HSC SECOND YEAR – COMPUTER SCIENCE

CHAPTER 2:

Data Abstraction

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Learning Objectives

The student will be able to Understand,

- **what is Abstract Data structures.**
- **Abstract data type.**
- **Difference between concrete and abstract implementation.**
- **Pairs.**
- **Data Abstraction in Structure.**

Data Abstraction- Introduction

- Data abstraction is a powerful concept in computer science that allows programmers to treat code as objects.
- For example, car objects, pencil objects, people objects, etc.
- Programmers need not to worry about how code is implemented — they have to just know what it does.

Data Abstraction- Introduction

- **Abstraction provides modularity (modularity means splitting a program in to many modules).**
- **Classes (structures) are the representation for "Abstract Data Types", (ADT)**

Abstract Data Type – ADT

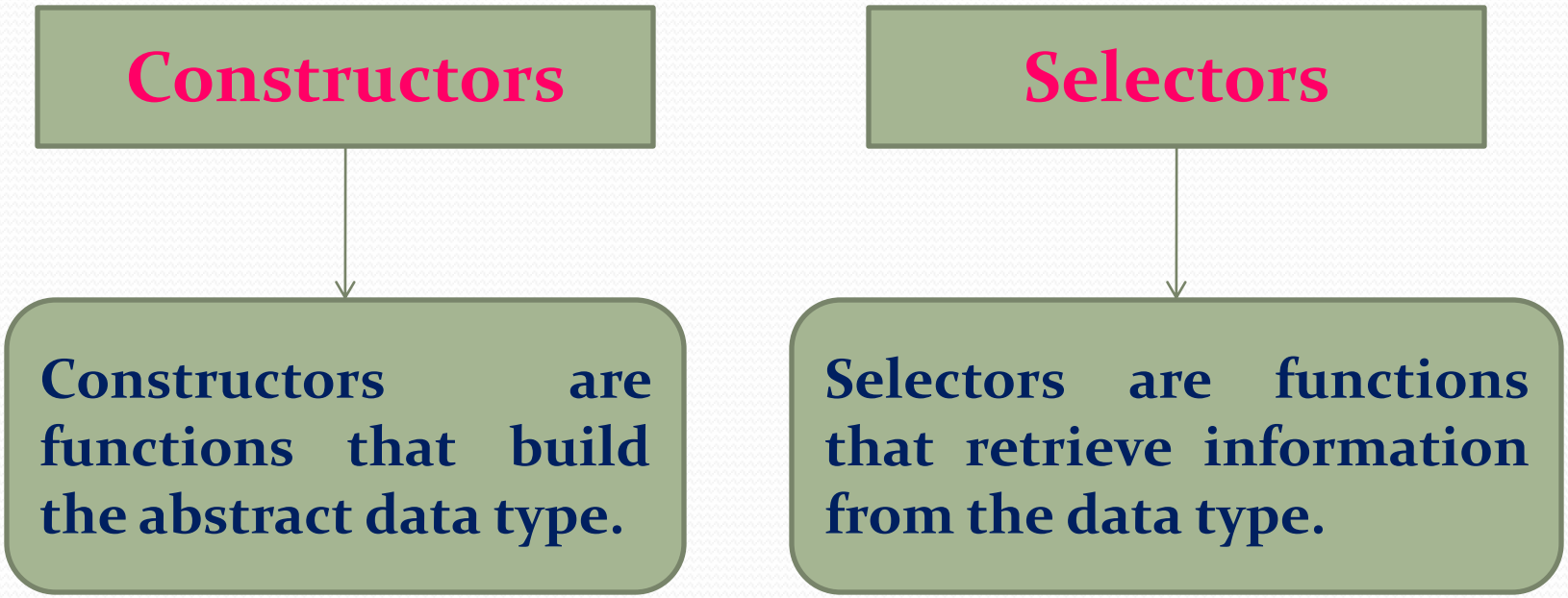
- Abstract Data type (ADT) is a type for objects whose behavior is defined by a set of values and operations.
- The definition of ADT only mentions what operations are to be performed but not how these operations will be implemented.
- It is called “abstract” because it gives an implementation independent view.
- The process of providing only the essentials and hiding the details is known as abstraction.

Abstract Data Type – ADT

- For example, when you want to drive a car, you don't need to know how the engine was built or what kind of material the tires are made of.
- You just have to know how to diver the car.

Facilitate data abstraction

- To facilitate data abstraction, you will need to create two types of functions: constructors and selectors.



Facilitate data abstraction - Example

- **For example,** Let's take an abstract data type called city.
- **This city object will hold the city's name, and its latitude and longitude.**
- **To create a city object, you'd use a function like**

```
city = makecity (name, lat, lon)
```

- **Here the function makecity (name, lat, lon) is the constructor. When it creates an object city, the values name, lat and lon are sent as parameters.**
- **To extract the information of a city object, you would use functions like**

```
getname(city), getlat(city), getlon(city)
```

- **getname(city), getlat(city) and getlon(city) are selector functions that obtain information from the object city.**

Differentiate constructors and selectors

Constructors	Selectors
Constructors are functions that build the abstract data type.	Selectors are functions that retrieve information from the data type.
Constructors create an object, bundling together different pieces of information	Selectors extract individual pieces of information from the object.

Differentiate Concrete data type and abstract data type

Concrete data type	Abstract data type
Concrete data types or structures (CDT's) are direct implementations of a relatively simple concept.	Abstract Data Types (ADT's) offer a high level view of a concept independent of its implementation.
A concrete data type is a data type whose representation is known.	Abstract data type the representation of a data type is unknown.

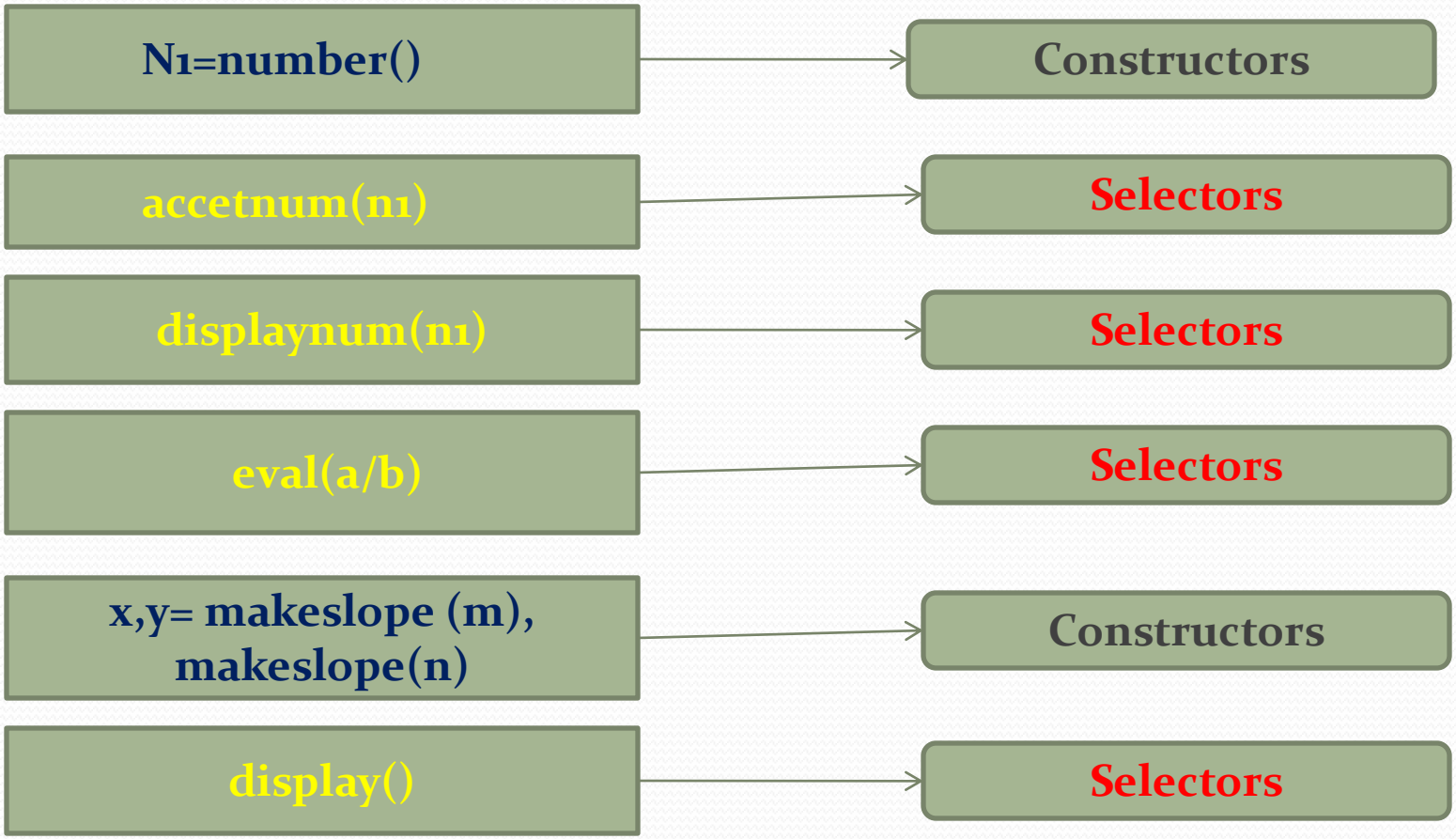
Parts of Program

- Any program consist of two parts.
- The two parts of a program are,
  - the part that operates on abstract data and
  - the part that defines a concrete representation, is connected by a small set of functions that implement abstract data in terms of the concrete representation.

Which Strategy is used for program designing?

- A powerful strategy for designing programs is 'wishful thinking'.
- Wishful Thinking is the formation of beliefs and making decisions according to what might be pleasing to imagine instead of by appealing to reality.

Identify Which of the following are constructors and selectors?



Lists, Tuples - Introduction

- To implement the data abstraction, Programming languages like Python provides a compound structure called Pair which is made up of list or Tuple.
- The first way to implement pairs is with the List construct.

Lists

- List is constructed by placing expressions within square brackets separated by commas.
- Such an expression is called a list literal.
- List can store multiple values.
- Each value can be of any type and can even be another list.

Example
lst := [10, 20]

The different ways to access the elements of a list

The elements of a list can be accessed in two ways.

- **Multiple Assignment**
- **Element Selection Operator**

Multiple Assignment

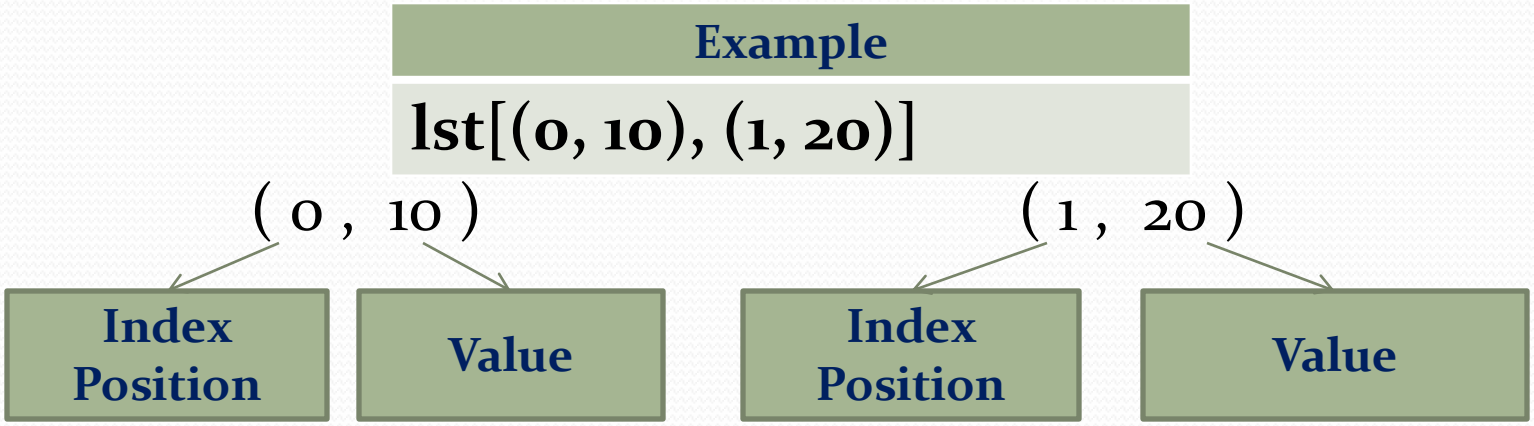
- **Which unpacks a list into its elements and binds each element to a different name.**

Example
lst := [10, 20] x, y := lst

- ***Here, x* will become 10 and *y* will become 20.**

Element Selection Operator

- It is expressed using square brackets.
- A second method for accessing the elements in a list is by the element selection operator.



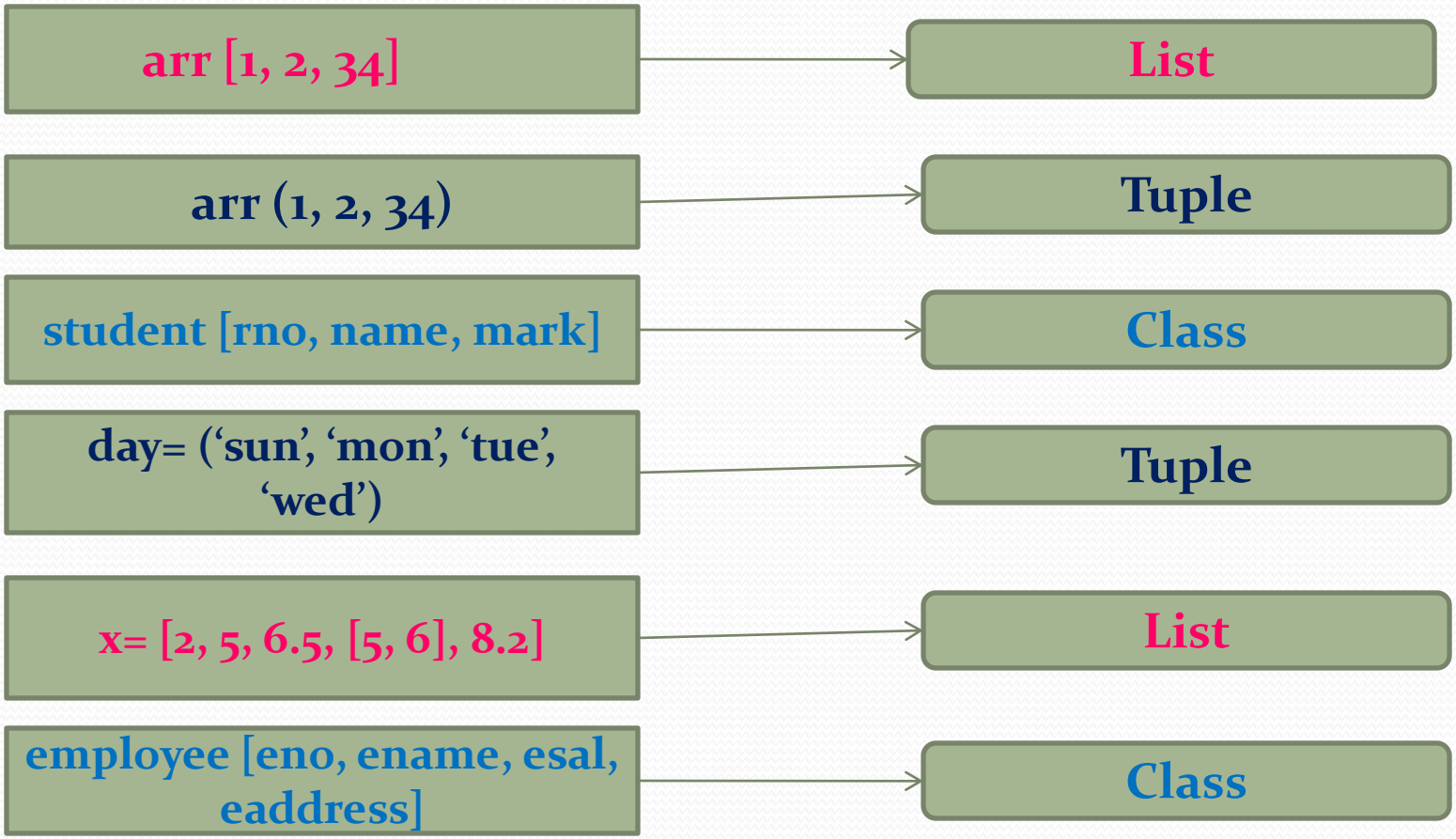
- Any way of bundling two values together into one can be considered as a pair.
- Lists are a common method to do so. Therefore List can be called as Pairs.

Tuples

- A tuple is a comma-separated sequence of values surrounded with parentheses.
- Tuple is similar to a list.
- The difference between the two is that you cannot change the elements of a tuple once it is assigned whereas in a list, elements can be changed.

Example
colour= ('red', 'blue', 'Green')

Identify Which of the following are List, Tuple and class ?



Data Abstraction in Structure

- List does not allow naming the various parts of a multi-item object.
- Instead of using a list, you can use the structure construct (In OOP languages it's called class construct) to represent multi-part objects where each part is named.

Data Abstraction in Structure

Example	
class Person: person( ) firstName := " “ id := " “ email := " “	main() p1:=Person() firstName := " Padmashri “ id :="994-222-1234“ email="compsci@gmail.com"

- **Same way using class you can create many objects of that type.**

EVALUATION

1. **Which of the following functions that build the abstract data type?**

   (A) Constructors (B) Destructors (C) recursive (D) Nested

2. **Which of the following functions that retrieve information from the data type?**

   (A) Constructors **(B) Selectors** (C) recursive (D) Nested

3. **The data structure which is a mutable ordered sequence of elements is called**

   (A) Built in **(B) List** (C) Tuple (D) Derived data

4. **A sequence of immutable objects is called**

   (A) Built in (B) List **(C) Tuple** (D) Derived data

5. **The data type whose representation is known are called**

   (A) Built in datatype (B) Derived datatype

   (C) Concrete datatype (D) Abstract datatype

EVALUATION

6. **The data type whose representation is unknown are called**

   (A) Built in datatype (B) Derived datatype

   (C) Concrete datatype **(D) Abstract datatype**

7. **Which of the following is a compound structure?**

   (A) Pair (B) Triplet (C) single (D) quadrat

8. **Bundling two values together into one can be considered as**

   (A) Pair (B) Triplet (C) single (D) quadrat

9. **Which of the following allow to name the various parts of a multi-item object?**

   (A) Tuples (B) Lists **(C) Classes** (D) quadrats

10. **Which of the following is constructed by placing expressions within square brackets?**

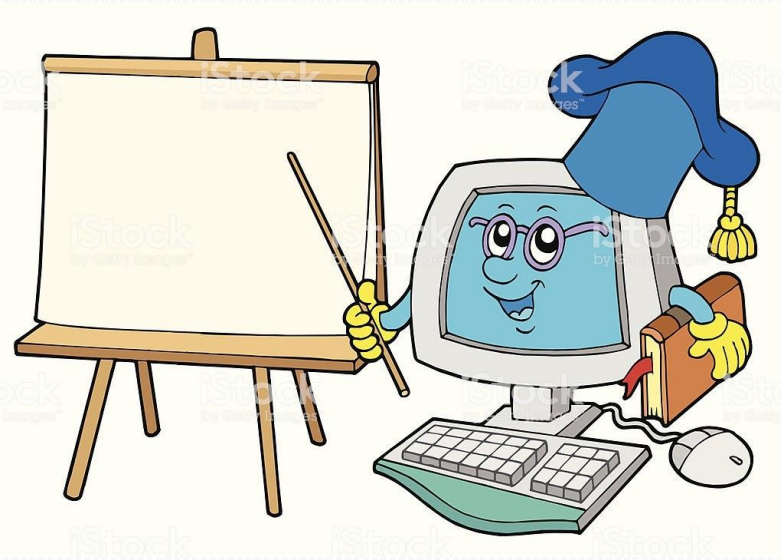
    (A) Tuples **(B) Lists** (C) Classes (D) quadrats

Important questions:

1. What is abstract data type?
2. Differentiate constructors and selectors.
3. What is a Pair? Give an example.
4. What is a List? Give an example.
5. What is a Tuple? Give an example.
6. Differentiate Concrete data type and abstract datatype.
7. Which strategy is used for program designing? Define that Strategy.
8. What are the different ways to access the elements of a list. Give example.
9. How will you facilitate data abstraction. Explain it with suitable example.

THANK YOU!!!

Education is the most *powerful weapon* which you can use to *change the world*.



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