SEE EXAM PREPARATION - HCI UNIT 1

Complete Question Bank with Detailed Answers

EXAM PATTERN ANALYSIS

Based on IA Question Papers and Question Bank, the SEE exam follows this pattern:

Section A (5 marks each - Choose 2 out of 3)

- Definition + Explanation with examples
- Real-world applications
- Comparison questions

Section B (2+8 marks format)

- Part (a): 2-mark questions (definitions, examples)
- Part (b): 8-mark questions (detailed explanations, applications, case studies)

Section C (10-mark questions)

- Application-based questions
- Design problems
- Case study analysis

2-MARK QUESTIONS WITH ANSWERS

1. Define human I/O channels.

Answer: Human I/O channels are the pathways through which humans receive information from and send information to the external environment. They include:

- **Visual channel** (eyes - sight)
- **Auditory channel** (ears - hearing)
- **Haptic channel** (skin - touch)
- **Movement channel** (motor system - physical actions)

2. What is short-term memory?

Answer: Short-term memory acts as a scratch pad for temporary recall of information. It has:

- **Duration:** 20-30 seconds
- **Capacity:** 7±2 chunks of information
- **Access time:** 70ms (rapid access)
- Information either moves to long-term memory or is lost

3. Mention two examples of haptic feedback in devices.

Answer:

1. **Smartphone vibration motors** - provide tactile feedback for notifications and touch interactions
2. **Game controller force feedback** - provides resistance and vibration during gaming

4. What is the significance of reasoning in HCI?

Answer: Reasoning helps users:

- **Problem-solve** when interacting with interfaces
- **Make decisions** based on available information
- **Predict system behavior** and plan actions
- **Understand cause-effect relationships** in system responses

5. Give an example of visual I/O in human-computer interaction.

Answer: Computer monitor displaying graphical user interface - user sees visual information (icons, text, images) and provides input through visual feedback (cursor movement, button highlighting).

6. Differentiate between recognition and recall.

Answer:

- **Recognition:** Identifying previously seen information when presented (easier) - e.g., multiple choice questions
- **Recall:** Reproducing information from memory without cues (harder) - e.g., essay questions

7. State one limitation of human memory.

Answer: Limited capacity of short-term memory - can only hold 7±2 chunks of information simultaneously, leading to information loss if not rehearsed.

8. Name two devices using auditory output effectively.

Answer:

1. **Voice assistants** (Alexa, Siri) - provide spoken responses
2. **GPS navigation systems** - give audio directions while driving

9. What is the typical span of short-term memory?

Answer: 7±2 chunks of information can be held simultaneously in short-term memory.

10. Define problem-solving in the context of HCI.

Answer: Problem-solving in HCI is the process of finding solutions to unfamiliar tasks using available knowledge and interface elements, involving productive and reproductive thinking.

11. Mention one reason why understanding human memory is critical in interface design.

Answer: To reduce cognitive load - interfaces must be designed within human memory limitations to prevent user errors and improve usability.

12. What is sensory memory?

Answer: Sensory memory is a buffer that briefly holds stimuli received through sensory channels (eyes, ears, touch) before passing relevant information to short-term memory.

13. Define 'slip' in terms of human error.

Answer: A **slip** is an error where the user has the correct intention but fails to execute it properly due to poor physical skill, inattention, or distraction.

14. How does size affect the visual detection of on-screen objects?

Answer: Larger objects are more easily detected visually. According to Fitts' Law, larger targets are easier and faster to select, improving user performance.

15. What is volatile memory?

Answer: Volatile memory is temporary storage that loses its contents when power is removed (e.g., RAM). It contrasts with non-volatile memory (e.g., hard drives) that retains data without power.

16. Define time-sharing in computing.

Answer: Time-sharing is a computing paradigm where multiple users share computer resources simultaneously through rapid switching between tasks, giving each user the illusion of dedicated access.

17. Define ergonomics in the context of HCI.

Answer: Ergonomics is the study of designing interfaces and environments that fit human physical and cognitive capabilities, focusing on comfort, safety, efficiency, and performance.

18. What is Interaction design?

Answer: Interaction design is the practice of designing interactive digital products, environments, and services, focusing on how users interact with technology.

5-MARK QUESTIONS WITH DETAILED ANSWERS

1. Define Human Computer Interaction. Examine the human I/O channels in human-computer interaction.

Answer:

Definition of HCI:
Human-Computer Interaction (HCI) is a multidisciplinary field focused on the design, evaluation, and implementation of interactive computing systems for human use and the study of major phenomena surrounding them.

Human I/O Channels:

1. Visual Channel:

- **Input:** Eyes receive light reflected from objects
- **Processing:** Retina (rods for low light, cones for color) converts light to electrical signals
- **Application in HCI:** Monitors, displays, visual feedback, icons, text
- **Design considerations:** Color blindness, visual acuity, screen resolution

2. Auditory Channel:

- **Input:** Ears detect sound waves (20Hz to 15kHz)
- **Processing:** Sound waves converted to electrical signals in cochlea
- **Application in HCI:** Audio feedback, voice commands, alerts, speech interfaces
- **Design considerations:** Background noise, hearing impairments

3. Haptic Channel:

- **Input:** Skin receptors detect pressure, temperature, pain
- **Processing:** Three types of receptors (thermoreceptors, nociceptors, mechanoreceptors)
- **Application in HCI:** Touch screens, tactile feedback, vibration
- **Design considerations:** Sensitivity varies by body part

4. Movement Channel:

- **Input/Output:** Motor control system for physical actions
- **Processing:** Reaction time varies by stimulus type (visual: 200ms, auditory: 150ms)
- **Application in HCI:** Mouse movement, keyboard input, gesture control
- **Design considerations:** Fitts' Law for target selection

2. List and Explain any five styles of user interaction with one example for each.

Answer:

1. Command Line Interface (CLI)

- **Description:** Direct text-based commands
- **Example:** Linux terminal commands
- **Advantages:** Powerful, precise control
- **Disadvantages:** Requires memorization, not intuitive

2. Menu-Based Interaction

- **Description:** Hierarchical options presented as lists
- **Example:** Mobile app navigation menus
- **Advantages:** Easy to learn, reduces memory load
- **Disadvantages:** Can be deep and slow for expert users

3. Form-Fill Interface

- **Description:** Structured data entry fields
- **Example:** Online registration forms
- **Advantages:** Familiar metaphor, validates input
- **Disadvantages:** Can be tedious for long forms

4. Direct Manipulation

- **Description:** Direct interaction with objects
- **Example:** Drag-and-drop in file managers
- **Advantages:** Intuitive, immediate feedback
- **Disadvantages:** Can be physically tiring

5. Natural Language Interaction

- **Description:** Communication in human language

- **Example:** Voice assistants (Siri, ChatGPT)
- **Advantages:** Natural, accessible
- **Disadvantages:** Ambiguity, context understanding issues

3. Illustrate how ATM interface design accounts for limitations in human memory.

Answer:

Short-term Memory Limitations:

- Capacity: 7±2 chunks
- Duration: 20-30 seconds
- Closure effect: Need to complete tasks

ATM Design Solutions:

1. Closure Effect Management:

- **Problem:** Users forget card after getting money
- **Solution:** Modern ATMs return card BEFORE dispensing cash
- **Reason:** Prevents closure before task completion

2. Chunking Information:

- **Problem:** Long account numbers hard to remember
- **Solution:** Display numbers in groups (1234-5678-9012)
- **Reason:** Utilizes natural chunking ability

3. Progressive Disclosure:

- **Problem:** Too much information overwhelms STM
- **Solution:** Show information step-by-step
- **Example:** Amount selection → PIN → Transaction type

4. Visual Cues and Confirmation:

- **Problem:** Users forget what they selected
- **Solution:** Display transaction summary before confirmation
- **Reason:** Provides external memory aid

5. Timeout Management:

- **Problem:** STM duration limitation
- **Solution:** Appropriate timeout periods with warnings
- **Reason:** Matches human attention span

4. Compare behavioral design goals and performance design goals with an example.

Answer:

Behavioral Design Goals:
Focus on how users **should** interact with the system

Characteristics:

- User satisfaction

- Ease of learning
- Error reduction
- User comfort and enjoyment

Performance Design Goals:
Focus on how **efficiently** users can complete tasks

Characteristics:

- Speed of task completion
- Accuracy of results
- System response time
- Throughput

Comparison Table:

Aspect	Behavioral Goals	Performance Goals
Focus	User experience and satisfaction	Efficiency and speed
Metrics	User ratings, learning time	Task completion time, error rates
Priority	Long-term usability	Short-term efficiency
Trade-offs	May sacrifice speed for comfort	May sacrifice comfort for speed

Example: Online Banking Application

Behavioral Design Goals:

- **Friendly interface** with clear navigation
- **Help and tutorials** for new users
- **Confirmations** for all transactions
- **Pleasant visual design** to reduce anxiety

Performance Design Goals:

- **Quick login** process (biometric authentication)
- **Fast transaction** processing
- **Minimal clicks** to complete common tasks
- **Optimized response times** for all operations

Potential Conflicts:

- More confirmations (behavioral) vs. faster transactions (performance)
- Detailed help (behavioral) vs. streamlined interface (performance)

8-10 MARK QUESTIONS WITH COMPREHENSIVE ANSWERS

1. List the different types of human memory. Illustrate how ATM interface design accounts for limitations in human memory.

Answer:

Types of Human Memory:

1. Sensory Memory

- **Function:** Buffer for stimuli from sensory channels
- **Duration:** Very brief (milliseconds)
- **Capacity:** Large but rapidly decaying
- **Types:** Iconic (visual), Echoic (auditory), Haptic (touch)

2. Short-term Memory (STM)

- **Function:** Temporary storage and processing
- **Duration:** 20-30 seconds without rehearsal
- **Capacity:** 7±2 chunks
- **Characteristics:** Rapid access (70ms), limited capacity

3. Long-term Memory (LTM)

- **Function:** Permanent storage of knowledge
- **Duration:** Potentially unlimited
- **Capacity:** Virtually unlimited
- **Types:**
  - **Episodic:** Personal experiences and events
  - **Semantic:** Facts, concepts, and skills

ATM Interface Design Considerations:

A. Short-term Memory Limitations:

1. The Card Return Problem:

- **Issue:** Users reach closure after receiving money and forget their card
- **Solution:** Return card BEFORE dispensing cash
- **Psychology:** Prevents premature closure, ensures task completion

2. Information Chunking:

- **Issue:** Long numbers exceed STM capacity
- **Solution:** Display account numbers as 1234-5678-9012
- **Psychology:** Utilizes natural chunking ability (3-4 items per chunk)

3. Progressive Disclosure:

- **Issue:** Too much information overwhelms STM
- **Solution:** Present options step-by-step
- **Example:** PIN → Account Selection → Transaction Type → Amount
- **Psychology:** Reduces cognitive load at each step

B. Long-term Memory Support:

1. Familiar Metaphors:

- **Solution:** Use banking terminology and familiar icons
- **Psychology:** Leverages existing semantic memory

2. Consistent Interface:

- **Solution:** Same layout across all ATM networks
- **Psychology:** Builds procedural memory for routine tasks

C. Error Prevention:

1. Confirmation Screens:

- **Issue:** Users may not remember their selections
- **Solution:** Summary screen before transaction execution
- **Psychology:** Provides external memory aid

2. Clear Feedback:

- **Issue:** Users uncertain about system state
- **Solution:** Audio and visual confirmation of each action
- **Psychology:** Supports both auditory and visual memory channels

D. Timeout Management:

- **Issue:** STM duration limitation
- **Solution:**
  - Appropriate timeout periods (30-60 seconds)
  - Warning messages before timeout
- **Psychology:** Matches human attention span and provides alerts

Real-world Impact:
This design approach has significantly reduced card retention incidents and improved user satisfaction with ATM interfaces worldwide.

2. Which are the types of human reasoning? Illustrate how decision-making is influenced by user reasoning.

Answer:

Types of Human Reasoning:

1. Deductive Reasoning

- **Definition:** Derives specific conclusions from general premises
- **Process:** General → Specific
- **Certainty:** Logically certain if premises are true
- **Example:**
  - All humans are mortal (general premise)
  - Socrates is human (specific premise)
  - Therefore, Socrates is mortal (logical conclusion)

2. Inductive Reasoning

- **Definition:** Generalizes from specific observations
- **Process:** Specific → General

- **Certainty:** Probable, not guaranteed
- **Example:**
  - All elephants observed have trunks (specific observations)
  - Therefore, all elephants have trunks (generalization)

3. Abductive Reasoning

- **Definition:** Infers best explanation from available evidence
- **Process:** Incomplete Information → Best Explanation
- **Certainty:** Best guess, not certain
- **Example:**
  - Car won't start (observation)
  - Battery might be dead (best explanation based on experience)

How Decision-Making is Influenced by User Reasoning:

A. Interface Navigation Decisions:

Deductive Reasoning Application:

- **Scenario:** User sees red warning message
- **Reasoning:** Red universally means danger/warning → This message is important → I should read it carefully
- **Design Implication:** Use consistent color coding across interfaces

Inductive Reasoning Application:

- **Scenario:** User encounters similar interfaces
- **Reasoning:** Previous experience with menus → All dropdown arrows work similarly → Click to see options
- **Design Implication:** Maintain consistency with established conventions

Abductive Reasoning Application:

- **Scenario:** System responds slowly
- **Reasoning:** Slow response usually means processing → System is probably working → Wait rather than click again
- **Design Implication:** Provide clear loading indicators

B. Problem-Solving in Interfaces:

1. Productive vs Reproductive Thinking:

Productive Thinking:

- **Definition:** Creative reorganization of problem elements
- **Example:** User finds new way to accomplish task using existing features
- **Design Support:** Flexible interfaces allowing multiple approaches

Reproductive Thinking:

- **Definition:** Applying previous knowledge mechanically
- **Example:** User follows memorized steps for routine tasks
- **Design Support:** Consistent workflows and shortcuts

C. Error Recovery Decisions:

Example Scenario: Online Shopping Cart Error

Deductive Reasoning:

- "Error messages usually explain the problem"
- "This error message says 'item out of stock'"
- "Therefore, I cannot purchase this item"

Inductive Reasoning:

- "Usually when items are out of stock, similar items are suggested"
- "I don't see suggestions here"
- "Maybe I should search for alternatives myself"

Abductive Reasoning:

- "The add to cart button isn't working"
- "Maybe the item is out of stock"
- "Let me check the product details page"

D. Trust and Security Decisions:

Banking App Example:

Deductive Reasoning:

- "Banks use https for security"
- "This URL shows https"
- "Therefore, this connection is secure"

Inductive Reasoning:

- "Legitimate banking apps always ask for credentials"
- "This app is asking for my password"
- "This seems normal"

Abductive Reasoning:

- "This login page looks slightly different"
- "Maybe it's a phishing attempt"
- "I should verify the URL carefully"

Design Implications for Supporting User Reasoning:

1. Support Deductive Reasoning:

- Clear hierarchies and categorization
- Consistent visual language
- Logical information architecture

2. Support Inductive Reasoning:

- Follow established conventions
- Provide similar interfaces for similar tasks
- Build on users' existing mental models

3. Support Abductive Reasoning:

- Provide clear system feedback

- Offer multiple paths to goals
- Design for error recovery

Conclusion:
Understanding how users apply different types of reasoning helps designers create interfaces that align with natural human thought processes, leading to more intuitive and effective user experiences.

3. Design a complete interaction system for a smart campus network.

Answer:

Users and Roles:

1. Students:

- Access timetables and attendance
- View grades and assignments
- Navigate campus locations
- Book facilities and resources

2. Faculty:

- Manage courses and evaluations
- Record attendance
- Upload materials and assignments
- Schedule meetings and classes

3. Administrators:

- Manage scheduling and resources
- Monitor system usage
- Generate reports
- Maintain user accounts

4. Visitors:

- Access campus maps and directions
- Register for events
- Request visitor access
- Find contact information

5. Security Personnel:

- Monitor surveillance systems
- Control access permissions
- Respond to emergency alerts
- Track visitor movements

Input/Output Devices:

Input Devices:

- **Touchscreens** - Interactive kiosks and information displays
- **Voice interfaces** - Hands-free commands and queries
- **Biometric scanners** - Fingerprint and facial recognition for access

- **QR code scanners** - Quick access to information and check-ins
- **RFID readers** - Student/staff ID card authentication
- **Mobile devices** - Smartphones and tablets for personal access

Output Devices:

- **Digital dashboards** - Role-based information displays
- **Mobile notifications** - Push alerts and updates
- **Information kiosks** - Campus-wide interactive displays
- **Audio alerts** - Emergency announcements and notifications
- **LED displays** - Status indicators and wayfinding
- **Projection systems** - Large-scale information sharing

Interaction Styles:

1. Touch and Gesture-Based Controls:

- Multi-touch interfaces for kiosks
- Swipe gestures for navigation
- Pinch-to-zoom for maps and schedules
- Long-press for context menus

2. Voice Commands:

- "Show my schedule for today"
- "Navigate to the library"
- "Check room availability"
- "Report maintenance issue"

3. Form Filling:

- Event registration forms
- Maintenance request submissions
- Feedback and survey forms
- Profile update interfaces

4. Direct Manipulation:

- Drag-and-drop scheduling
- Interactive campus maps
- File uploads and downloads
- Calendar management

Key Features:

1. Role-Based Dashboards:

- **Student Dashboard:** Timetables, grades, notifications, campus map
- **Faculty Dashboard:** Course management, student records, scheduling
- **Admin Dashboard:** System analytics, user management, resource allocation
- **Visitor Dashboard:** Campus map, event information, contact directory

2. Real-Time Alerts:

- Emergency notifications
- Schedule changes
- Event reminders
- System maintenance updates

3. Context-Aware Services:

- Location-based information
- Personalized recommendations
- Adaptive interface based on usage patterns
- Time-sensitive content delivery

4. Remote Access:

- Mobile applications for all user types
- Web-based interfaces
- Offline functionality for critical features
- Synchronization across devices

5. Multi-Device Compatibility:

- Responsive design for various screen sizes
- Cross-platform mobile applications
- Browser compatibility
- Accessibility features for assistive technologies

Usability and Feedback:

Visual Feedback:

- Progress indicators for loading operations
- Color-coded status indicators (green=available, red=busy)
- Highlighting for active selections
- Visual confirmation of completed actions

Haptic Feedback:

- Vibration confirmation on mobile devices
- Tactile response for kiosk interactions
- Force feedback for important selections
- Different vibration patterns for different alert types

Error Handling:

- Clear error messages with suggested solutions
- Graceful degradation when services are unavailable
- Automatic retry mechanisms for network issues
- Help context relevant to current task

Accessibility Support:

- Screen reader compatibility
- Large text and high contrast options

- Voice navigation alternatives
- Keyboard-only navigation support
- Multiple language support

Network and Security:

Secure Wi-Fi Infrastructure:

- Campus-wide wireless coverage
- Role-based network access
- Bandwidth management and prioritization
- Guest network with limited access

Data Encryption:

- End-to-end encryption for sensitive data
- Secure protocols for all communications
- Regular security audits and updates
- Compliance with privacy regulations

Single Sign-On (SSO):

- Unified authentication across all services
- Integration with existing campus systems
- Password policy enforcement
- Multi-factor authentication options

Biometric Authentication:

- Fingerprint scanning for secure areas
- Facial recognition for automated check-ins
- Iris scanning for high-security zones
- Backup authentication methods

Activity Monitoring:

- User activity logs for security purposes
- System usage analytics for optimization
- Anomaly detection for security threats
- Privacy-compliant data collection

Implementation Considerations:

1. Scalability:

- Support for growing user base
- Modular architecture for easy expansion
- Load balancing for peak usage times
- Cloud-based infrastructure options

2. Integration:

- APIs for existing campus systems
- Database synchronization

- Third-party service integration
- Legacy system compatibility

3. Maintenance:

- Regular software updates
- Hardware maintenance schedules
- User training and support
- Performance monitoring and optimization

This comprehensive smart campus network system provides seamless interaction across multiple touchpoints while maintaining security, accessibility, and user satisfaction.

IMPORTANT DIAGRAMS TO REMEMBER

1. Norman's Seven-Stage Model

```
EXECUTION-EVALUATION LOOP
Goal → Intention → Specify Actions → Execute →
Perceive → Interpret → Evaluate → Goal
```

2. Memory Structure

```
Sensory Memory → Short-term Memory → Long-term Memory
                 (7±2 chunks,         (Episodic + Semantic)
                  20-30 seconds)
```

3. Human I/O Channels

```
Visual (Eyes) ↕
Auditory (Ears) ↕ BRAIN ↕ Motor (Movement)
Haptic (Touch) ↕
```

4. Interaction Framework

```
USER ↔ INPUT ↔ SYSTEM ↔ OUTPUT ↔ USER
     Task      Core    Display
```

EXAM SUCCESS TIPS

For 2-Mark Questions:

- Write precise definitions
- Include key characteristics or examples
- Use technical terminology correctly

For 5-Mark Questions:

- Start with definition
- Provide detailed explanation
- Include relevant examples
- Draw diagrams where applicable

For 8-10 Mark Questions:

- Structure your answer with clear headings
- Include introduction and conclusion
- Provide real-world examples and case studies
- Draw detailed diagrams
- Connect theory to practical applications

Memory Techniques:

- **VHAM** for I/O channels (Visual, Haptic, Auditory, Movement)
- **DAI** for reasoning types (Deductive, Abductive, Inductive)
- **SSL** for memory types (Sensory, Short-term, Long-term)

Common Mistakes to Avoid:

- Don't confuse slips with mistakes
- Remember ATM card-return example for closure
- Distinguish between recognition and recall
- Know Fitts' Law applications

This comprehensive guide covers all possible SEE questions for HCI Unit 1 with detailed answers optimized for maximum marks.