1. Define HCI. Why do we need to study HCI?

Ans: **Human–computer interaction** researches the design and use of **computer** technology, focused on the interfaces between people and **computers.**

Human–computer interaction has only been in widespread use since the early 1980s.

Students need to study HCI not because it is their subject but it helps them a lot , for them to be more open in the modern world. I am a student in an HCI subject and I am excited to study and learn more about this subject. I need to HCI because I need to know more about machine and human interaction. I am willing to learn the basics of interface designs and its evaluations. As an Information Technology student, HCI motivates me more in designing. This subject will make me better in handling computers. HCI might not be easy, it could be confusing but it will help me be better in being a socially active person.HCI opens me on how broad technology and how we use machine technology nowadays.

- The human the one whom computer systems are designed to assist. Alternatively we may call user.

The requirements of the user should therefore be our first priority. Why?

- In order to design something for someone, we need to understand their capabilities and limitations.
- We need to know if there are things that they will find difficult or, even, impossible.
- It will also help us to know what people find easy and how we can help them by encouraging these things.

2. What are the skill needed to produce an effective design?

Ans: HCI is undoubtedly a multi-disciplinary subject. The ideal designer of an interactive system would have expertise in a range of topics:

- Psychology and cognitive science - to give his knowledge of the user's perceptual, cognitive and problem-solving skills.

- Ergonomics - for the user's physical capabilities.

- Sociology - to help her understand the wider context of the interaction.

- Computer science and engineering – to be able to build the necessary technology.

- Business - to be able to market it.

- Graphic design - to produce an effective interface presentation;.

- Technical writing - to produce the manuals.

- It is not possible to design effective interactive systems from one discipline in isolation. Input is needed from all sides.

- For example, a beautifully designed graphic display may be unusable if it ignores dialog constraints or the psychological limitations of the user.

3. Which components of computer are concern of HCI?

Ans:

- People

- Computers and

- Tasks that are performed

- usability

The system must support the user's task.

If the system forces the user to adopt an unacceptable mode of work then it is not usable.

There are three 'use' words that must all be true for a product to be successful; it must be:

- **useful – accomplish what is required: play music, cook dinner, format a document;**

- **usable – do it easily and naturally, without danger of error, etc.;**

- **used – make people want to use it, be attractive, engaging, fun, etc.**

4. What do you mean by the myth "3V" in HCI?

Ans: There are three 'use' words that must all be true for a product to be successful; it must be:

- **useful – accomplish what is required: play music, cook dinner, format a document;**

- **usable – do it easily and naturally, without danger of error, etc.;**

- **used – make people want to use it, be attractive, engaging, fun, etc.**

5. What do you mean by the User, Computer and Interaction?

Ans: By *user we may mean*

- *an individual* user,

- a group of users working together, or

- a sequence of users

in an organization, each dealing with some part of the task or process.

The user is whoever is trying to get the job done using the technology.

By computer we mean

- any technology ranging from the general desktop computer to a large-scale computer system,

- a process control system or

- an embedded system.

The system may include non-computerized parts, including other people.

By *interaction we mean any communication between* a user and computer, be it direct or indirect.

Direct interaction involves a dialog with feedback and control throughout performance of the task.

Indirect interaction may involve batch processing or intelligent sensors controlling the environment.

6. Clearly explain the "Laws of size Constancy".

- Ans: Given that the visual angle of an object is reduced as it gets further away, we might expect that we would perceive the object as smaller.

- In fact, our perception of an object's size remains constant even if its visual angle changes.

- Same as a person's height is perceived as constant even if they move further from us.

This is the *law of size constancy, and it indicates that our perception of size relies on* factors other than the visual angle.

7. Define the term "Visual Acuity".

- Ans: Visual acuity is the ability of a person to perceive fine detail.

- Person with normal vision can detect a single line if it has a visual angle of 0.5 seconds of arc. Spaces between lines can be detected at 30 seconds to 1 minute of visual arc.

- These represent the limits of human visual acuity.

8. What is Fitts Law?

- Ans: Fitts' Law describes the time taken to hit a screen target:

$$Mt = a + b \log_2(D/S + 1)$$

where: a and b are empirically determined constants

Mt is movement time

D is Distance

S is Size of target

$\Rightarrow$ targets as large as possible
distances as small as possible

9. Describe different types of reasoning with example.

- Ans: Deduction:

    - derive logically necessary conclusion from given premises.

    e.g.   If it is Friday then she will go to work

    It is Friday

    Therefore she will go to work.

- Logical conclusion not necessarily true:

    e.g.   If it is raining then the ground is dry

    It is raining

    Therefore the ground is dry

- When truth and logical validity clash …

    e.g.   Some people are babies

    Some babies cry

    Inference - Some people cry

    Correct?

- People bring world knowledge to bear

- Induction:

    - generalize from cases seen to cases unseen

    - e.g.   all elephants we have seen have trunks
        therefore all elephants have trunks.

- Unreliable:

- – can only prove false not true

… but useful!

- Humans not good at using negative evidence

    e.g. Wason's cards.

- **7 E 4 K**

- If a card has a vowel on one side it has an even number on the other

- Is this true?

- How many cards do you need to turn over to find out?

    …. and which cards?

    Abductive reasoning:

- reasoning from event to cause

    e.g.   Sam drives fast when drunk.

    If I see Sam driving fast, assume drunk.

- Unreliable:

    can lead to false explanations

10.   What is problem solving theory? Mention some of the theories and explain one of them.

- Ans: Process of finding solution to unfamiliar task using knowledge.

- Several theories.

- Gestalt

- problem solving both productive and reproductive

    - – productive draws on insight and restructuring of problem

    - – attractive but not enough evidence to explain `insight' etc.

    - – move away from behaviourism and led towards information processing theories

    Problem space theory

    - – problem space comprises problem states

    - – problem solving involves generating states using legal operators

    - – heuristics may be employed to select operators
        e.g. means-ends analysis

- operates within human information processing system
  - e.g. STM limits etc.

- largely applied to problem solving in well-defined areas
  - e.g. puzzles rather than knowledge intensive areas

- Analogy

  - analogical mapping:

    - novel problems in new domain?

    - use knowledge of similar problem from similar domain

  - analogical mapping difficult if domains are semantically different

- Skill acquisition

  - skilled activity characterized by chunking

    - lot of information is chunked to optimize STM

  - conceptual rather than superficial grouping of problems

  - information is structured more effectively

11.   What are the difference between Long-Term Memory and Short-Term Memory?

Ans:

Comparison of Three Stages of Memory

Sensory
1. Large capacity
2. Contains sensory information
3. Very brief retention (1/2 sec for visual; 2 secs for auditory)

Short Term
1. Limited capacity
2. Acoustically encoded
3. Brief storage (up to 30 seconds w/o rehearsal)
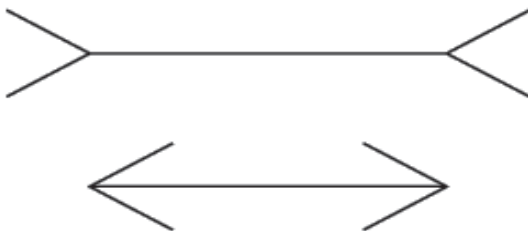4. Conscious processing of information

Long Term
1. Unlimited capacity
2. Semantically encoded
3. Storage presumed permanent
4. Information highly organized

11. What is Gestalt Theory and Problem Space theory?

Ans: Ques. 10

12. What is Muller-Layer Illusion?

Ans:

The two lines are the same length.

False application of the law of size constancy: top line appears like a concave edge,

bottom like a convex edge.

Former therefore seems further away than the latter and is therefore scaled to appear larger.

13. How human realize the size, color, brightness and dept of a visual image?

Ans:

- Size and depth

  – visual angle indicates how much of view object occupies
        (relates to size and distance from eye)

  – visual acuity is ability to perceive detail.

  – familiar objects perceived as constant size
        (in spite of changes in visual angle when far away)

- Brightness

  – subjective reaction to levels of light

  – affected by luminance of object

  – measured by just noticeable difference

  – visual acuity increases with luminance as does flicker

    - Colour

  – made up of hue, intensity, saturation

  – cones sensitive to colour wavelengths

  – blue acuity is lowest

  – 8% males and 1% females colour blind

14.What are the difference between deductive reasoning and abductive reasoning?

Deductive, Inductive, and Abductive Syllogisms

Deductive	Inductive	Abductive
All men are mortal;	Socrates is a man;	All men are mortal;
Socrates is a man;	Socrates is mortal;	Socrates is mortal;
∴ Socrates is mortal.	∴ All men are mortal.	∴ Socrates is a man.

Adapted from: Hui, J., Cashman, T. and T. Deacon. 2008. Bateson's Method: Double Description. What is It? How Does It Work? What Do We Learn? in J. Hoffmeyer (ed.) A Legacy for Living Systems: Gregory Bateson As Precursor to Biosemiotics.

15.What are the mental models? Why are they important in interface design?

Ans: Types of error

- slips

    – right intention, but failed to do it right

    – causes: poor physical skill,inattention etc.

    – change to aspect of skilled behaviour can cause slip

- mistakes

    – wrong intention

    – cause: incorrect understanding

humans create mental models to explain behaviour.

if wrong (different from actual system) errors can occur

16.Why do we need to study on human psychology in HCI?

- Ans: Some direct applications

    – e.g.   blue acuity is poor
    $\Rightarrow$ blue should not be used for important detail

- However, correct application generally requires understanding of context in psychology, and an understanding of particular experimental conditions

- A lot of knowledge has been distilled in

    – guidelines (chap 7)

    – cognitive models (chap 12)

    – experimental and analytic evaluation techniques (chap 9)

17.What are the different types or error that a human can do? What do you mean by mental model?

Ans: Ques. 16

18.How do you explain the "Interaction Paradigm"? What are the processes of paradigm shifting?

Ans: New computing technologies arrive, creating a new perception of the human—computer relationship.

We can trace some of these shifts in the history of interactive technologies.

- Batch processing- *Impersonal computing*

Batch processing is the processing transactions in a group or batch. No user interaction is required once batch processing is underway.

This differentiates batch processing from transaction processing, which involves processing transactions one at a time and requires user interaction. While batch processing can be carried out at any time i.e. iddle time.

- Time-sharing- *Interactive computing*

In data processing, method of operation in which multiple users with different programs interact nearly simultaneously with the central processing unit of a large-scale digital computer.

- Networking- *Community computing*

- Graphical display- *Direct manipulation*

- Microprocessor- *Personal computing*

- WWW- *Global information*

- Ubiquitous Computing- A symbiosis of physical and electronic worlds in service of everyday activities.

19.Write the name of some pointing devices with their uses.

Ans: mouse, touchpad
trackballs, joysticks etc.
touch screens, tablets
eyegaze, cursors

Mouse:

- Handheld pointing device

    – very common

    – easy to use

    – Two characteristics

    – planar movement

How does it work?:

Two methods for detecting motion

- Mechanical

    – Ball on underside of mouse turns as mouse is moved

    – Rotates orthogonal potentiometers

    – Can be used on almost any flat surface

- Optical

    – light emitting diode on underside of mouse

    – may use special grid-like pad or just on desk

    – less susceptible to dust and dirt

    – detects fluctuating alterations in reflected light intensity to calculate relative motion in (x, z) plane

Touchpad:

- small touch sensitive tablets

- 'stroke' to move mouse pointer

- used mainly in laptop computers

- good 'acceleration' settings important

    – fast stroke

        - lots of pixels per inch moved

        - initial movement to the target

    – slow stroke

        - less pixels per inch

        - for accurate positioning

Joystick and keyboard nipple:

Joystick

    – indirect
            pressure of stick = velocity of movement

    – buttons for selection
                on top or on front like a trigger

    – often used for computer games
            aircraft controls and 3D navigation

Keyboard nipple

    – for laptop computers

    – miniature joystick in the middle of the keyboard

Touch-sensitive screen:

- Detect the presence of finger or stylus on the screen.

- works by interrupting matrix of light beams, capacitance changes or ultrasonic reflections

- *direct* pointing device

- Advantages:

  - fast, and requires no specialised pointer

  - good for menu selection

  - suitable for use in hostile environment: clean and safe from damage.

- Disadvantages:

  - finger can mark screen

  - imprecise (finger is a fairly blunt instrument!)

    - difficult to select small regions or perform accurate drawing

  - lifting arm can be tiring

Digitizing tablet:

- Mouse like-device with cross hairs

- used on special surface
  - rather like stylus

- very accurate
  - used for digitizing maps

Eyegaze:

- control interface by eye gaze direction

  - e.g. look at a menu item to select it

- uses laser beam reflected off retina

  - … a very low power laser!

- mainly used for evaluation (ch x)

- potential for hands-free control

- high accuracy requires headset

- cheaper and lower accuracy devices available
  sit under the screen like a small webcam

Cursor keys:

- Four keys (up, down, left, right) on keyboard.

- Very, very cheap, but slow.

- Useful for not much more than basic motion for text-editing tasks.

- No standardised layout, but inverted "T", most common
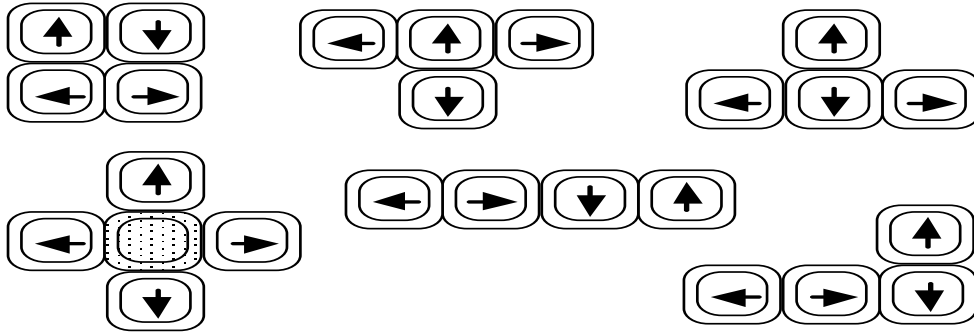
20.   What are the elements of WIMP interface?

Ans: Windows

        Icons

          Menus

            Pointers

… or windows, icons, mice, and pull-down menus!

- default style for majority of interactive computer systems, especially PCs and desktop machines

21. What are the seven stages of Donald Norman's Model?

- Ans: Seven stages

    – user establishes the goal

    – formulates intention

    – specifies actions at interface

    – executes action

    – perceives system state

    – interprets system state

    – evaluates system state with respect to goal

- Norman's model concentrates on user's view of the interface

22.What do you mean by ergonomics in context of HCI?

Ans: physical aspects of interfaces

industrial interfaces

- Study of the physical characteristics of interaction

- Also known as human factors – but this can also be used to mean much of HCI!

- Ergonomics good at defining standards and guidelines for constraining the way we design certain aspects of systems

- arrangement of controls and displays

e.g. controls grouped according to function or frequency of use, or sequentially

- surrounding environment

e.g. seating arrangements adaptable to cope with all sizes of user

- health issues

e.g. physical position, environmental conditions (temperature, humidity), lighting, noise,

- use of colour

e.g. use of red for warning, green for okay,
awareness of colour-blindness etc.

24. Discuss different types of interaction style?

Ans:

Common Interaction Style:

- command line interface

- menus

- natural language

- question/answer and query dialogue

- form-fills and spreadsheets

- WIMP

- point and click

- three–dimensional interfaces

Command line interface:

- Way of expressing instructions to the computer directly

    – function keys, single characters, short abbreviations, whole words, or a combination

- suitable for repetitive tasks

- better for expert users than novices

- offers direct access to system functionality

- command names/abbreviations should be meaningful!

Typical example: the Unix system

Menus:

- Set of options displayed on the screen

- Options visible

    - less recall - easier to use

    - rely on recognition so names should be meaningful

- Selection by:

    - numbers, letters, arrow keys, mouse

    - combination (e.g. mouse plus accelerators)

- Often options hierarchically grouped

- Restricted form of full WIMP system

Natural language:

- Familiar to user

- speech recognition or typed natural language

- Problems

    - vague

    - ambiguous

    - hard to do well

- Solutions

    - try to understand a subset

    - pick on key words

Query interfaces:

- Question/answer interfaces

    - user led through interaction via series of questions

    - suitable for novice users but restricted functionality

- often used in information systems

Don't mess with SQL

- Query languages (e.g. SQL)

    - used to retrieve information from database

    - requires understanding of database structure and language syntax, hence requires some expertise

Form-fills:

- Primarily for data entry or data retrieval

- Screen like paper form.

- Data put in relevant place

- Requires

    - good design

    - obvious correction
      facilities

Spreadsheets:

- first spreadsheet VISICALC, followed by Lotus 1-2-3
  MS Excel most common today

- sophisticated variation of form-filling.

    - grid of cells contain a value or a formula

    - formula can involve values of other cells

    - user can enter and alter data spreadsheet maintains consisteny

WIMP Interface:

Windows

Icons

Menus

Pointers

… or windows, icons, mice, and pull-down menus!

- default style for majority of interactive computer systems, especially PCs and desktop machines

Point and click interfaces:

- used in ..

- multimedia
- web browsers
- hypertext
- just click something!
    - icons, text links or location on map
- minimal typing

Three dimensional interfaces:

- virtual reality
- 'ordinary' window systems
- 3D workspaces
    - use for extra virtual space
    - light and occlusion give depth
    - distance effects

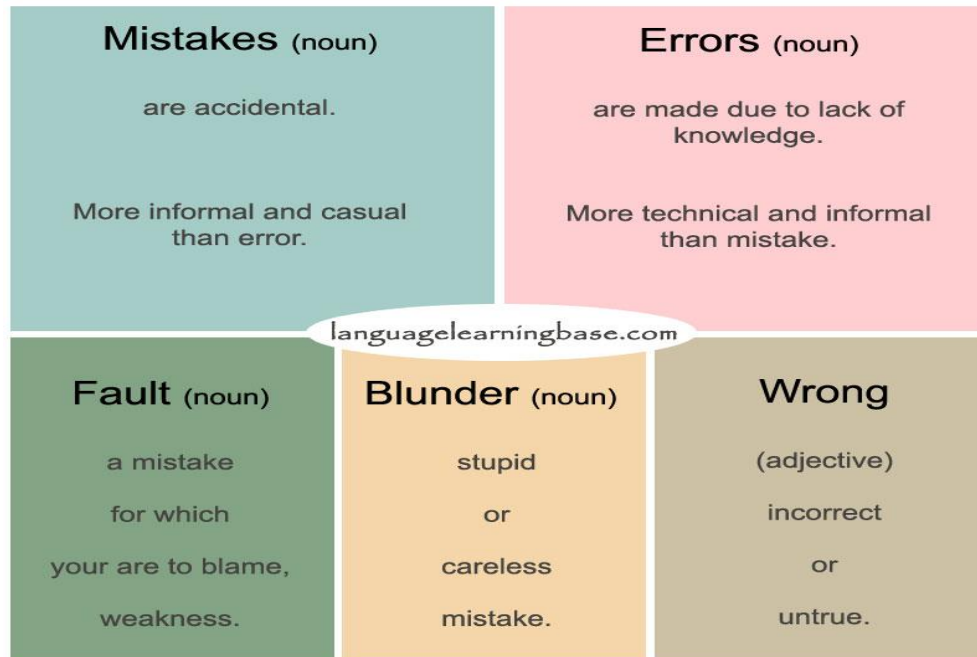## 25. What is the difference between error and slip?

Ans: slip

understand system and goal
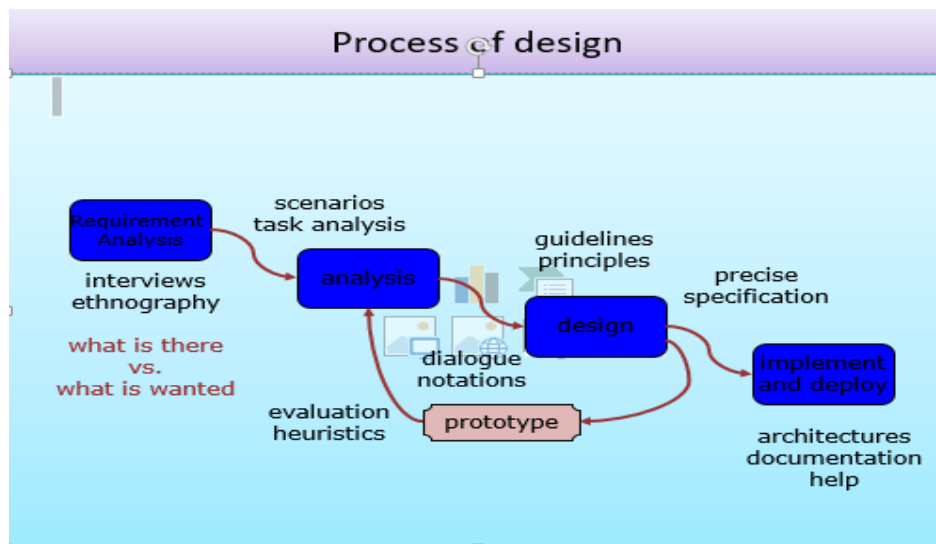
correct formulation of action

incorrect action

mistake

may not even have right goal!

Mistakes (noun) are accidental. More informal and casual than error.

Errors (noun) are made due to lack of knowledge. More technical and informal than mistake.

languagelearningbase.com

Fault (noun) a mistake for which your are to blame, weakness.

Blunder (noun) stupid or careless mistake.

Wrong (adjective) incorrect or untrue.

## 26. Describe the steps of process design.

Ans:

Process of design

- limited time ⟹ design trade-off

- usability?

    – finding problems and fixing them?

    – deciding what to fix?

- a perfect system is badly designed

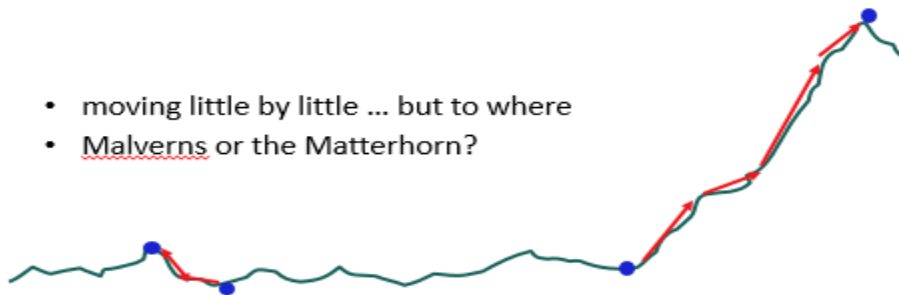   –   too good $\Rightarrow$ too much effort in design

27.   What is prototyping in software design? What are the pitfalls in prototyping?

- Ans: you never get it right first time
- if at first you don't succeed …

| design | → | prototype | → | evaluate | OK → done |

re-design
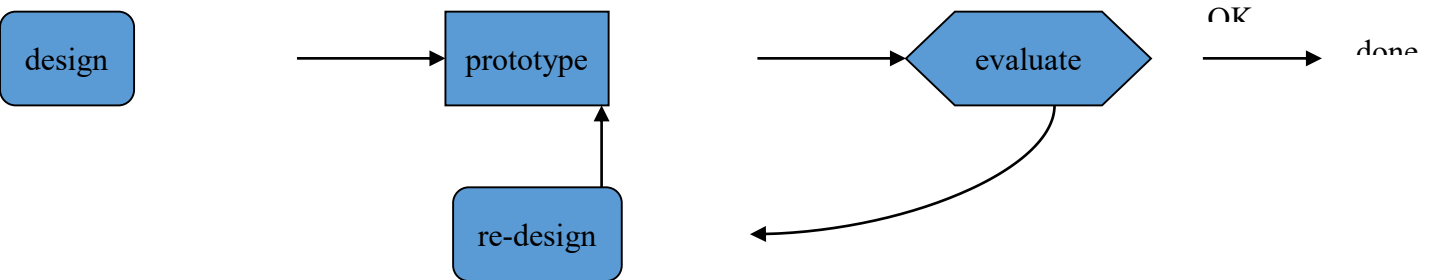
pitfalls of prototyping

- moving little by little … but to where
- Malverns or the Matterhorn?

1. need a good start point
2. need to understand what is wrong

28.   What do you mean by software life cycle?

Ans:

- Software engineering is the discipline for understanding the software design process, or life cycle

## 29.   What is usability engineering?

Ans:

- Usability engineering is used to determine to what degree a product or prototype will be user-friendly.

- Usability engineering requires a firm knowledge of computer science and psychology and approaches product development based on customer feedback.

- A usability engineer works hand-in-hand with customers, working to develop a better understanding of the functionality and design requirements of a product in order to build more reliable data for it.

There are six general attributes define usability: (ISO usability standard 9241)

- Utility
- Learn-ability
- Efficiency
- Retain-ability
- Errors
- Customer satisfaction

30.   Write on IBIS and design space analysis

Ans:
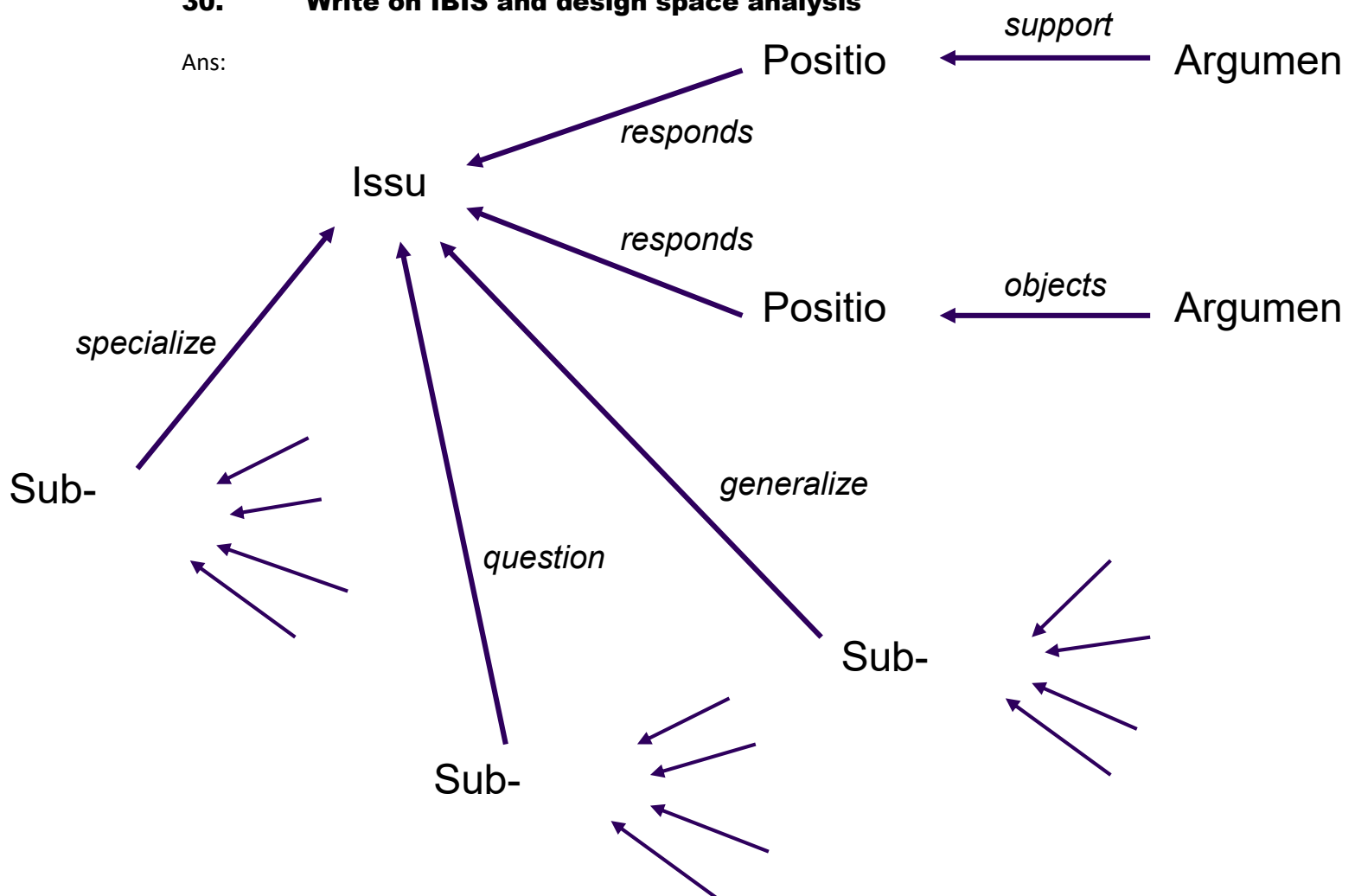
basis for much of design rationale research

process-oriented

main elements:

issues

– hierarchical structure with one 'root' issue

positions

– potential resolutions of an issue

arguments

– modify the relationship between positions and issues

gIBIS is a graphical version

Design space analysis:

An more deliberative approach to design rationale which emphasizes a post hoc structuring of the space of design alternatives that have been considered in a design project. This approach, embodied in the Questions, Options and Criteria (QOC) notation, is characterized as design space analysis.
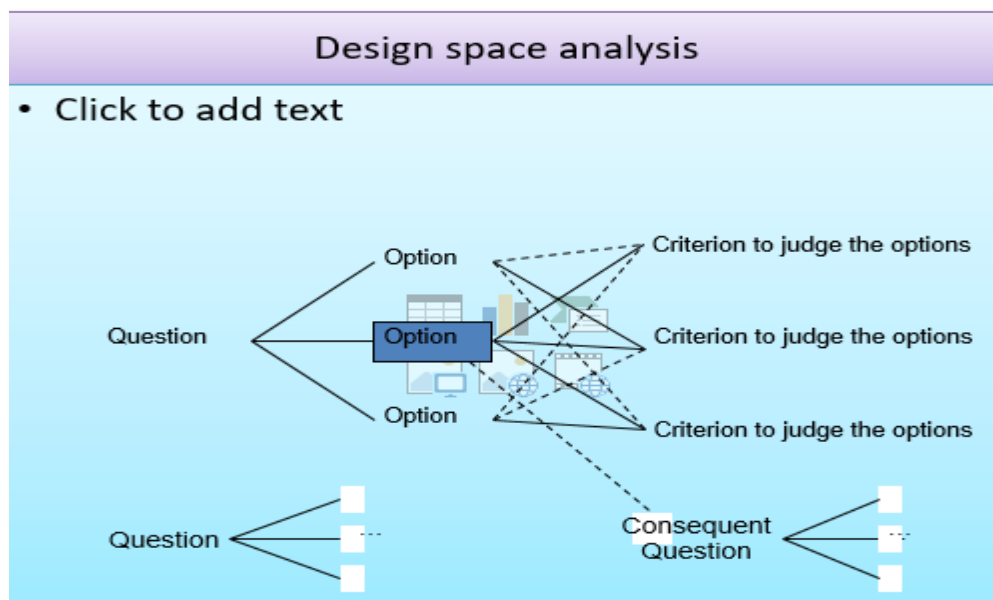
31.   Define the terms sensor-based and context-aware interaction.

- Ans: Humans are good at recognizing the "context" of a situation and reacting appropriately

- Automatically sensing physical phenomena (e.g., light, temp, location, identity) becoming easier

- How can we go from sensed physical measures to interactions that behave as if made "aware" of the surroundings?

32.   What is design rationale? List different types of DR. Write the benefits of DR.

Ans: Design rationale is information that explains why a computer system is the way it is, including its

structural and architectural design

 its functional and behavioural description

Benefits of design rationale

Communication throughout life cycle: Design rationale provides a communication mechanism among the members of a design team so that during later stages of design and/or maintenance it is possible to understand what critical decisions were made, what alternatives were investigated and the reason why one alternative was chosen over the others.

Reuse of design knowledge across products: Accumulated knowledge in the form of design rationales for a set of products can be reused to transfer what has worked in one situation to another situation which has similar needs.

Enforces design discipline: Forces the designer to deliberate more carefully about design decisions.

Presents arguments for design trade-offs: There is usually no single best design alternative. More often, the designer is faced with a set of trade-offs between different alternatives.

Organizes potentially large design space : Even if an optimal solution did exist for a given design decision, the space of alternatives is so vast that it is unlikely a designer would discover it.

Capturing contextual information : The usability of an interactive system is very dependent on the context of its use. The flashiest graphical interface is of no use if the end-user does not have access to a high-quality graphics display or a pointing device.

Reuse of design knowledge across products: Accumulated knowledge in the form of design rationales for a set of products can be reused to transfer what has worked in one situation to another situation which has similar needs.

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Types of DR:

Process-oriented

preserves order of deliberation and decision-making. Providing a historical record of design decisions.

Structure-oriented

Concern with the structure of the space of all design alternatives, which can be reconstructed by post hoc consideration of the design activity.

Two examples:

Design space analysis

33.   What is the main element of issue based information system(IBIS)? Draw the hierarchical structure of gIBIS.

Ans: Ques. 30

34.   What are differences between interactions and interventions?

Ans:

design interactions not just interfaces

not just the immediate interaction

designing interventions not just artefacts

not just the system, but also …

- documentation, manuals, tutorials

- what we say and do as well as what we make

35.   Draw the waterfall model for software lifecycle?

Ans:

```
Requirements
specification
        |
        v
   Architectural
      design
          |
          v
       Detailed
        design
            |
            v
      Coding and
      unit testing
              |
              v
        Integration
        and testing
                |
                v
          Operation and
          maintenance
```