BASIC NOTIONS
an overview

- **DEFINITION**

- **NAME**

- **ABSTRACTION**

- **SET**

- **TYPE**

BASIC NOTIONS
introduction

DEFINITION:

> **DESCRIPTION OF A NEW CONCEPT IN TERMS OF EXISTING CONCEPTS.**

EFFECTIVE DEFINITION:

- **COMPLETE**

  meaning of a new concept is given by its definition, and only that.

- **UNAMBIGUOUS**

  an obvious requirement for definitions.

BASIC NOTIONS
introduction

NAME:

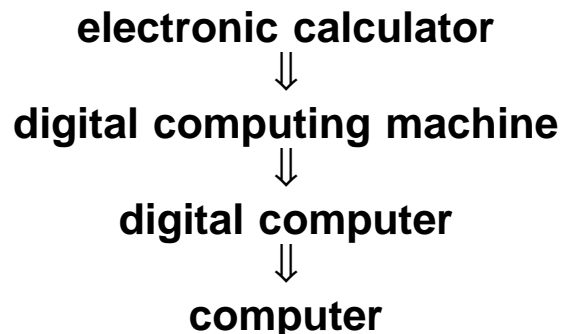**TERM IDENTIFYING AN OBJECT IN A CERTAIN ENVIRONMENT.**

EFFECTIVE NAME:

- **REPRESENTS ACCUMULATED KNOWLEDGE**

  correspond to conceptual categories.

- **NOT FOR UNIVERSAL IDENTIFICATION**

  type identification is unique within a data model, instance is unique within a type.

NAMES GENERALLY ORIGINATE FROM A DESCRIPTION:

EXAMPLE:

<div align="center">

electronic calculator

⇓

digital computing machine

⇓

digital computer

⇓

computer

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BASIC NOTIONS
sets

ABSTRACTION:

- **DESCRIPTION OF THE REALITY**
- **CONTAINS ONLY INVARIANTS**

EXAMPLE: AXIOM OF EXTENSIONALITY

A SET IS THE COLLECTION INTO A SINGLE UNIT OF DEFINITE, DISTINCT OBJECTS OF OUR INTUITION OR THOUGHT.

THE WHOLE IS CALLED A SET AND THE COLLECTED OBJECTS ARE THE ELEMENTS IN IT.

SUPPOSE OBJECTS A, B AND C IN SET S:

MATHEMATICAL NOTATION: S = {A, B, C}

HERE:

set **S = A, B, C.**

subject   predicate

EVIDENT THAT

- **B IS AN ELEMENT OF SET S AND**
- **X IS NOT AN ELEMENT OF SET S.**

BASIC NOTIONS
justification of types

A SET IS A COLLECTION OF DEFINITE, DISTINCT OBJECTS, SO:

IT MUST BE POSSIBLE TO DECIDE UNAMBIGUOUSLY FOR EACH OBJECT WHETHER OR NOT IT IS CONTAINED IN THE SET !!

CONSIDER: G = {A, B, {D}}

1   THIS SET MAY CONTAIN THREE ELEMENTS:

    set **A = ...**
    set **B = ...**
    set **... = D**

    BUT, THIS SETS CONTAINS TWO ELEMENTS IF:

    set **B = D**

2   IS C ELEMENT OF THIS SET G ?

    YES IF   *set* **C = D**
    UNDECIDABLE IF *set* **C = ...**

G RESULTS IN COMPLETE DESCRIPTIONS !!

CONCLUSION:

THE COLLECTION OF TYPES INTO A UNIT IS A TYPE.

MATHEMATICAL NOTATION: **{T} = {{X}, {Y}, {Z}}**

HERE WE USE: *type* **T = X, Y, Z.**

BASIC NOTIONS
sets and types

DATA OBJECTS HAVE:

1   IDENTIFICATIONS

**COLLECTING IDENTIFICATIONS RESULTS IN SET.
A SET HAS:**
- **N INTENTIONS (description using predicate)**
- **1 EXTENSION (definition using elements)**

EXTENSION: *set* **S = A, B, C.**

2   PROPERTIES

**COLLECTING PROPERTIES RESULTS IN TYPE.
A TYPE HAS:**
- **1 INTENTION (definition using properties)**
- **N DENOTATIONS (description using instances)**

INTENSION: *type* **T = X, Y, Z.**

RESULT DISJOINT CLASSES: *set* AND *type*

TWO SETS OF OPERATIONS:

1   FOR SETS: *set* $\Rightarrow$ *set*
UNION, INTERSECTION, DIFFERENCE

2   FOR TYPES: *type* $\Rightarrow$ *type*
SPECIALIZATION, GENERALIZATION, DIFFERENTIATION

BASIC NOTIONS
sets and types

	name	address	town	department	salary
501	Brewer	6, Knot	Shingles	stores	12,500
502	Fisher	23, Stream	Selling	manufacturing	13,500
503	Taylor	12, Lane	Guilding	manufacturing	14,000
504	Stewart	3, Bush	Wimblon	sales	13,500
505	Potter	67, Market	Washing	accounting	11,500
506	Butcher	2, Place	Selling	manufacturing	15,000
507	Brewer	7, Crescent	Guilding	purchase	13,500

← type employee →

set staff

INVARIANT:

- **PROPERTIES ⇒ TYPE**

  type employee = name, address, town,
  department, salary.

- **ELEMENTS ⇒ SET**

 *set* staff = 501, 502, 503, 504, 505, 506, 507.

BASIC NOTIONS
sets

DEFINITION:

- **A *set* is a definite collection into a single unit of distinct objects. An object from the collection is called an element of the set.**

SET ALGEBRA:

- **The *union* of sets A and B is the set of elements contained in A or B.**

- **The *intersection* of sets A and B is the set of elements contained in both A and B.**

- **The *difference* of sets A and B is the set of elements contained in A and not in B.**

VENN DIAGRAMS:

A B	A B	A B
union	**intersection**	**difference**
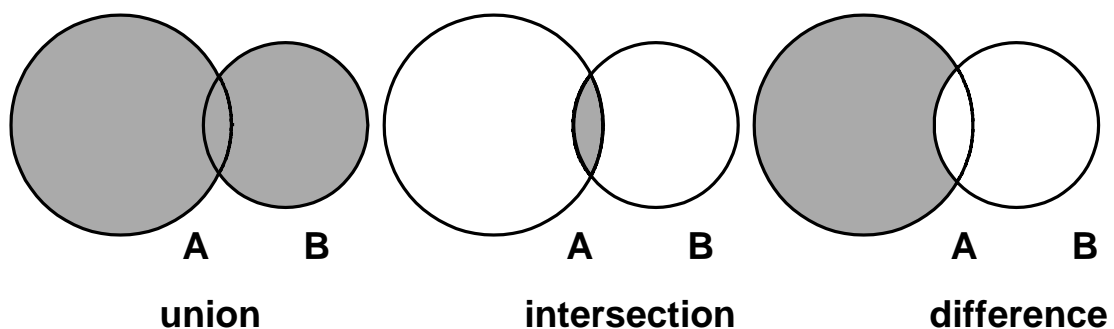
BASIC NOTIONS
types

DEFINITION:

- **A *type* is a definite aggregation of distinct properties. Properties from the aggregation are called attributes. An object having properties of the type is called an instance of this type.**

TYPE ALGEBRA:

- **The *specialization* of types A and B is the type consisting of properties in A or B.**

- **The *generalization* of types A and B is the type consisting of properties in both A and B.**

- **The *differentiation* of types A and B is the type consisting of the properties in A and not in B.**
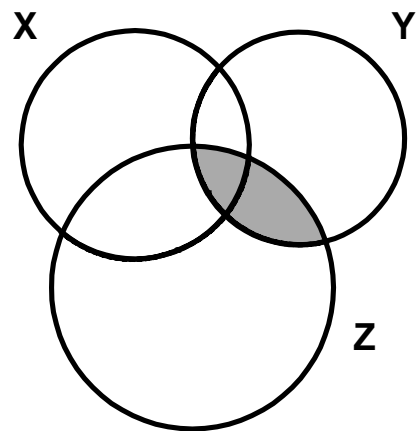
TYPE DEFINITIONS:

type A = X, Z   *type* B = Y, Z.

VENN DIAGRAMS:
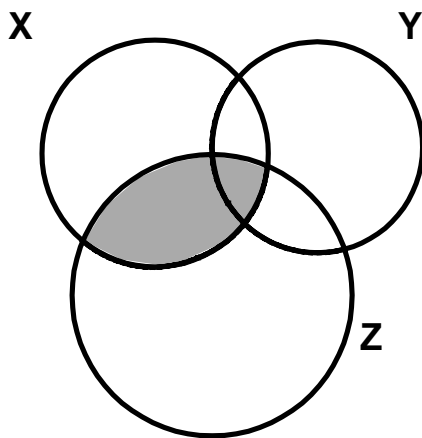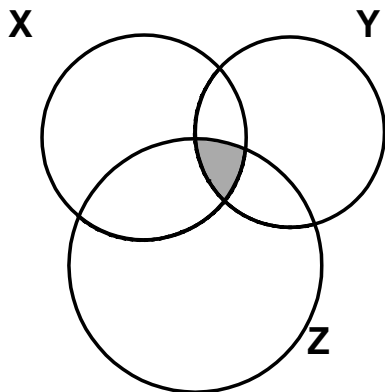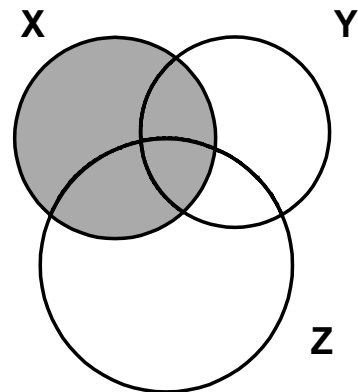

denotation of type A

denotation of type B

OPERATIONS:

denotation of
specialization S
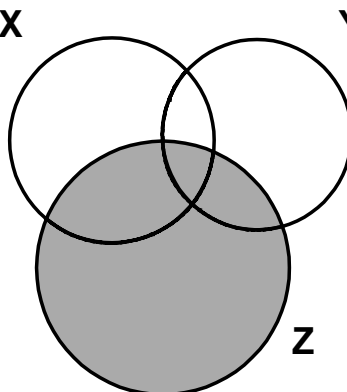
denotation of
generalization G

denotation of
differentiation D

type S = X, Y, Z   *type* G = Z   *type* D = X