

Q. 2 b) List and discuss any ten advantages of graphical systems.

Graphical Systems: Advantages and Disadvantages

Advantages

Symbols recognized faster than text : symbols can be recognized faster and more accurately than text, and that the graphical attributes of icons, such as shape and color, are very useful for quickly classifying objects, elements, or text by some common property.

Faster learning : pictorial representation aids learning, and symbols can also be easily learned.

Faster use and problem solving : Visual or spatial representation of information has been found to be easier to retain and manipulate and leads to faster and more successful problem solving. Symbols have also been found to be effective in conveying simple instructions.

Easier remembering: Because of greater simplicity, it is easier for casual users to retain operational concepts.

More natural: Graphic representations of objects are thought to be more natural and closer to innate human capabilities.

Exploits visual/spatial cues: Spatial relationships are usually found to be understood more quickly than verbal representations. Visually thinking is believed to be better than logical thinking.

Provides context: Displayed objects are visible, providing a picture of the current context.

Fewer errors: More concrete thinking affords fewer opportunities for errors. Reversibility of actions reduces error rates because it is always possible to undo the last step. Error messages are less frequently needed.

Increased feeling of control: The user initiates actions and feels in control. This increases user confidence and hastens system mastery.

Immediate feedback: The results of actions furthering user goals can be seen immediately. Learning is quickened. If the response is not in the desired direction, the direction can be changed quickly.

Predictable system responses: Predictable system responses also speed learning.

Easily reversible actions: The user has more control. This ability to reverse unwanted actions also increases user confidence and hastens system mastery.

Less anxiety concerning use: Hesitant or new users feel less anxiety when using the system because it is so easily comprehended, is easy to control, and has predictable responses and reversible actions.

More attractive: Direct-manipulation systems are more entertaining, cleverer, and more appealing. This is especially important for the cautious or skeptical user.

May consume less space: Icons may take up less space than the equivalent in words. More information can often be packed in a given area of the screen. This, however, is not always the case.

Q. 3 List and discuss the characteristics of graphical user interface in detail.

1. Sophisticated Visual Presentation
2. Pick-and-Click Interaction
3. Restricted Set of Interface Options
4. Visualization
5. Object Orientation
6. Use of Recognition Memory
7. Concurrent Performance of Functions

1. Sophisticated visual presentation:

Visual presentation is the visual aspect of the interface. It is what people see on the screen. The sophistication of a graphical system permits displaying lines, including drawings andicons. It also permits the displaying of a variety of character fonts, including different sizesand styles. The display of 16 million or more colors is possible on some screens. Graphicsalso permit animation and the presentation of photographs and motion video.The meaningful interface elements visually presented to the user in a graphical systeminclude:

- windows - primary, secondary, or dialog boxes
- menus - menu bar, pulldown, pop-up, cascading
- icons - represent objects such as programs or files
- Assorted screen-based controls - text boxes, list boxes, combination boxes, settings, scroll bars, and buttons
- mouse pointer and cursor.

The objective is to reflect visually on the screen the real world of the user as realistically,meaningfully, simply, and clearly as possible.

2. Pick-and-click interaction:

To identify the element for a proposed action is commonly referred to as *pick*, the signal toperform an action as *click*.

- The primary mechanism for performing this pick-and-click is most often the mouse andits buttons. The user moves the mouse pointer to the relevant element (pick) and theaction is signaled (click).
- The secondary mechanism for performing these selection actions is the keyboard. Mostsystems permit pick-and-click to be performed using the keyboard as well.

3. **A restricted set of interface options:**

The array of alternatives available to the user is what is presented on the screen or what maybe retrieved through what is presented on the screen, nothing less, nothing more. This conceptfostered the acronym WYSIWYG.

4. visualization:

Visualization is a cognitive process that allows people to understand information that isdifficult to perceive, because it is **either too voluminous or too abstract**. It involveschanging an entity's representation to reveal gradually the structure and/or function of theunderlying system or process. Presenting specialized graphic portrayals facilitatesvisualization.

The best visualization method for an activity depends on what people are trying to learnfrom the data. The goal is not necessarily to reproduce a realistic graphical image, but toproduce one that conveys the most relevant information. **Effective visualizations canfacilitate mental insights, increase productivity and more accurate use of data.**

5. Object orientation:

A graphical system consists of **objects and actions**. *Objects* are what people see on thescreen.Objects can be composed of *subobjects.*

A) IBM's Common User Access application breaks objects into three meaningful classes:

1.Data

2.Container

3.device.

Data objects present information. This information, either text or graphics, normallyappears in the body of the screen. It is, essentially, the screen-based controls for informationcollection or presentation organized on the screen.

Container objects are objects to hold other objects. They are used to group two or morerelated objects for easy access and retrieval. There are three kinds of container objects:

- Workplace
- Folders
- Workareas.

The *workplace* is the desktop, the storage area for all objects. *Folders* are general-purposecontainers for long-term storage of objects. *Workareas* are temporary storage folders used for storing multiple objects currently being worked on.

Device objects represent physical objects in the real world, such as printers or trash baskets. These objects may contain others for acting upon. A file, for example, may be placed in a printer for printing of its contents.

B) Microsoft Windows specifies the characteristics of objects depending upon the relationships that exist between them.These relationships are called collections, constraints, composites, and containers.

A ***collection*** is the simplest relationship—the objects sharing a common aspect. Acollection might be the result of a query or a multiple selection of objects. Operations can be applied to a collection of objects.

A ***constraint*** is a stronger object relationship. Changing an object in a set affects some other object in the set. A document being organized into pages is an example of a constraint.

A ***composite*** exists when the relationship between objects becomes so significant that the aggregation itself can be identified as an object. Examples include a range of cells organized into a spreadsheet, or a collection of words organized into a paragraph.

A ***container*** is an object in which other objects exist. Examples include text in a document or documents in a folder. A container often influences the behavior of its content. It may add or suppress certain properties or operations of objects placed within it, control access to its content, or control access to kinds of objects it will accept.

Another important object characteristic is ***persistence***. Persistence is the maintenance of a state once it is established. An object's state (for example, window size, cursor location, scroll position, and so on) should always be automatically preserved when the user changes it.

- **Properties or Attributes of Objects**

Properties help to describe an object and can be changed by users. Examples of properties are text styles (such as normal or italics), font sizes (such as 10 or 12 points), or window

background colors (such as black or blue).
Actions
Commands are actions that manipulate objects. They may be performed in a variety of ways, including by direct manipulation or through a command button. They are executed immediately when selected. Once executed, they cease to be relevant. Examples of commands are opening a document, printing a document, closing a window, and quitting an application.
Property/attribute specification actions establish or modify the attributes or properties of objects. When selected, they remain in effect until deselected. Examples include selecting cascaded windows to be displayed, a particular font style, or a particular color.
The following is a typical *property/attribute specification sequence:*
1. The user selects an object—for example, several words of text.
2. The user then selects an action to apply to that object, such as the action BOLD.
3. The selected words are made bold and will remain bold until selected and changedagain.
A series of actions may be performed on a selected object. Performing a series of actions onan object also permits and encourages system learning through exploration.
Application versus Object or Data Orientation
An application-oriented approach takes an action:object approach, like this:
Action> 1. An application is opened (for example, word processing).
Object> 2. A file or other object selected (for example, a memo).
An object-oriented object:action approach does this:
Object> 1. An object is chosen (a memo).
Action> 2. An application is selected (word processing).
Views
Views are ways of looking at an object's information. IBM's SAA CUA describes four kinds of views: composed, contents, settings, and help.
Composed views present information and the objects contained within an object. They are typically associated with data objects and are specific to tasks and products being worked with.
Contents views list the components of objects. ***Settings*** views permit seeing and changing object properties. ***Help*** views provide all the help functions.

6. Use of recognition memory:
Continuous visibility of objects and actions encourages use of a person's more powerfulrecognition memory. The "out of sight, out of mind" problem is eliminated.

Q. 4 Describe in detail, the important human characteristics in user interface design

Important Human Characteristics in Design
Perception: Perception is our awareness and understanding of the elements and objects of our environment through the physical sensation of our various senses, including sight, sound, smell, and so forth. Perception is influenced, in part, by *experience.*
Other perceptual characteristics include the following:
Proximity. Our eyes and mind see objects as belonging together if they are near each other in space.
Similarity. Our eyes and mind see objects as belonging together if they share a common visual property, such as color, size, shape, brightness, or orientation.
Matching patterns. We respond similarly to the same shape in different sizes. The letters of the alphabet, for example, possess the same meaning, regardless of physical size.

Succinctness. We see an object as having some perfect or simple shape because perfection or simplicity is easier to remember.

Closure. Our perception is synthetic; it establishes meaningful wholes. If something does not quite close itself, such as a circle, square, triangle, or word, we see it as closed anyway.

Unity. Objects that form closed shapes are perceived as a group.

Continuity. Shortened lines may be automatically extended.

Balance. We desire stabilization or equilibrium in our viewing environment. Vertical, horizontal, and right angles are the most visually satisfying and easiest to look at.

Expectancies. Perception is also influenced by expectancies; sometimes we perceive not what is there but what we expect to be there.

Context. Context, environment, and surroundings also influence individual perception.

Signals versus noise. Our sensing mechanisms are bombarded by many stimuli, some of which are important and some of which are not. Important stimuli are called signals; those that are not important or unwanted are called noise.

Memory

Knowledge, experience, and familiarity govern the size and complexity of the information that can be remembered. In performance, research indicates that a greater working memory is positively related to increased reading comprehension, drawing inferences from text, reasoning skill, and learning technical information.

Sensory Storage

Sensory storage is the buffer where the automatic processing of information collected from our senses takes place. It is an unconscious process, large, attentive to the environment, quick to detect changes, and constantly being replaced by newly gathered stimuli. In a sense, it acts like radar, constantly scanning the environment for things that are important to pass on to higher memory.

Visual Acuity

The capacity of the eye to resolve details is called *visual acuity*. It is the phenomenon that results in an object becoming more distinct as we turn our eyes toward it and rapidly losing distinctness as we turn our eyes away—that is, as the visual angle from the point of fixation increases.

Foveal and Peripheral Vision

Foveal vision is used to focus directly on something; *peripheral vision* senses anything in the area surrounding the location we are looking at, but what is there cannot be clearly resolved because of the limitations in visual acuity just described. Foveal and peripheral vision maintain, at the same time, a cooperative and a competitive relationship. Peripheral vision can aid a visual search, but can also be distracting.

Information Processing

The information that our senses collect that is deemed important enough to do something about then has to be processed in some meaningful way.

Mental Models

As a result of our experiences and culture, we develop mental models of things and people we interact with. A mental model is simply an internal representation of a person's current understanding of something. Mental models are gradually developed in order to understand something, explain things, make decisions, do something, or interact with another person. Mental models also enable a person to predict the actions necessary to do things if the action has been forgotten or has not yet been encountered.

Movement Control

Once data has been perceived and an appropriate action decided upon, a response must be made; in many cases the response is a movement. In computer systems, movements include such activities as pressing keyboard keys, moving the screen pointer by pushing a mouse or rotating a trackball, or clicking a mouse button.

Learning

Learning, as has been said, is the process of encoding in long-term memory information that is contained in short-term memory. It is a complex process requiring some effort on our part. Our ability to learn is important—it clearly differentiates people from machines.

Skill

The goal of human performance is to perform skillfully. To do so requires linking inputs and responses into a sequence of action.

Individual Differences

In reality, there is no average user. A complicating but very advantageous human characteristic is that we all differ in intellectual abilities, learning abilities and speed, and so on.

Q. 5 a) Define usability. Explain the common usability problems

Usability

usability to describe the effectiveness of human performance. simply defined usability as "the capability to be used by humans easily and effectively, where,
easily = to a specified level of subjective assessment,
effectively = to a specified level of human performance."

Common Usability Problems

Mandel (1994) lists the 10 most common usability problems in graphical systems as reported by IBM usability specialists. They are:

1. Ambiguous menus and icons.
2. Languages that permit only single-direction movement through a system.
3. Input and direct manipulation limits.
4. Highlighting and selection limitations.
5. Unclear step sequences.
6. More steps to manage the interface than to perform tasks.
7. Complex linkage between and within applications.
8. Inadequate feedback and confirmation.
9. Lack of system anticipation and intelligence.
10. Inadequate error messages, help, tutorials, and documentation.

Q. 5b) Briefly explain a different human interaction speeds

Human Interaction Speeds

Many researchers have studied the speed at which people can perform using various communication methods.. The following, as summarized by Bailey (2000), have been found to be typical interaction speeds for various tasks. These speeds are also summarized in Table 1.6.

Table 1.6: Average Human Interaction Speeds

READING	
Prose text:	250–300 words per minute.
Proofreading text on paper:	200 words per minute.
Proofreading text on a monitor:	180 words per minute.
Listening:	150–160 words per minute.
Speaking to a computer:	105 words per minute.
After recognition corrections:	25 words per minute.
KEYING: TYPEWRITER	
Fast typist:	150 words per minute and higher.
Average typist:	60–70 words per minute.
COMPUTER	
Transcription:	33 words per minute.
Composition:	19 words per minute.
TWO FINGER TYPISTS	
Memorized text:	37 words per minute.
Copying text:	27 words per minute.
HAND PRINTING	
Memorized text:	31 words per minute.
Copying text:	22 words per minute.

Reading. The average adult, reading English prose in the United States, has a reading speed in the order of 250 to 300 words per minute. Proofreading text on paper has been found to occur at about 200 words per minute, on a computer monitor, about 180 words per minute (Ziefle, 1998). Nontraditional reading methods have also been explored in research laboratories. One technique that has dramatically increased reading speeds is called Rapid Serial Visual Presentation, or RSVP. In this technique single words are presented one at a time in the center of a screen. New words continually replace old words at a rate set by the reader. Bailey (1999a) tested this technique with a sample of people whose paper document reading speed was 342 words per minute (with a speed range of 143 to 540 words per minute). Single words were presented on a screen in sets at a speed sequentially varying ranging from 600 to 1,600 words per minute. After each set a comprehension test was administered.

For measured comprehension scores of 75 percent or higher, the average reading speed was 1,212 words per minute. This is about 3.5 times faster than reading in the traditional way. Bailey concludes that computer technology can help improve reading speeds, but nontraditional techniques must be used.

Listening. Words can be comfortably heard and understood at a rate of 150 to 160 words per minute. This is generally the recommended rate for audio books and video narration (Williams, 1998). Omoigui et al. (1999) did find, however, that when normal speech is speeded up using compression, a speed of 210 words per minute results in no loss of comprehension.

Speaking. Dictating to a computer occurs at a rate of about 105 words per minute (Karat et al., 1999; Lewis, 1999). Speech recognizer misrecognitions often occur, however, and when word correction times are factored in, the speed drops significantly to an average of 25 words per minute. Karat et al. (1999) also found that the speaking rate of new users was 14 words per minute during transcription and eight words per minute during composition.

Keying. Fast typewriter typists can key at rates of 150 words per minute and higher. Average typing speed is considered to be about 60 to 70 words per minute. Computer keying has been found to be much slower, however. Speed for simple transcription found by Karat et al. (1999) was only 33 words per minute and for composition only 19 words per minute. In this study, the fastest typists typed at only 40 words per minute, the slowest at 23 words per minute. Brown (1988) reports that two-finger typists can key memorized text at 37 words per minute and copied text at 27 words per minute. Something about the computer, its software, and the keyboard does seem to significantly degrade the keying process. (And two-finger typists are not really that bad off after all.)

Hand printing. People hand-print memorized text at about 31 words per minute. Text is copied at about 22 words per minute (Brown, 1988).

Q. 6 Illustrate the five commandments to eliminate the pitfalls in designing the user interface

<u>Designing for People: The Five Commandments</u>

Gain a complete understanding of users and their tasks.

The users are the customers. Today, people expect a level of design sophistication from all interfaces, including Web sites. The product, system or Web site must be geared to people's needs, not those of the developers. A wide gap in technical abilities, goals, and attitudes often exists between users and developers. A failure to understand the differences will doom a product or system to failure.

Solicit early and ongoing user involvement.

Involving the users in design from the beginning provides a direct conduit to the knowledge they possess about jobs, tasks, and needs. Involvement also allows the developer to confront a person's resistance to change, a common human trait. People dislike change for a variety of reasons, among them fear of the unknown and lack of identification with the sys-tem. Involvement in design removes the unknown and gives the user a stake in the system or identification with it. One caution, however: user involvement should be based on job or task knowledge, not status or position. The boss seldom knows what is really happening out in the office.

Perform rapid prototyping and testing.

Prototyping and testing the product willquickly identify problems and allow you to develop solutions. The design process is complex and human behavior is still not well understood. While the design guidelines that follow go a long way toward achieving ease of use, all problems cannot possibly be predicted. Prototyping and testing must be continually performed during all stages of development to uncover all potential defects. If thorough testing is not performed before product release, the testing will occur in the user's office. Encountering a series of problems early in system use will create a negative first impression in the customer's mind, and this may harden quickly, creating attitudes that may be difficult to change. It is also much harder and more costly to fix a product after its release. In many instances, people may adapt to, or become dependent upon, a design, even if it is inefficient. This also makes future modifications much more difficult.

Modify and iterate the design as much as necessary. While design will proceed through a series of stages, problems detected in one stage may force the developer to revisit a previous stage. This is normal and should be expected. Establish user performance and acceptance criteria and continue testing and modifying until all design goals are met.

Integrate the design of all the system components. The software, the documentation,the help function, and training needs are all important elements of a graphicalsystem or Web site and all should be developed concurrently. A system isbeing constructed, not simply software. Concurrent development of all pieces
will point out possible problems earlier in the design process, allowing them to be more effectively addressed. Time will also exist for design trade-offs to be thought out more carefully.