

INFORMATION ASSURANCE & SECURITY (ITEC 85) – Final Exam (Key Answers) (1/1)

I. True or False: (2pts each)

60% T || 40% F

II. Identification: (2pts each)

Security Strategy
Trends
Availability
Confidentiality
Encryption
Contingency Plan
Cybercriminals
Computer Crime
Blockchain
Computer Forensics

III. Enumeration:

A: (1pt each)

1. Authentication
2. Access Control
3. Encryption
4. Passwords
5. Backup
6. Firewalls
7. Virtual Private Networks (VPN)
8. Physical Security
9. Security Policies

B: (1pt each)

1. Ransomware attacks
2. IoT Attacks
3. Cloud Attacks
4. Phishing Attacks
5. Blockchain and Cryptocurrency attacks
6. Software vulnerabilities
7. Machine Learning and AI Attacks

C: (1pt each)

1. Confidentiality
2. Integrity
3. Availability

D: (1pt each)

1. Understanding of the organizational information resources
2. Regular backups of all data
3. Offsite storage of backups
4. Test of the data restoration

E: (2pts each)

1. Ensure the Safety of Students, Faculty, Staff, and Visitors
2. Prepare Staff and Students for Any Emergency
3. Ensure the Continuation of Essential Functions During an Emergency
4. Minimize Damage and Losses Resulting From an Inability to Perform Essential Functions
5. Facilitate Decision Making During an Emergency
6. Achieve a Timely and Orderly Recovery from a Disruption of Services Caused by an Emergency

F: (1pt each)

1. Walkout
2. Sabotage
3. Stealing
4. Virus
5. Invasion

G: (1pt each)

1. Flood
2. Fire
3. Earthquake
4. Hurricanes

IV. DIRECTION: (1pt each)

Client
Service Ticket & Session Key
KDC
Service
Request or ticket granting ticket (TGT)
Service Ticket & Authenticator

APPLICATION DEVELOPMENT AND EMERGING TECHNOLOGIES (DCIT 26) (1/3)

Prototype - can also mean a typical example of something such as in the use of the derivation 'prototypical'.

- enables our developers and designers to show our understanding of the customer's requirements.

Prototyping Model - a basic version of the system is built, tested, and then reworked as necessary until an acceptable prototype is finally achieved.

4 TYPES OF PROTOTYPING

1. Rapid (Throwaway) prototyping
2. Evolutionary prototyping
3. Incremental prototyping
4. Extreme prototyping

Rapid Prototyping - is the most commonly used AndPlus. Its name refers to the ease and speed with which a prototype can be modified to try different ideas with the user audience and incorporate their feedback.

- is also known as "**throwaway prototyping**" because the prototype is expected to be relevant only in the short term, such as one sprint in the Agile development framework.

(e.g. 3D printing)

Evolutionary Prototype - differs from the traditional notion of a software prototype

- is a functional piece of software, not just a simulation.
- starts with a product that meets only the system requirements that are understood.

(e.g. creating computer software through multiple trials & redesign until the software is without fault.)

Incremental prototyping - is useful for enterprise software that has many modules and components which may be loosely related to one another.

- separate small prototypes are built in parallel.
- the individual prototypes are evaluated and refined separately, and then merged into a comprehensive whole, (e.g. when developing a car, the manufacturer starts with a prototype or model that costs less and incorporates new technology.)

Extreme prototyping - is more common for web application development.

Composed of:

1. Presentation layer

- Displayed in the user's browser

2. Services layer

- Communications services
- Business logic
- Authentication and authorization
- Other back-end services

3 PHASES:

1. **Build** HTML wireframes to simulate the presentation layer. These webpages have limited interactivity. They are complete enough to show users the various user journeys through the application.
2. **Transform** the wireframes to fully functional HTML pages, tying them to a simulated services layer.
3. **Code** and implement the services layer.

Quality assurance (QA) is the act or process of confirming a firm's quality requirements are being met.

Managing the quality of production involves *planning, fulfilling, and monitoring activities.*

The term "**quality assurance**" is sometimes used interchangeably with "**quality control**".

Quality Control pertains to the actual fulfillment of whatever quality requirements have been put in place.

User Interface Design (UID) - The visual part of a computer application or operating system through which a client interacts with a computer.

- It determines how commands are given to the computer and how data is displayed on the screen.

TYPES:

1. **Text-Based User Interface or Command Line Interface** - This method relies primarily on the keyboard. (e.g. UNIX.)

2. **Graphical User Interface (GUI)** - a system of interactive visual components for computer software.

Using programming language like **PHP** and a database such as **MySQL** allows you to *make your sites dynamic / to have them customizable and contain real-time information.*

PHP is a server-side scripting language designed specifically for the Web. *You can embed PHP code that will be executed each time the page is visited.*

- **PHP code** is interpreted at the Web server and generates HTML or other output that the visitor will see.

- created by **Rasmus Lerdorf** in **1994**.

- PHP originally stood for "**Personal Home Page**" and was

APPLICATION DEVELOPMENT AND EMERGING TECHNOLOGIES (DCIT 26) (2/3)

released as a free open-source project.

- In **1997**, PHP was renamed to the current **“PHP: Hypertext Preprocessor.”**

PHP’s Strengths

1. High Performance
2. Interfaces to many different database systems
3. Built-in libraries for many common Web tasks
4. Low cost
5. Ease of learning and use
6. Portability
7. Availability of source code

MySQL’s Strengths

1. High Performance
2. Low Cost
3. Easy to configure and learn
4. Portable
5. Source code is available

Client-Side Scripting - The code is executed on the user’s machine after the page has been loaded. It enables you to make changes to a page without requiring a page reload. Responsible for many web features that you can see such as pop-up windows, some animations, drop-down menus. (e.g. Javascript and VBscript.)

Server-Side Scripting - The code is performed on the site’s hosting server before the page is delivered to the user. *Any changes that must be made by the script requires page refresh or reload.*

WAMP / XAMPP - all-in-one solution to easily install Apache, MySQL, and PHP, and they are free and readily available from the internet.

System Testing is a level of testing that validates the complete and

fully integrated software product.
- purpose is to evaluate the end-to-end system specifications.

Software Testing is the process of evaluating and verifying that a software product or application does what it is supposed to do.
- The benefits include preventing bugs, reducing development costs and improving performance.
- Its importance is if there any bugs or error in the software, it can be identified early and can be solved.

Properly tested product ensures:

1. Reliability
2. Security &
3. High performance

The benefits of software testing:

1. Cost effective
2. Security
3. Product quality
4. Customer satisfaction

Testing is important because software bugs could be expensive or even dangerous.

Software bugs can potentially cause monetary and human loss.

Testing Strategies in software engineering:

1. Unit testing - test the unit of the program. It helps developers to know whether the individual unit of code is working properly or not.

2. Integration testing - test on construction and design of the software. The integrated units are working without errors or not.

3. Software testing - the process of evaluating and verifying that a software product or application does what it is supposed to do.

4. Program testing - method of executing an actual software program with the aim of testing program behavior and finding errors. It executed with test case

data to analyze or response to the test data

A good program testing is one who has high chances of finding bugs.

Verification is the process of checking that a software achieves its goal without any bugs.
- It is the process to ensure whether the product that is developed is right or not.
- It verifies whether the developed product fulfills the requirements that we have.

Activities involved in Verification:

1. Inspections
2. Reviews
3. Walkthroughs
4. Desk-checking

Validation is the process of checking whether the software product is up to the mark or in other words product has high level requirements.

- It is the process of checking the validation of product i.e. it checks what we are developing is the right product.

- it is validation of actual and expected product.

Activities involved in Validation:

1. Black box testing
2. White box testing
3. Unit testing
4. Integration testing

V model - a software development life cycle methodology, describes the activities to be performed and the results that have to be produced during the life cycle of the product. It is known as verification and validation model.

V-Model Objectives:

1. Project Risks Minimization
2. Guaranteed Quality
3. Total Cost reduction of the Entire Project
4. Improved Communication between all Parties Involved.

APPLICATION DEVELOPMENT AND EMERGING TECHNOLOGIES (DCIT 26) (3/3)

Advantages of V-Model:

1. Emphasize for verification and validation of the product in early stages of product development.
2. Each stage is testable
3. Project management can track progress by milestones
4. Easy to understand implement and use

Limitations of V-Model:

1. Does not easily handle events concurrently.
2. Does not handle iterations or phases
3. Does not easily handle dynamic changes in requirements
4. Does not contain risk analysis or Mitigation activities

V-Model Different Phases:

1. The Requirements phase, a document describing what the software is required to do after the software is gathered and analyzed and the corresponding test activity is user **acceptance testing**.

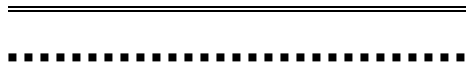
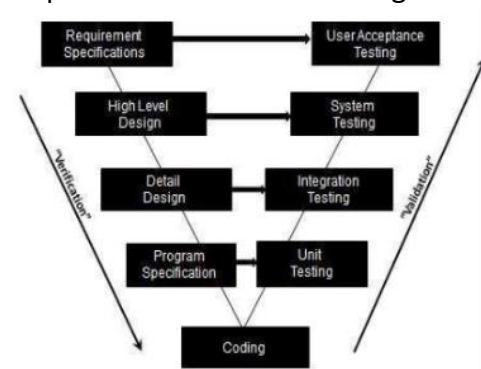
2. The Architectural Design phase, where a software architecture is designed and building the components within the software and the establishing the relationships between the components and the corresponding test activity is **System Testing**.

3. The High Level Design phase, breaking the system into subsystems with identified interfaces; then gets translated to a more detailed design and the corresponding test activity is **Integration testing**.

4. The Detailed Design phase, where the detailed

implementation of each component is specified. The detailed design broken into Data structures, Algorithm used and the corresponding test activity is **Unit Testing**.

5. Coding in which each component of the software is coded and tested to verify if faithfully implements the detailed design.



RESEARCH (DCIT60A) (1/4)

The **Title** describes your study's key topic or ideas. An excellent title uses as few words as possible to explain the content. The title is the most read portion of a work, and it is frequently the first to be read.

An **Abstract** is a brief overview of a research paper or a complete thesis. *It is an original composition, not a paraphrase.* An abstract must be self-contained and make sense without additional reference to outside sources or the article itself.

The **Introduction** initial task is to inform the reader about your topic and why it is interesting or significant.

The **hook** is an eye-catching first line that effectively emphasizes the importance of your issue.

5 PART OF INTRODUCTION:

1. INTRODUCTION
2. STATEMENT OF THE PROBLEM
3. IMPORTANCE OF THE STUDY
4. OBJECTIVES
5. TIME AND PLACE OF THE STUDY
6. SCOPE AND LIMITATION
7. DEFINITION OF TERMS

A **Problem Statement** is a research explanation that explains the topic that has to be studied. It helps the reader to easily comprehend the research's objective and intent.

IMPORTANCE OF THE

STUDY – It establishes the context underpinning the investigation. It includes the reasoning, the core issue statement, and a summary of the research questions addressed.

OBJECTIVES - outlines what you hope to achieve with your research endeavor. They

summarize the strategy and objective of the project. It should occur at the conclusion of your problem statement at the beginning of research paper.

TIME AND PLACE OF THE

STUDY - The province, territory, or country of the institution from which a person obtained a certificate, diploma, or degree, or; the province, territory, or country of the institution that a person attended.

SCOPE AND LIMITATION -

describes the general limits and bounds of your research. It describes what your research will look, like the population to be studied, the size of the study, and the length of the investigation. *Factors and variables not included in the study are considered limitations.*

DEFINITION OF TERMS - The

frequently required in dissertations. It provides your readers with an understanding of the concepts or factors that will be discussed throughout your study, as well as contextual information on how you will be using those concepts in your study.

A **Literature Review** is an objective, concise, and critical summary of published research literature relevant to the topic of an article's research. A literature review can be an end in itself or a prelude to and justification for conducting primary research.

Related Studies involve reviewing or studying existing works in your project/research field. Related Works are an important constraint because they pave the way for the entire research process.

Journals, magazines, website links, government reports, and other sources can be used to find related studies.

A **Conceptual Model** is a system representation. It is made up of concepts that are used to help people know, understand, or simulate the subject that the model represents.

Documents, records, software, information, and other materials or work product in any tangible form created or developed during or in conjunction with the Research Activity are referred to as **Research Materials**.

A **Study Method** is a strategy or procedure that researchers employ to acquire data for their research topic.

The **Sample** is the set of people who will actually take part in the study. This is known as a **sampling approach**.

TYPES OF SAMPLING METHOD:

1. **Probability Sampling** involves random selection, allowing you to make strong statistical inferences about the whole group.
2. **Non-probability Sampling** involves non-random selection based on convenience or other criteria, allowing you to easily collect data.

Probability Sampling means that every member of the population has a chance of being selected. It is mainly used in quantitative research.

4 types of Probability Sample:

1. Simple random sampling
2. Systematic sampling
3. Stratified sampling
4. Cluster sampling

RESEARCH (DCIT60A) (2/4)

Individuals in a **Non-Probability Sample** are chosen based on non-random criteria, and not every individual has a chance of being included. It is frequently utilized. The goal of this form of study is to gain an early knowledge of a tiny or under-researched community.

4 types of non-Probability

sample:

1. Convenience sampling
2. Voluntary response sampling
3. Purposive sampling
4. Snowball sampling

COLLECTION OF DATA - is the process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes.

The **Data Collection** component of research is common to all fields of study including physical and social sciences, humanities, business, etc.

Data Processing occurs when data is collected and translated into usable information. Usually performed by a data scientist or team of data scientists.

Statistical Treatment of data is the act of taking raw data and turning it into something that can be interpreted and used to make decisions. It is important for businesses because it allows them to take customer feedback and turn it into actionable insights.

Data analysis is a process for obtaining raw data, and converting it into information useful for decision-making by users. **Data**, is

collected and analyzed to answer questions, test hypotheses, or disprove theories.

Results Section - The findings portion of your research report is where you assemble and present the data acquired. This part should also provide a basic summary of what you learned from your investigation. The results should be written in the passive voice.

When writing the results section of a research paper:

1. Include a short introduction restating the research question.
2. Mention the criteria for data collection and the characteristics of your study group.
3. Describe the findings in the same order applied in your methods section. Each method has to have result.
4. Use visual charts to give the reader a simple representation of the data you have acquired.
5. Conclude with a small paragraph summarizing your key outcomes.

***Results Section** should state the findings without interpretation.*

Discussion Section includes your remarks, interpretation, and derivation of the hypothesis's outcomes.

For concise Discussion:

1. Summarize your findings
2. Interpret the results and compare them with your hypothesis
3. Cover the implications of the results from your study
4. Go over the limitations of your study
5. Recommend what could be adjusted to yield more quality results in future

You should clearly express points in the discussion to make your reader understand when you hint at a limitation, a recommendation, or implementation.

The **Results section** comprises brief reports of what you got after the experiment.

the **Discussion section** interprets the results and speculates why you found the results and what they mean for your study. *You may have to add citations in the discussion section to put your results into context.*

Summary, Conclusion and Recommendation - This is required in all research projects, whether qualitative and quantitative. When reading a research work, readers look first to the summary, conclusion, and suggestion to see if they can point out what the dissertation is stating because this is frequent in this chapter.

Summary of findings shows and summarizes the most important variables and outcomes of a study. It informs the reader of what was done, how it was done, and the research outcomes.

Conclusion should help people comprehend why the study is important to them. A **conclusion** is a synthesis of important aspects. It is required in a thesis, journal article, or dissertation to educate readers of the strength and impact of the study's assertions.

Steps when writing the Conclusion of your study:

1. Restate the research topic.
2. Reiterate the thesis (objective of the study).
3. Make a summary of the main points.

RESEARCH (DCIT60A) (3/4)

4. Mention the relevance or outcomes.
5. Wrap up your thoughts.

The **Recommendations** should be based on the study's findings. The proposal is an excellent chance to elaborate, taking into mind the potential implications of your study findings. Other issues that your study did not cover should be addressed in the recommendation for additional research.

Research is a process of steps to collect and analyze information to increase our understanding of the topic or issue.

IMPORTANCE OF

RESEARCH - Research can find answers to things that are unknown, filling gaps in knowledge and changing the way that healthcare professionals work.

WHAT ARE THE IMPORTANT IN RESEARCH

1. RESEARCH ADDS TO OUR KNOWLEDGE
2. RESEARCH IMPROVES PRACTICE
3. RESEARCH INFORMS POLICY DEBATES

Meaning of Research - Is the pursuit of truth with help of study, observations, comparison and experiment.

Objectives of Research:

1. Defining and redefining the problems
2. Formulating the hypotheses or suggested solutions.
3. Collecting, organizing and evaluating data.
4. Making deductions and reading conclusions

5. Carefully testing the conclusions to determine whether they fit the formulating hypotheses

Motivation in Research

1. Desire to get research degree
2. Desire to face challenges in solving the unsolved problems
3. Desire to get intellectual joy doing some creative work
4. Desire to be of service to the society
5. Desire to get responsibility

TYPES OF RESEARCH

1. **Descriptive Research**- Means description of the state of affairs as it exists at present. Researcher only reports only what has happened or what is happening
2. **Applied Research** - Aims at finding solution for an immediate problem
3. **Quantitative Research** - Based on the measurement of quantity or amount.
4. **Conceptual Research** - Related to some abstract ideas or theory. Used by philosophers and thinkers
5. **Empirical Research** - Relies on experience or observations alone.
6. **Qualitative Research** - Concerned with qualitative phenomenon.
7. **Fundamental Research** - Mainly concerned with generalizations and with the formulation of a theory.
8. **Analytical Research** - Researcher has to use facts on information already available.

Research Methods - Refers to the methods/techniques researchers use in performing research operations.

Research Methodology - It may be understood as a science of studying how research is done scientifically. We study the various steps that are adopted by researcher in studying his research

problem along with the logic behind them.

Steps in Sample Design

1. Define the universe
Sampling unit
2. Source list or sampling frame
3. Size of sample
4. Sampling method or technique
5. Parameters of interest
6. Budgetary constraint
7. Select the sample

METHODS OF SAMPLING

1. Random or Probability Sampling
2. Non- Random or Non-Probability Sampling

Random or Probability Sampling

1. Simple random sample
2. Systematic sample
3. Stratified random sample
4. multi-stage random sample
5. Cluster sample or area sample
6. Sequential sample or sample in installments
7. Replicated or interpenetrating sample

Non-Random or Non-Probability Sampling

1. Purposive sample
2. Quota sample
3. Convenience sample

METHODS OF COLLECTION OF DATA

1. Primary Data
2. Secondary Data

Collection of Primary Data

Questionnaires, observations, interviews, schedules

Collection of Secondary Data -

means data that is already available. It may be either published or unpublished.

Sources:

Diaries, letters, unpublished biographies and autobiographies

After collection of data, it has to be processed and analyzed.

RESEARCH (DCIT60A) (4/4)

Process of Analysis:

1. Editing
2. Coding
3. Classification
4. Tabulation

Elements /Types of Analysis

1. Descriptive analysis
2. Correlation analysis
3. Multivariate analysis
 - Multiple regression analysis
 - Multiple discriminant analysis
 - Multivariate analysis of variance (or Multi-ANOVA)
- Canonical analysis
- Inferential analysis

Hypothesis means a mere assumption or some supposition to be proved or disapproved

Characteristics of Hypothesis

1. It should be clear and precise
2. Should be capable of being tested
3. It should state the relationship between variables
4. It should be limited by scope and be specific
5. It should be stated as far as possible with most simple terms
6. It should be consisted with most known facts
7. It should be amenable to testing within a reasonable time
8. Must explain the facts that gave rise to the need for explanation

Types of Hypothesis

1. Null Hypothesis
2. Alternative Hypothesis

Procedure of testing Hypothesis

1. Formulate a null or alternative Hypothesis
2. Choose the level of significance of the test
3. Choose the location of the critical region
4. Choose the appropriate test statistics

5. Compute from the sample observations using the relevant formula
6. Compare the sample value of the chosen statistics with the Theoretical (table)

The important parametric tests are:

Z-Test, T-Test, X-Test and F- Test

Non –Parametric tests

A. One sample and Two sample tests

- Binomial test
- Chi- square test
- McNemar test

B. K- sample tests ($K > 3$)

- Kruskal-Wallis test: H
- Friedman test
- Kendall`s coefficient of concordance: W

Interpretation of data means the task of drawing conclusions and of explaining their significance after a careful analysis of data. Requires a great skill on the part of the researcher. It is an art that one learns through practice and experience

PARTS OF RESEARCH:

1. TITLE
2. ABSTRACT
3. INTRODUCTION
4. REVIEW LITERATURE
5. METHODS OF RESEARCH
6. DATA ANALYSIS
7. RESULT
8. CONCLUSION
9. REFERENCE

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INTRODUCTION TO HCI (1/)

Human Computer Interaction

(HCI) - The study of the design, evaluation and implementation of interactive computing systems for human use.

A cross-disciplinary area (e.g., engineering, psychology, ergonomics, design) that deals with the theory, design, implementation, and evaluation of the ways that humans use and interact with computing devices.

3 parts:

the person, the computer, and the ways they work together.

Components of HCI

1. **User** - an individual user, a group of users working together. sight, hearing, touch relay information is vital. Different users form different conceptions about their interactions and have different ways of learning. Cultural and national differences play a part.

2. **Computer** – Any technology ranging from desktop computers, to large scale computer systems. Devices such as mobile phones or VCRs can also be considered to be "computers"

3. **Interaction** - HCI attempts to ensure that they both get on with each other and interact successfully. In order to achieve a usable system, you need to apply what you know about humans and computers, In real systems, the schedule and the budget are important and vital to find a balance between what would be ideal for the users and what is feasible in reality.

Goals of HCI

to produce usable and safe systems, as well as functional systems.

Producing computer systems with good usability:

1. understand the factors that determine how people use technology
2. develop tools and techniques to enable building suitable systems
3. achieve efficient, effective, and safe interaction
4. put people first

Usability of HCI - It is one of the key concepts in HCI. It is concerned with making systems easy to learn and use.

A usable system is:

1. easy to learn
2. easy to remember how to use
3. effective to use
4. efficient to use
5. safe to use
6. enjoyable to use

Factors in HCI

- A. **Organisation Factors**
- B. **Environmental Factors**
- C. **Health and Safety Factors**
- D. **The User**
- E. **Comfort Factors**
- F. **User Interface**
- G. **Task Factors**
- H. **Constraints**
- I. **System Functionality**
- J. **Productivity Factors**

Disciplines contributing to HCI

- A. **Computer Science**
 - technology software
 - design, development & maintenance
 - User Interface Management Systems (UIMS) & User Interface Development Environments (UIDE)
 - prototyping tools
 - graphics
- B. **Cognitive Psychology**
 - information processing
 - capabilities limitations
 - cooperative working
 - performance prediction
- C. **Social Psychology**
 - Social & organizational structures
- D. **Ergonomics/Human Factors**

- hardware design
- display readability

E. **Linguistics**

- Natural language interfaces

F. **Artificial Intelligence**

- Intelligent software

G. **Philosophy, Sociology & Anthropology Computer supported cooperative work (CSCW)**

H. **Engineering & Design**

- graphic design
- engineering principles

Humans are limited in their capacity to process information.

Information is received and responses given via:

1. visual channel
2. auditory channel
3. haptic channel
4. movement

VISUAL CHANNEL

Human vision is a highly complex activity with a range of physical and perceptual limitations. It is the primary source of information for the average person. *Vision begins with light.*

The **eye** is a mechanism for receiving light and transforming it into electrical energy.

Light is reflected from objects and their image is focused upside down on the back of the eye.

The **receptors** in the eye transform it into electrical signals then passed to the brain.

THE EYE

The **cornea and lens** at the front of the eye focus the light into a sharp image on the back of the eye, the **retina**.

The **retina** is light sensitive with two types of photoreceptor: **rods and**

INTRODUCTION TO HCI (2/)

cones.

Rods are highly sensitive to light and allow us to see under a low level illumination. They are unable to resolve fine detail and are subject to light saturation.

There are approximately 120 million rods per eye mainly situated towards the edges of the retina.

Rods dominate peripheral vision.

Cones are the second type of receptor in the eye. They are less sensitive to light therefore they can tolerate more light.

There are three types of cone. This allows color vision.

There's approximately 6 million cones, mainly concentrated on the fovea.

There is one blind spot where the optic nerve enters the eye.

The **retina** also has specialized nerve cells called ganglion cells.

There are two types:

1. **X-cells**, which are concentrated in the fovea and are responsible for the early detection of pattern
2. **Y-cells** which are more widely distributed in the retina and are responsible for the early detection of movement.

DESIGN FOCUS - Humans ability to read or distinguish falls off inversely as the distance from our point of focus increases

VISUAL PERCEPTION - How we perceive size and depth, brightness and color.

Perceiving size and depth - Visual angle is affected by both the size

of the object and its distance from the eye.

Perceiving brightness - It is affected by luminance which is the amount of light emitted by an object.

INTRODUCTION TO HCI (3/)

Brightness is in fact a subjective reaction to levels of light.

Contrast is related to **luminance**: it is a function of the luminance of an object and the luminance of its background.

Color is usually regarded as being made up of three components: **hue, intensity and saturation.**

Hue is determined by the spectral wavelength of the light. Blues have short wavelengths, greens medium and reds long.

Intensity is the brightness of the color

Saturation is the amount of whiteness in the color.

Humans can perceive in the region of 7 million different colors.

Visual processing involves the transformation and interpretation of a complete image

Expectations affect the way an image is perceived.

The ability to interpret and exploit our expectations can be used to resolve ambiguity.

Optical illusions highlight the differences between the way things are and the way we perceive them

READING

Stages in Reading process:

1. the visual pattern of the word on the page is perceived.
2. It is decoded with reference to an internal representation of language.
3. The final stages of language processing include syntactic and semantic analysis and operate on phrases or sentences.

Adults read approximately 250 words a minute

Words are scanned serially, character by character, words can be recognized as quickly as single characters

HEARING – considered secondary to sight

- hearing begins with vibrations in the air or sound waves.

3 sections: outer ear, middle ear and inner ear.

Pitch is the frequency of the sound. low frequency produces a low pitch. High frequency, a high pitch.

Loudness is proportional to the amplitude of the sound; the *frequency remains constant.*

Timbre relates to the type of the sound: sounds may have the same pitch and loudness but be made by different instruments

The human ear can hear frequencies from about 20 Hz to 15 kHz. It can distinguish frequency changes at low frequencies but is less accurate at high frequencies.

The **auditory system** performs some filtering of the sounds received, allowing us to ignore background noise

The ear can differentiate quite subtle sound changes and can recognize familiar sounds without concentrating

TOUCH - “Haptic Perception”. The third and last of the senses that to consider. It tells us when we touch something hot or cold, and can therefore act as a warning.

3 types of sensory receptor:

1. **thermoreceptors** respond to heat and cold
2. **nociceptors** respond to intense pressure
3. **mechanoreceptors** respond to pressure.

2 kinds of mechanoreceptor:

1. **Rapidly adapting mechanoreceptors** - respond to immediate pressure as the skin is indented. It reacts more quickly with increased pressure. However, they stop responding if continuous pressure is applied.

• **Slowly adapting mechanoreceptors** - respond to continuously applied pressure.

A second aspect of haptic perception is **kinesthesia**: awareness of the position of the body and limbs.

3 types:

1. **rapidly adapting**, which respond when a limb is moved in a particular direction
2. **slowly adapting**, which respond to both movement and static position
3. **positional receptors**, which only respond when a limb is in a static position.

MOVEMENT

Motor control is the way we move affects our interaction with computers.

Movement time is dependent largely on the physical characteristics of the subjects: their age and fitness.

INTRODUCTION TO HCI (4/)

Reaction time varies according to the sensory channel through which the stimulus is received.

A second measure of motor skill is **accuracy** and is dependent on the task and the user.

Speed and accuracy of movement are important considerations in the design of interactive systems

Users will find it more difficult to manipulate small objects, targets should generally be as large as possible and the distance to be moved as small as possible.

HUMAN MEMORY - Storing all our factual knowledge, our memory contains our knowledge of actions or procedures

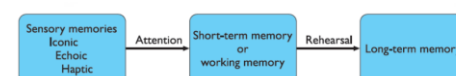
Information is stored in memory:

1. sensory memory
2. short-term (working) memory
3. long-term memory

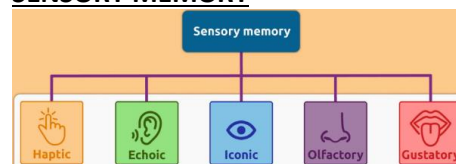
It allows us to repeat actions, to use language, and to use new information received via our senses.

It also gives us our sense of identity, by preserving information from our past experiences.

MODEL STRUCTURE OF MEMORY



SENSORY MEMORY



The **sensory memories** act as buffers for stimuli received through the

senses.

It exists for each sensory channel: **iconic memory** for visual stimuli, **echoic memory** for aural stimuli and **haptic memory** for touch.

Attention is the concentration of the mind on one out of a number of competing stimuli or thoughts.

Information received by sensory memories is quickly passed into a more permanent memory store, or overwritten and lost.

Short-term memory or working memory acts as a ‘scratch-pad’ for temporary recall of information.

- It can be accessed rapidly
- Decays rapidly. information can only be held there temporarily, in the order of 200 ms.
- It has a limited capacity

Patterns can be useful as aids to memory

Recency effect is where recall of the last words presented is better than recall of those in the middle.

Long Term Memory - Main memory resource where we store factual information, experiential knowledge, procedural rules of behavior

- It is huge, if not unlimited in capacity.
- It has a relatively slow access time of approximately a tenth of a second.
- Forgetting occurs more slowly in long-term memory.

2 types of long-term memory:

1. **Episodic memory** represents our memory of events and experiences in a serial form.

• **Semantic memory**, on the other hand, is a structured record of facts, concepts and skills that we have acquired.

Long-term memory may store information in a semantic network

Items are associated to each other in classes and may inherit attributes from parent classes.

Frames and Scripts - Models on how to organize information into data structures.

Frame based representation:

DOG	COLLIE
Fixed legs: 4	Fixed breed of: DOG type: sheepdog
Default: diet: carnivorous sound: bark	Default: size: 65 cm
Variable size: color:	Variable color:

Scripts attempt to model the representation of stereotypical knowledge about situations. It represents this default or stereotypical information

John took his dog to the surgery. After seeing the vet, he left.

ELEMENTS OF A SCRIPT:

1. Entry conditions. Conditions that must be satisfied for the script to be activated.
2. Result. Conditions that will be true after the script is terminated.
3. Props. Objects involved in the events described in the script.
4. Roles. Actions performed by particular participants.
5. Scenes. The sequences of events that occur.
6. Tracks. A variation on the general pattern representing an alternative scenario.

3 main activities related to long-term memory:

1. Storage or remembering of information
2. Forgetting
3. Information retrieval

Information from short-term memory is stored in long-term memory by rehearsal.

According to the study of Ebbinghaus, the amount learned was directly proportional to the amount of time spent learning, which is also known as the **total time hypothesis**.

Repetition is not enough to learn information if not meaningful and familiar.

It is difficult to remember a set of words representing concepts than a set of words representing objects

Information is processed and applied:

1. reasoning
2. problem solving
3. skill acquisition
4. error

Reasoning is the process by which we use the knowledge we have to draw conclusions or infer something new about the domain of interest.

Types of reasoning:

1. **Deductive** - reasoning derives the logically necessary conclusion from the given premises.
2. **Inductive** - is generalizing from cases we have seen to infer information about cases we have not seen.
3. **Abductive** - reasons from a fact to the action or state that caused it.

PROBLEM SOLVING - It is the process of finding a solution to an unfamiliar task, using the knowledge we have.

It is characterized by the ability to adapt the information we have to deal with new situations.

Views on how people solve problems:

1. Gestalt Theory
2. Problem Space Theory
3. Analogy

Gestalt Theory - problem solving is both productive and reproductive - productive problem solving involves insight and restructuring of the problem while reproductive solving problem draws on previous experiences.

Problem Space Theory - problem has an initial state and a goal state and people use the operators to move from the former to the latter.

Heuristics such as means-ends analysis are employed to select appropriate operators to

reach the goal.

Means-ends analysis the initial state is compared with the goal state and an operator chosen to reduce the difference between the two.

Problem Space Theory - operates within the constraints of the human processing system such as the limited capacity of short-term memory - their General Problem Solver model which is based on it, have largely been applied to problem solving in well-defined domains, for example solving puzzles.

Analogy in Problem Solving

Analogy is a cognitive process of transferring information or meaning from a particular subject to another, or a linguistic expression corresponding to such a process.

Done by mapping knowledge relating to a similar known domain to the new problem – called **analogical mapping**.

Similarities between the known domain and the new one are noted and operators from the known domain are transferred to the new one.

PSYCHOLOGY AND THE DESIGN OF INTERACTIVE SYSTEM

recognition is easier than recall

Guidelines - Human cognitive and perceptual process cannot be all directly applied to design due to being partial and simplistic.

Models to support design - Psychological theory has led to the development of analytic and predictive models of user behavior.

Techniques for evaluation - Psychology also provides a range of empirical techniques which we can employ to evaluate our designs and our systems.

*Human as an information processor,
receiving inputs from the world
Information is received through the
senses particularly*

*Information is stored in memory,
either temporarily in sensory or
working memory, or permanently in
long-term memory.*

*Human perception and cognition are
complex and sophisticated but they
are not without their limitations.*

*An understanding of the capabilities
and limitations of the human as
information processor can help us to
design interactive systems.*

*The principles, guidelines and models
derived from cognitive psychology are
invaluable tools for the designer of
interactive systems.*

DCIT26 CONT. (1/1)

Software design is the process by which an agent creates a specification of a software artifact, intended to accomplish goals, using a set of primitive components and subject to constraints.

- involves problem solving and planning a software solution.

IMPORTANCE OF SOFTWARE DESIGN

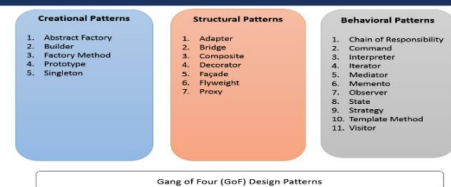
1. Dynamic
2. Flexible
3. Reusability
4. Easy to Understand
5. Cost-efficiency is increased

PATTERN - a solution to a common software problem in a context capture design expertise and allow that expertise to be communicated patterns are designs; they are structure of codes must be instantiated/applied

IMPORTANCE OF PATTERN

1. Help reuse existing high quality solutions to commonly occurring problems
2. Improve individual and team learning
3. Shift level of thinking to a high perspective
4. Illustrate basic object-oriented principles
5. Improves modifiability and maintainability of the code

SOFTWARE DESIGN PATTERN



CREATIONAL PATTERN

- ◆ **Abstract Factory**: Allow creation of families of related objects independent of implementation
- ◆ **Builder**: Can be used to ease the construction of a complex object from simple objects.
- ◆ **Factory Method**: Used to create objects without specifying concrete classes.

◆ **Prototype**: allows cloning objects, even complex ones, without coupling to their specific classes.

◆ **Singleton**: Ensure a class has one only instance, and provide a global point of access of it.

◆ **Adapter**: Convert interface of a class into one that another class requires e.g. (Cables, Media Player)

◆ **Bridge**: decouples an abstraction from its implementation, so that the two can vary independently.

◆ **Composite**: Compose objects into tree structures

◆ **Decorator**: Attach additional responsibilities to an object keeping the same interface.

◆ **Façade**: Provide a simple unified interface to a set of interfaces in a subsystem.

◆ **Flyweight**: It is used to create a large number of objects of almost similar nature

◆ **Proxy**: Surrogate or substitute for another object.
e.g. (ATM, Cheque, Credit Cards)

BEHAVIORAL PATTERN

◆ **Chain of Responsibility**: Avoid coupling sender to receiver by passing request along until someone handles it e.g. (Kiosk System)

◆ **Command**: it's used to manage algorithms, relationships and responsibilities between objects.

◆ **Iterator**: Provide a way to access the elements of an objects sequentially without exposing its underlying representation

◆ **Interpreter**: Language interpreter for a small grammar

◆ **Mediator**: Coordinates interactions between its associates

- Used to restore state of object to a previous state e.g. (Archive, Undo method)

◆ **Observer**: Dependents update automatically when subject changes e.g. (Social Media)

◆ **State**: Object whose behavior depends on its state

◆ **Strategy**: Abstraction for selecting one of many algorithms

◆ **Template Method**: A skeleton of an algorithm in an operation, and defers some steps to subclasses

◆ **Visitor**: Represents an operation applied to elements of an object structure.

DESIGN PRINCIPLES

◆ **Modularization**: Is the process of continuous decomposition of the software system until fine – grained components are created.

◆ **Abstraction**: A view of an object that focuses on the information to a particular purpose

◆ **Encapsulation**: exposing only the information that is essential while hiding details of how the services are carried out.

◆ **Cohesion**: is defined as the degree to which all elements of a module, class, or component work together as a functional unit.

High cohesion is good, and low cohesion is bad.

◆ **Coupling**: is defined as the degree of interdependence between two or more classes, modules, or components.

Tight coupling is bad, and loose coupling is good.

◆ **Sufficiency**: Measures how well the designed units are at providing only the services that are sufficient for achieving the intent (no more).

◆ **Completeness**: Measures how well the designed units are at providing the required services for achieving the intent (no less).

INSY 55 (1/2)

FORM - a business document that contains some predefined data and often includes some areas where additional data are to be filled in
- has a stylized format and is typically not in a simple row and column format

- examples: order forms, employment applications, and class registration sheets

REPORT - a business document that includes only predefined data
- a passive document that is used only for reading and viewing
- can also be printed to a computer file

- often has rows and columns of data
- for reading only and includes data on multiple unrelated records

Forms and Reports Format

1. Meaningful Information

- Only needed information should be displayed
- Information should be provided in a manner that is usable without modification

2. Balance the Layout

- Balanced on screen or on page
- Adequate spacing and margins
- All data and entry fields should be clearly labeled

3. Design an Easy Navigation System

- Show how to move forward and backward
- Show where you are

Most commonly used methods:

- Blinking and audible tones
- Color differences
- Intensity differences
- Size differences
- Reverse video
- Boxing
- Underlining
- All capital letters

Useful when:

- notifying users of errors in data entry or processing
- providing warnings to users regarding possible problems, such as

unusual data values or an unavailable device

- drawing attention to keywords, commands, high-priority messages, and data that have changed or gone outside normal operating ranges

Color versus No-Color

Benefits:

- Soothes or strikes the eye.
- Accents an uninteresting display.
- Facilitates subtle discriminations in complex displays.
- Emphasizes the logical organization of information.
- Draws attention to warnings. Evokes more emotional reactions.

Designing Tables and Lists

1. Use meaningful labels
2. Formatting columns, rows, and text

3. Formatting numeric, textual, and alphanumeric data

Table versus Graphs

Use table for

- Reading individual data values

Use graph for

- Providing a quick summary of data
- Detecting trends over time
- Comparing points and patterns of different variables
- Forecasting activities
- Reporting huge amounts of information when relatively simple impressions are to be drawn

Assessing Usability

Characteristics of usability

- Speed
- Accuracy
- Satisfaction

Usability

- an overall evaluation of how a system performs in supporting a certain user for a certain task

Consistency

- influences users' ability to increase proficiency when interacting with a system

Other factors of usability

- Efficiency
- Ease
- Format

Usability Factors	Guidelines for Achievement of Usability
Consistency	<ul style="list-style-type: none">Consistent use of terminology, abbreviations, formatting, titles, and navigation within and across outputsConsistent response time each time a function is performed
Efficiency	<ul style="list-style-type: none">Formatting should be designed with an understanding of the task being performed and the intended userText and data should be aligned and sorted for efficient navigation and entryEntry of data should be avoided where possible
Ease	<ul style="list-style-type: none">Outputs should be self-explanatory and not require users to remember information from prior outputs in order to complete tasksLabels should be extensively used, and all scales and units of measure should be clearly indicated
Usability Factors	Guidelines for Achievement of Usability
Format	<ul style="list-style-type: none">Information format should be consistent between entry and displayFormat should distinguish each piece of data and highlight, not bury, important dataSpecial symbols (i.e., decimal places, dollar signs, and +/- signs) should be used as appropriate
Flexibility	<ul style="list-style-type: none">Information should be viewed and retrieved in a way most convenient to the userUsers should be given options for the sequence in which to enter or view data and for use of shortcut keystrokes, and the system should remember where the user stopped during the last use of the system
Characteristic	Consideration for Form and Report Design
User	<ul style="list-style-type: none">Issue related to experience, skills, motivation, education, and personality should be considered
Task	<ul style="list-style-type: none">Tasks differ in amount of information that must be obtained from or provided to the userTask demands such as time pressure, cost of errors, and work duration will influence usability
System	<ul style="list-style-type: none">The platform on which the system is constructed will influence interaction styles and devices
Environment	<ul style="list-style-type: none">Social issues such as the users' status and role should be considered in addition to environment concerns such as lighting, sound, task interruptions, temperature, and humidityThe creation of usable forms and reports may necessitate changes in the users' physical work facilities

Implementation - activities that occur before the system is turned over to its users

Coding - the process where the physical design specifications developed by the analysis team are converted into computer code by the programming team

Testing - the process of examining a product to ascertain what defects it contains

- product can be tested through reviewing their construction and composition or through exercising their function and examining the results

Types of Testing

Unit Testing - also called module testing

- the process of testing individual code modules before they are integrated with other modules

Integration Testing - combining modules and testing them

- identify errors that were not or could not be detected by unit testing individual modules

System Testing

- the programs are integrated into systems

- performed first by developers or test personnel

INSY 55 (2/2)

- performed mostly at the end of each iteration to identify significant issues

Acceptance Testing - testing the system in the environment where it will eventually be used. Way for users to verify if the system meets their requirements the last round of testing before the system is handed over to its users

Two types:

- Alpha testing
- Beta testing

Alpha Testing

- User testing of a completed information system using simulated data

Types of tests done:

- Recovery testing
- Security testing
- Stress testing

Beta Testing - User testing of a completed information system using real data in the real user environment
- can be considered as a preparation of the installation phase

Installation - the process of moving from the current information system to the new one

Direct Installation - Changing over from the old information system to a new one by turning off the old system when the new one is turned on

Parallel Installation - Running the old information system and the new one at the same time until management decides the old system can be turned off

- Useful mainly when a system is large, complex, and composed of relatively independent subsystems

Documentation - provides information to users on how a system is operated and maintained

- provides information required for future modifications or re-implementation

Types of Documentation

1. **System Documentation** - records detailed information about a system's design specifications, its internal workings, and its functionality
provide information to designers and developers who will maintain or re-implement the system

TYPES:

Internal documentation
External documentation

User Documentation - provides an ongoing support for end users of the system

Two aspects of an organization's computing infrastructure:

Training
Support

Computer Infrastructure - all of the resources and practices necessary to aid people adequately use computer systems to do their primary work

Classification of users:

End users

Methods for user support: On-line documentation and troubleshooting

Resident experts:

A help desk
Technical support

Maintenance - modification of a software product after delivery

Types of Maintenance

1. **Corrective Maintenance** - changes made to repair flaws in its design, coding, or implementation of the system

- remove errors or bugs from the system, procedures, hardware, network, data structures, and documentation
- adds a little or no value to the organization

2. **Adaptive Maintenance** - making changes to an information system to develop its functionality to changing business needs or to migrate it to a different operating environment
- usually a small part of an organization's maintenance effort

3. **Perfective Maintenance** - improve the system's efficiency, reliability, functionality, or maintainability

- considered to be proactive
- fix the system before it breaks

4. **Preventive Maintenance** - changes made to a system to lessen the chance of future system failure

- anticipate problems and correct them before they occur

Cost is an important expenditure in information system maintenance.

- The high costs associated with maintenance mean that the factors influencing maintainability of systems should be understood.

- Maintainability

Approaches to Organizing System Maintenance

1. **Separate Approach** - maintenance group rejects new projects unless properly and thoroughly tested

- forces better documentation and formalizes the conversion from development to operations status and change procedures

2. **Combine Approach** - both groups form one major group of the information system

- users may be unable to distinguish work as for development or maintenance

3. **Functional Approach** - systems professionals are removed from IS and assigns them to business functions for both development and maintenance