IAT-3-UID-Scheme&Solution

CMR INSTITUTE OF TECHNOLOGY

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Internal Assesment Test –III, September 2023									
Sub:	**User Interface Design**							**Code:**	**22MCA254**
Date:	**27/09/2023**	**Duration:**	90 mins	**Max Marks:**	50	**Sem:**	II	**Branch:**	MCA

	Answer Any 5 **QUESTIONS**	Marks	OBE	
			CO	RBT
	PART-I			
1)	List and explain the seven types of interaction task used for pointing devices.	10	CO1	L1
	OR			
2)	Write short notes on i. Keyboard Layout ii. Displays-small devices	10	CO1	L1
	PART-II			
3)	Explain any five examples of direct manipulation.	10	CO1	L2
	OR			
4)	Discuss command Language strategies and structure with example	10	CO5	L3
	PART-III			
5)	Explain the guidelines for using naming and abbreviation.	10	CO4	L2
	OR			
6)	Explain any five advantages of WYSIWYC word and processor.	10	CO3	L2
	PART-IV			
7)	Explain OAI model explanation of direct manipulation.	10	CO1	L3
	OR			
8)	Discuss direct control pointing devices and comparison of pointing devices.	10	CO2	L2
	PART-V			
9)	Discuss goals for language design with suitable example.	10	CO5	L3
	OR			
10)	Explain the basis for preparing error messages with example	10	CO4	L4

Solutions

1. List and explain the seven types of interaction task used for pointing devices.

Pointing devices are applicable in six types of interaction tasks:

- **1. Select:**
  - user chooses from a set of items.
  - used for traditional menu selection, identification of a file in a directory, or marking of a part in an automobile design.
- **2. Position:**
  - user chooses a point in a one-, two-, three-, or higher-dimensional space
  - used to create a drawing, to place a new window, or to drag a block of text in a figure.
- **3. Orient:**
  - user chooses a direction in a two-, three-, or higher-dimensional space.
  - direction may simply rotate a symbol on the screen, indicate a direction of motion for a space ship, or control the operation of a robot arm.
- **4. Path:**
  - user rapidly performs a series of position and orient operations.
  - may be realized as a curving line in a drawing program, the instructions for a cloth cutting machine, or the route on a map.
- **5. Quantify:**
  - user specifies a numeric value.
  - usually a one-dimensional selection of integer or real values to set parameters, such as the page number in a document, the velocity of a ship, or the amplitude of a sound.
- **6. Text:**
  - user enters, moves, and edits text in a two-dimensional space. The
  - pointing device indicates the location of an insertion, deletion, or change.
  - more elaborate tasks, such as centering; margin setting; font sizes; highlighting, such as boldface or underscore; and page layout.

2. Write short notes on

i. **Keyboard Layout**

QWERTY layout

ii. 1870 Christopher Latham Sholes

iii. good mechanical design and a clever placement of the letters that slowed down the users enough that key jamming was infrequent

iv. put frequently used letter pairs far apart, thereby increasing finger travel distances

Dvorak layout

v. 1920

vi. reduces finger travel distances by at least one order of magnitude

vii. Acceptance has been slow despite the dedicated efforts of some devotees

viii. it takes about 1 week of regular typing to make the switch, but most users have been unwilling to invest the effort

ABCDE style

ix. 26 letters of the alphabet laid out in alphabetical order nontypists will find it easier to locate the keys

Additional keyboard issues

IBM PC keyboard was widely criticized because of the placement of a few keys

i. backslash key where most typists expect SHIFT key

ii. placement of several special characters near the ENTER key

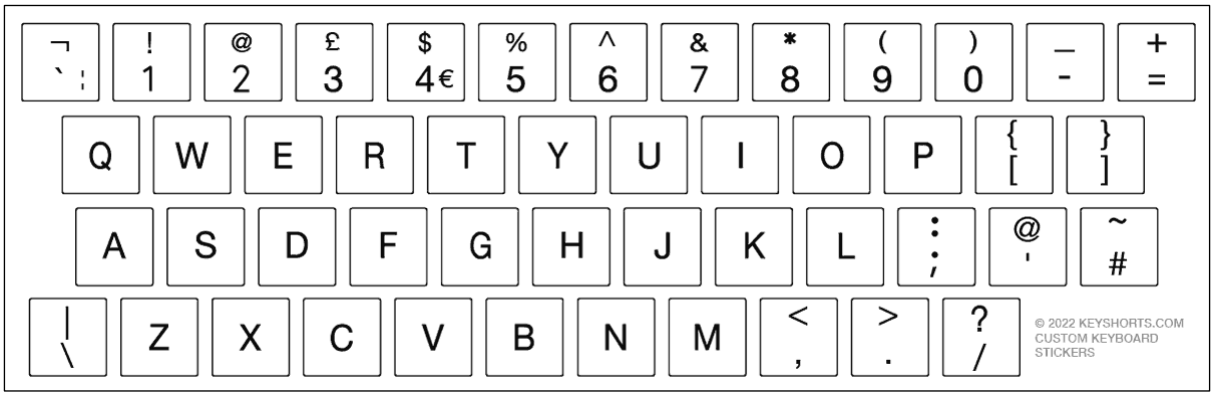
Number pad layout

wrist and hand placement

- **Keys**
  - 1/2 inch square keys
  - 1/4 inch spacing between keys
  - slight concave surface
  - matte finish to reduce glare finger slippage
  - 40- to 125-gram force to activate
  - 3 to 5 millimeters displacement
  - tactile and audible feedback important
  - certain keys should be larger (e.g. ENTER, SHIFT, CTRL)
  - some keys require state indicator, such as lowered position or light indicator (e.g. CAPS LOCK)
  - key labels should be large, meaningful, permanent
  - some "home" keys may have additional features, such as deeper cavity or small raised dot, to help user locate their fingers properly (caution - no standard for this)
- **Function keys**
  - users must either remember each key's function, identify them from the screen's display, or use a template over the keys in order to identify them properly
  - can reduce number of keystrokes and errors
  - meaning of each key can change with each application

- placement on keyboard can affect efficient use
- special-purpose displays often embed function keys in monitor bezel
- lights next to keys used to indicate availability of the function, or on/off status
- typically simply labeled F1, F2, etc, though some may also have meaningful labels, such as CUT, COPY, etc.
- frequent movement between keyboard home position and mouse or function keys can be disruptive to use
- alternative is to use closer keys (e.g. ALT or CTRL) and one letter to indicate special function

- **Cursor movement keys**
  - up, down, left, right
  - some keyboards also provide diagonals
  - best layout is natural positions
  - inverted-T positioning allows users to place their middle three fingers in a way that reduces hand and finger movement
  - cross arrangement better for novices than linear or box
  - typically include typamatic (auto-repeat) feature
  - important for form-fillin and direct manipulation
  - other movements may be performed with other keys, such as TAB, ENTER, HOME, etc.

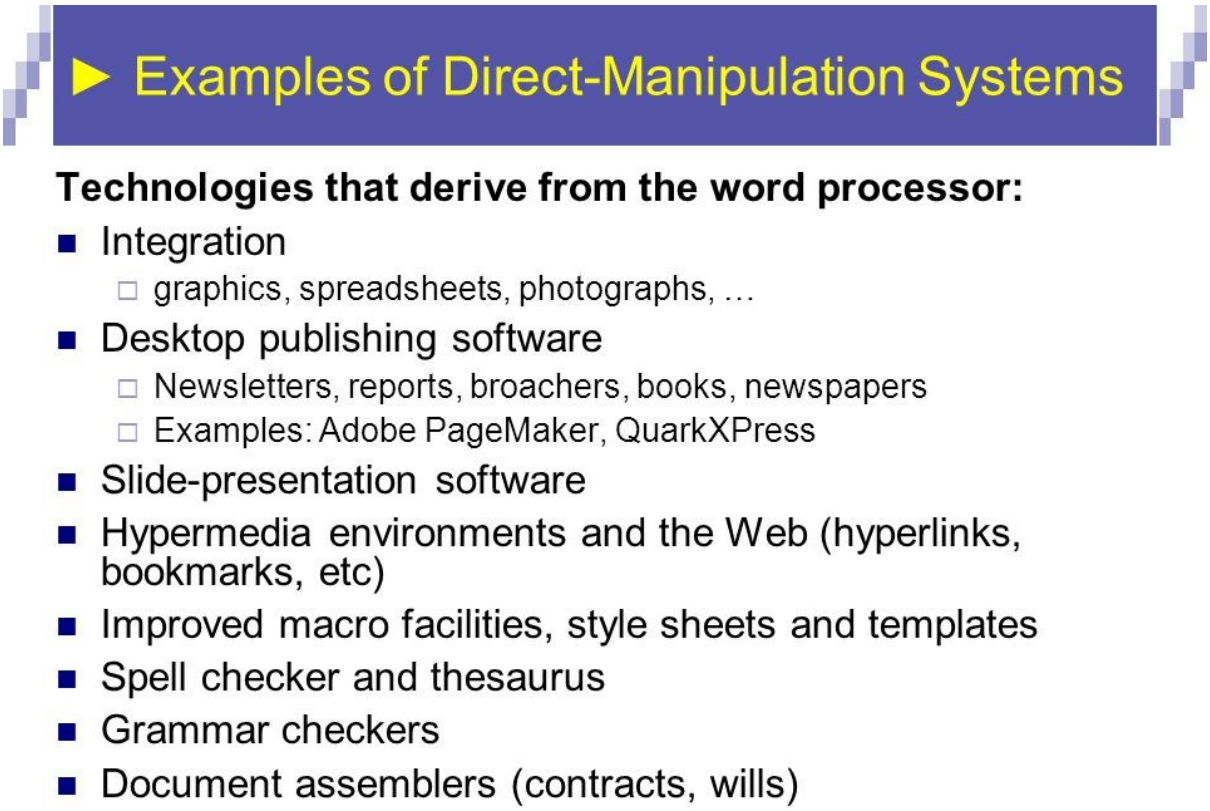


x. **Displays-small devices**

- Currently mobile devices used for brief tasks, except for game playing
- Optimize for repetitive tasks
- Custom designs to take advantage of every pixel
- DataLens allows compact overviews
- Web browsing difficult
- Okay for linear reading, but making comparisons can be difficult

2. Explain any five examples of direct manipulation.

Direct manipulation is an interaction style in which the objects of interest in the UI are visible and can be acted upon via physical, reversible, incremental actions that receive immediate feedback.



- **Voice information systems**
  - Stored speech commonly used to provide information about tourist sites, government services, after-hours messages for organizations
  - Low cost
  - Voice prompts
  - Deep and complex menus frustrating
  - Slow pace of voice output, ephemeral nature of speech, scanning and searching problems
  - Voice mail
  - Handheld voice recorders
  - Audio books
  - Instructional systems

4.Discuss command Language strategies and structure with example

- Several strategies for command organization have emerged. A unifying interface concept or metaphor aids learning, problem solving, and retention.

- Electronic-mail enthusiasts conduct lively discussions about the metaphoric merits of such task-related objects as file drawers, folders, documents, memos, notes, letters, or messages.
- The appropriate interface actions (CREATE, EDIT, COPY, MOVE, DELETE) and the choice of action pairs such as LOAD/SAVE (too much in the computer domain), READ/WRITE (acceptable for letters, but awkward for file drawers), or OPEN/CLOSE (acceptable for folders, but awkward for notes).

- Designers often err by choosing a metaphor closer to machine domain than to the user's task domain.
    - **Simple command set**
        - Each command is chosen to carry out a single task. The number of commands match the number of tasks.
        - For small number of tasks, this can produce a system easy to learn and use.
        - E.g. the vi editor of Unix.
    - **Command plus arguments/options**
        - Follow each command by one or more arguments that indicate objects to be manipulated, e.g.
            - COPY FILEA, FILEB
            - DELETE FILEA
            - PRINT FILEA, FILEB, FILEC
        - Keyword labels for arguments are helpful for some users, e.g. COPY FROM=FILEA TO=FILEB.
        - Commands may also have options to indicate special cases, e.g.:
            - PRINT/3,HQ FILEA
            - PRINT (3, HQ) FILEA
            - PRINT FILEA -3, HQ

            to produce 3 copies of FILEA on the printer in the headquarters building.
        - Error rates and the need for extensive training increase with the number of possible options.
    - **Hierarchical command structure**
        - In the third option, the set of commands is organized into a tree structure, like a menu tree. The first level might be the command action, the second might be an object argument, and the third might be a destination argument:

Action	Object	Destination
CREATE	File	File
DISPLAY	Process	Local printer
REMOVE	Directory	Screen
COPY		Remote printer
MOVE		

Structure

- Human learning, problem solving, and memory are greatly facilitated by meaningful structure.
- Meaningful structure is beneficial for *task concepts*, and *syntactic* details of command languages.
- **Consistent argument ordering**: Several studies have shown that there are benefits associated with using a ***consistent*** order for arguments. For example, when presented

with commands with ***inconsistent*** and consistent argument ordering, users performed significantly faster with the consistent argument ordering.

Inconsistent	**order of argument**	**Consistent order of arguments**	
SEARCH	file no, message id	SEARCH	message id, file no
TRIM	message id, segment size	TRIM	message id, segment size
REPLACE	message id, code no	REPLACE	message id, code no
INVERT	group size, message id	INVERT	message id, group size

- **Symbol versus keywords:** Command structure affects performance

Symbol editor	Keyword editor
FIND: /TOOTH/; -1	BACKWARD TO "TOOTH"
LIST: 10	LIST 10 LINES
RS: / KO / , / OK/;*	CHANGE ALL "KO" TO "OK"

5. Explain the guidelines for using naming and abbreviation.

Ehrenreich and Porcu (1982) offer this set of guidelines:

- A *simple* primary rule should be used to generate abbreviations for **most items**; a *simple secondary rule* should be used for those items where there is a **conflict**.
- Abbreviations generated by the ***secondary rule*** should have a **marker** (for example, an asterisk) incorporated in them.
- The number of words abbreviated by the *secondary rule* should be kept to a **minimum.**
- **Users** should be ***familiar with the rules*** used to generate abbreviations.
- Truncation should be used because it is an easy rule for users to comprehend and remember. However, when it produces a large number of identical abbreviations for different words, adjustments must be found.
- Fixed-length abbreviations should be used in preference to variable-length ones.
- *Abbreviations should not be designed to incorporate endings (ING, ED, S).*
- Unless there is a *critical space problem*, abbreviations should not be used in messages generated by the computer and read by the user.
-

Six Potential Abbreviation Strategies

- **Simple truncation:** The first, second, third, etc. letters of each command.
- **Vowel drop with simple truncation:** Eliminate vowels and use some of what remains.
- **First and last letter:** Since the first and last letters are highly visible, use them.
- **First letter of each word in a phrase:** Use with a hierarchical design plan.
- **Standard abbreviations from other contexts:** Use familiar abbreviations.
- **Phonics:** Focus attention on the sound.

Naming and Abbreviations

There is often a lack of consistency or obvious strategy for construction of command abbreviations.

Specificity Versus Generality

Infrequent, discriminating words	insert	delete
Frequent, discriminating words	add	remove
Infrequent, nondiscriminating words	amble	perceive
Frequent, nondiscriminating words	walk	view
General words (frequent, nondiscriminating)	alter	correct
Nondiscriminating nonwords (nonsense)	GAC	MIK
Discriminating nonwords (icons)	abc-adbc	abc-ab

6. Explain any five advantages of WYSIWYC word and processor.

WYSIWYG editors enable users to manipulate the content or layout without having to type any commands. For example, when users write a document using a word processor, it uses WYSIWYG, as what they create, format and edit is replicated in the printed document or PDF file.

The advances of WYSIWYG (What You See Is What You Get)word processors:

xi. Display a full page of text
xii. Display of the document in the form that it will appear when the final printing is done
xiii. Show cursor action
xiv. Control cursor motion through physically obvious and intuitively natural means
xv. Use of labeled icon for actions
xvi. Display of the results of an action immediately
xvii. Provide rapid response and display

Offer easily reversible actions

Ease of Use: One of the primary advantages of using a WYSIWYG editor is its ease of use. Users can create and edit content visually, without needing to have a deep understanding of coding or markup languages. It widens accessibility for new web or document creators.

Speed: WYSIWYG editors help users create content more quickly than if they had to write code manually. Users can create layouts and designs quickly using templates and drag-and-drop tools.

Consistency: Because the editor generates code based on user input, it can help ensure consistency across different pages or documents. Maintaining a consistent style and formatting is useful for larger projects with multiple contributors.

Understand the Code: While you don't need to be an expert in coding or markup languages, it's still important to understand the basics of HTML and CSS. Having basic knowledge ease design and troubleshooting.

Use Templates: Many editors come with pre-built templates that you can use as a starting point for your project. Templates ensure consistent design and save time on multiple pages.

Use Stylesheets: Stylesheets are a powerful tool that can help you maintain consistency in the design and layout of your work. Using stylesheets defines element styles and applies them consistently across content.

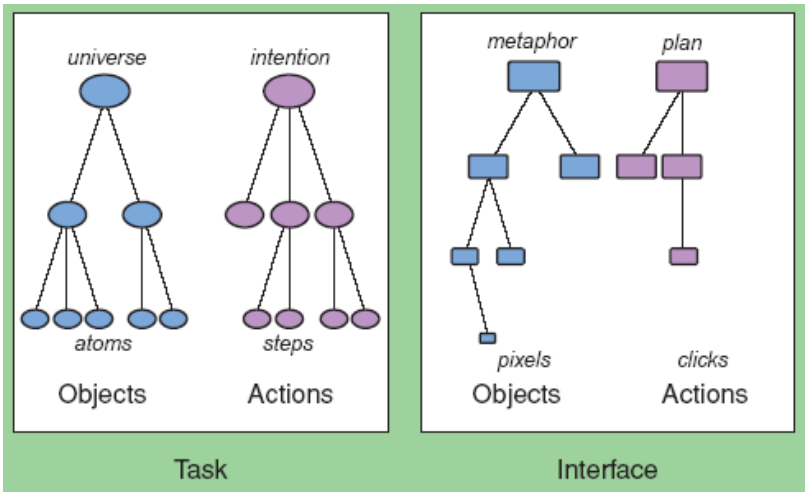
Keep It Simple: While it can be tempting to add lots of flashy design elements to your content, it's important to remember that simplicity is often best. Avoid clutter with multiple fonts, colors, or design elements.

Test and Preview: Before publishing your work, make sure to test it across multiple platforms and devices to ensure that it looks and functions as intended. Use the preview mode in your WYSIWYG editor to check that your content appears as you expect it to.

7. Explain OAI model explanation of direct manipulation.

The OAI Model explanation of direct manipulation

- Portrait of direct manipulation:
  - Continuous representation of the objects and actions of interest
  - Physical actions or presses of labeled buttons instead of complex syntax
  - Rapid incremental reversible operations whose effect on the object of interest is immediately visible
- Beneficial attributes:
  - Novices learn quickly
  - Experts work rapidly
  - Intermittent users can retain concepts
  - Error messages are rarely needed
  - Users see if their actions are furthering their goals
  - Users experience less anxiety
  - Users gain confidence and mastery



Visual Thinking and Icons

- The visual nature of computers can challenge the first generation of hackers
- An icon is an image, picture, or symbol representing a concept
- Icon-specific guidelines
  - Represent the object or action in a familiar manner
  - Limit the number of different icons
  - Make icons stand out from the background
  - Consider three-dimensional icons
  - Ensure a selected icon is visible from unselected icons
  - Design the movement animation
  - Add detailed information

8. Discuss direct control pointing devices and comparison of pointing devices.

Direct-control pointing devices are those that allow the user to directly manipulate the cursor or pointer on the screen. Examples of direct-control pointing devices include a mouse, trackball, or joystick. These devices are more appropriate for tasks that require precise movements, such as graphic design or gaming.

With pointing, the user clicks or taps on an object to select or move it. With positioning, the user uses the mouse or touchpad to move the object to a new location. Pointing and positioning techniques are often used in combination to create more complex

There are many different types of pointing devices that you may encounter when using a computer, but each performs the same main functions which are: 1) to point the cursor to a location on the monitor, 2) to click, 3) to drag and 4) to select something.

- **mouse**
  - the hand rests in a comfortable position, buttons on the mouse are easily pressed, even long motions can be rapid, and positioning can be precise
- **trackball**
  - usually implemented as a rotating ball 1 to 6 inches in diameter that moves a cursor
- **joystick**
  - are appealing for tracking purposes
- **graphics tablet**
  - a touch-sensitive surface separate from the screen
- **touchpad**
  - built-in near the keyboard offers the convenience and precision of a touchscreen while keeping the user's hand off the display surface
- Human-factors variables
  - speed of motion for short and long distances
  - accuracy of positioning
  - error rates
  - learning time
  - user satisfaction
- Other variables
  - cost , durability ,space requirements , weight
  - left- versus right-hand use , likelihood to cause repetitive-strain injury
  - compatibility with other systems
- **Some results**
  - direct pointing devices faster, but less accurate
  - graphics tablets are appealing when user can remain with device for long periods without switching to keyboard
  - mouse is faster than isometric joystick
  - for tasks that mix typing and pointing, cursor keys a faster and are preferred by users to a mouse
  - muscular strain is low for cursor keys

9. Explain the stages of user interface design methodology(LUCID) in details with suitable example

Stage 1: Develop Product Concept

- Create a high concepts
- Establish Business objectives
- Set usability design team
- Identify user population
- Identify technical and environment issues
- Produce staffing plan , schedule and budget

Stage 2: Research and Needs Analysis

- Break job activities into task unit
- Partition user population into homogeneous segments
- Identify major objects and structures which will be used in the software interface

Stage 3: Design Concepts and Key Screen Prototype

- Identify set of key screen, logion, home, major process.
- Conduct Initial review and usability test
- Initiate guidelines and style guide

Stage 4: Iterative Design and Refinement

- Conduct heuristic and expert reviews
- Conduct full-scale usability tests.
- Deliver prototype and specifications

Stage 5: Implement Software

- Develop standard practices
- Manage late stage change
- Develop online help, documentation and tutorials

Stage 6: Provide Roll-Out Support

- Provide training and assistance
- Perform logging, evaluation, and maintenance

10. Explain the various characteristics of Direct Manipulation.

Direct manipulation is a human–computer interaction style which involves continuous representation of objects of interest and rapid, reversible, and incremental actions and feedback.

- The advances of WYSIWYG (What You See Is What You Get)word processors:
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Technologies that derive from the word processor:

- Integration
- Desktop publication software
- Slide-presentation software
- Hypermedia environments
- Improved macro facilities
- Spell checker and thesaurus

Grammar checkers

The VisiCalc spreadsheet and its descendants

- VisiCalc users delighted in watching the program propagate changes across the screen.
- In some cases, spatial representations provide a better model of reality
- Successful spatial data-management systems depend on choosing appropriate:
  - Icons
  - Graphical representations
  - Natural and comprehensible data layouts

- **Video games**
- From PONG to Nintendo GameCube, Sony PlayStation 2, and Microsoft Xbox
- Field of action is visual and compelling
- Commands are physical actions whose results are immediately shown on the screen
- No syntax to remember
- Most games continuously display a score
- DOOM and Quake controversial

3. Explain the guidelines for using naming and abbreviation.

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Discriminating nonwords (icons)	abc-adbc	abc-ab

4. Discuss goals for language design with suitable example.

"objective criteria for good language design may be summarized in five catch phrases: simplicity, security, fast translation, efficient object code, and readability."

- Close correspondence between **reality** and the **notation**
- Convenience in carrying out manipulations **relevant to user's tasks**
- Compatibility with **existing notations**
- Flexibility to accommodate **novice** and **expert users**
- Expressiveness to **encourage creativity**
- **Visual** appeal

Designers should

- **determine functionality** of the system by studying users' task domain
- create a list of **task actions** and **objects**
- abstract this list into a set of interface actions and objects
- represent **low-level interface** syntax
- create a table of **user communities** and tasks, with expected use frequency
- **determine hierarchy** of importance of user communities (i.e. prime users)
- evaluate **destructive actions** (e.g. deleting objects) to ensure reversibility
- **identify error conditions** and prepare error messages
- allow shortcuts for **expert users**, such as **macros** and **customizing system parameters**

W.r.t. programmers:

• learnable (simple, "natural", no special cases)
• expressive, easy to write
• for particular application domain? or in general?
• readable, understandable; no "clever" encodings

• simple, clear feature interactions; no undefined combinations; no error-prone features; early, extensive automatic error checking
• simple, clear, efficient implementation model
• what helps extensibility, modifiability?

W.r.t. tools:

• easy to automatically reason about & optimize
• easy to quickly extract important implementation info
• unambiguous
• regular enough to generate by machine

5. Explain the basis for preparing error messages with example

Error Messages

- Error messages are key part of an overall interface design strategy of guidance for the user. The strategy should ensure integrated, coordinated error messages that are consistent across one or multiple applications.
- Avoid
  - imperious tone that condemns user
  - messages that are too generic (e.g. WHAT? or SYNTAX ERROR)
  - messages that are too obscure (e.g. FAC RJCT 004004400400)

.1 Specificity

- Messages that are too general make it difficult for the novice to know what has gone wrong. Simple and condemning messages are frustrating because they provide neither enough information about what has gone wrong nor the knowledge to set things right. The right amount of specificity therefore is important.

User-centered phrasing

Suggests user controls the interface, initializing more than responding

User should have control over amount of information system provides e.g. screen tips; a help button for context-sensitive help or an extensive online user manual

Telephone company, "We're sorry, but we are unable to complete your call as dialed. Please hang up, check your number, or consult the operator for assistance", versus "Illegal telephone number. Call aborted. Error number 583-2R6.9. Consult your user manual for further information.'

Appropriate physical format

use uppercase-only messages for brief, serious warnings

avoid code numbers; if required, include at end of message

debate over best location of messages. E.g. Could be:

- near where problem arose
- placed in consistent position on bottom of screen
- near to, but not obscuring relevant information

Poor	Better
SYNTAX ERROR	Unmatched left parenthesis
ILLEGAL ENTRY	Type first letter: **S**end, **R**ead, or **D**rop
INVALID DATA	Days range from 1 to 31
BAD FILE NAME	File names must begin with a letter

Constructive guidance and positive tone

- Messages should, where possible, indicate what users should do to correct the problem.
- Unnecessarily hostile messages using violent terminology can disturb non-technical users:
  - FATAL ERROR, RUN ABORTED
  - CATASTROPHIC ERROR: LOGGED WITH OPERATOR
  - Negative terms such as ILLEGAL, ERROR, INVALID, BAD should be eliminated or used infrequently

- audio signals useful, but can be embarrassing - place under user control

- Development of effective messages
  - Messages should be evaluated by several people and tested with suitable participants
  - Messages should appear in user manuals and be given high visibility
  - Users may remember the one time when they had difficulties with a computer system rather than the 20 times when everything went well
- Recommendations
    - Increase attention to message design
    - Establish quality control
    - Develop guidelines
      - Have a positive tone
      - Be specific and address the problem in the user's terms
      - Place the users in control of the situation
      - Have a neat, consistent, and comprehensible format
    - Carry out usability test
    - Collect user performance data