BTEC Level 3 Computing

Unit 1 - Principles of Computer Science

Data Structures

Selecting, applying, using and interpreting common data structures within a computer program to store and process data.

Data Structures

What are Data Structures?

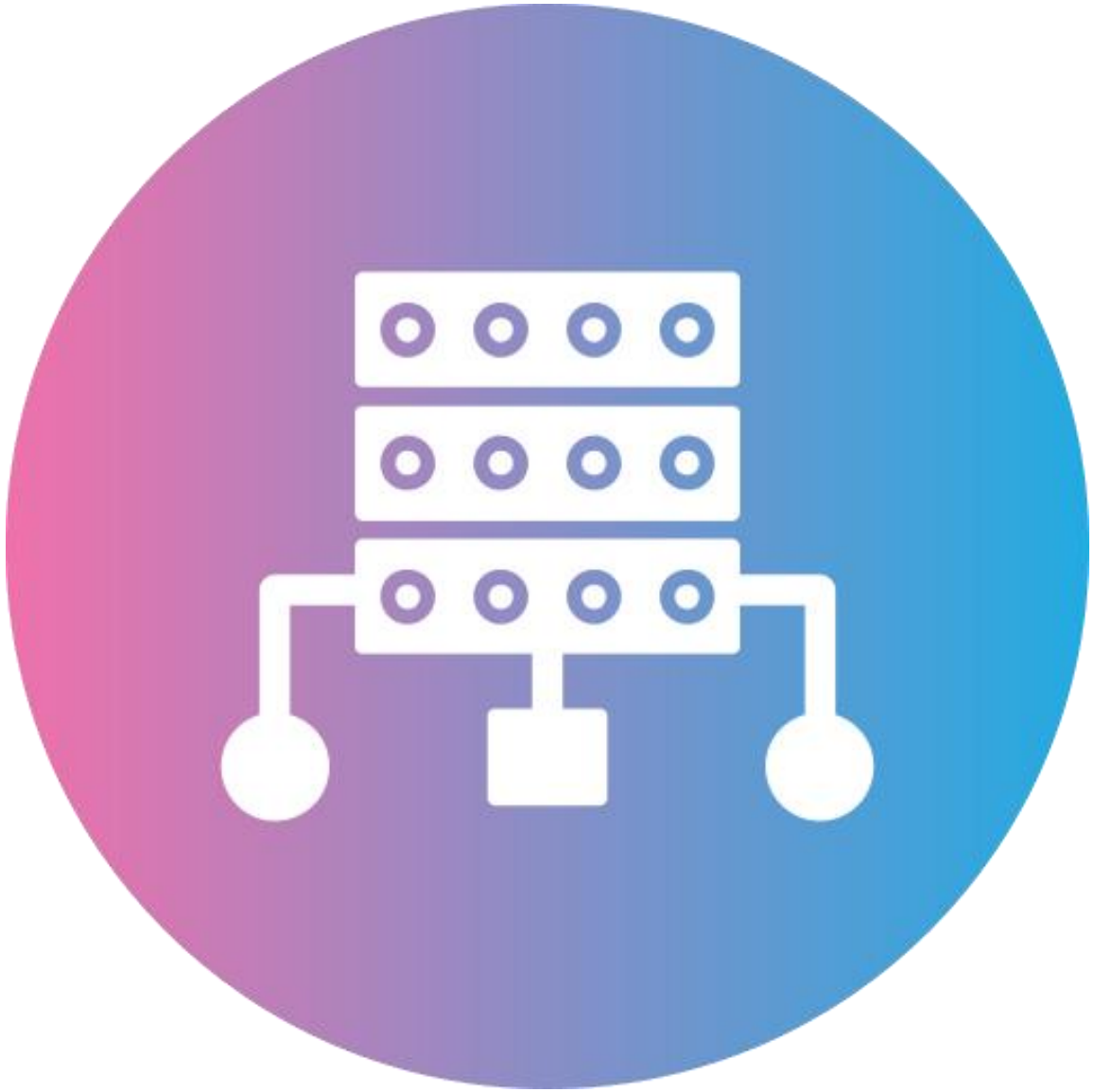
Data structures are ways to organise and store data in a computer so it can be used efficiently.

Think of them like containers: some are good for storing lists of things, others are better for looking up information quickly, and so on.

They help you manage your data effectively.

Types Of Data Strucures

- Lists.
- Arrays.
  - Single Dimensional Array.
  - Multi-Dimensional Array
- Records.
- Sets.



Lists

- A list in Python is like a container that can hold a bunch of items, in a specific order.
- Think of it like a shopping list: you can put different things on it (numbers, words, even other lists!), and the order matters.
- You can easily add, remove, or change items on your list.
- Python lists: https://docs.python.org/3/tutorial/datastructures.html

Python 3 List Example - 1D

```
# creating the list
colors = ["red", "green", "blue", "yellow", "purple"]

# add colour to the list
colors.append("turquoise")

# remove colour
colors.remove("red")
```

Arrays

- In Python Lists and Arrays are more or less the same thing.
- Other languages like Java use the term Array or Array List.
- See the next page, that is why many newcomers prefer Python.

Arrays Java Example

```
import java.util.ArrayList;

public class ColorList {
    public static void main(String[] args) {
        // Create an ArrayList to hold Strings (colors)
        ArrayList<String> colors = new ArrayList<>();

        // Add the colors to the list
        colors.add("red");
        colors.add("green");
        colors.add("blue");
        colors.add("yellow");
        colors.add("purple");
```

Python 3 List Example - 2D

```
colors_2d = [
    ["red", "green", "blue"],  # List of primary colors
    ["yellow", "orange", "purple"],  # List of secondary colors
    ["black", "white", "gray"]  # List of neutral colors
]

# Accessing elements:
print(colors_2d[0][1])  # Output: green (row 0, column 1)
print(colors_2d[1][0])  # Output: yellow (row 1, column 0)
print(colors_2d[2][2])  # Output: gray (row 2, column 2)
```

Records or Tuple

- Records group related data together, like a container for different types of information.
- They have named fields for easy access.
- Think of them like rows in a spreadsheet.
- Different languages have different names for them (struct, tuple, etc.), but the idea is the same.
- https://docs.python.org/3/tutorial/datastructures.html#tuples-and-sequences

Records or Tuple Example

- # Using named tuples (good for simple, immutable records):
  from collections import namedtuple

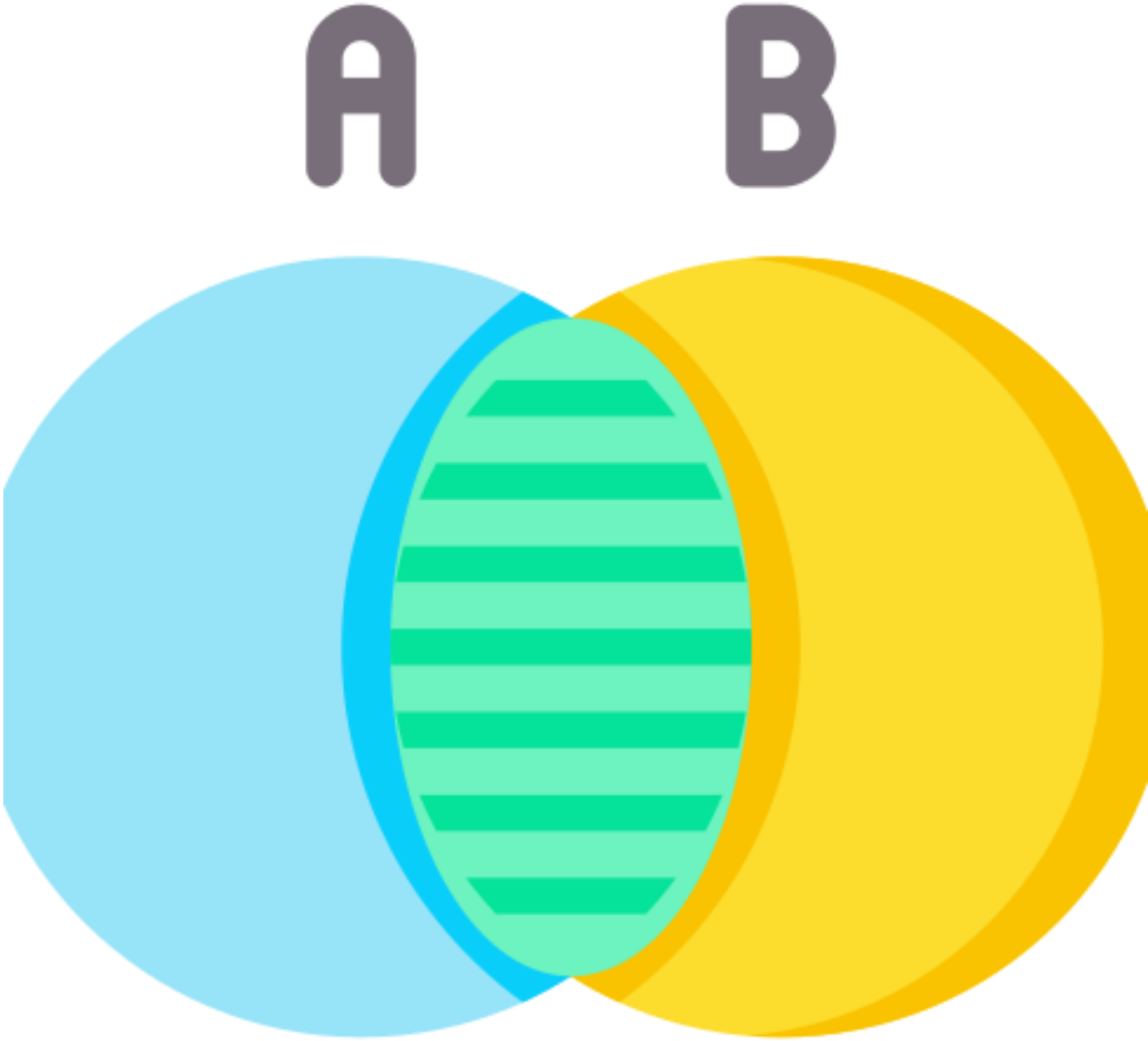
  ColorRecord = namedtuple("ColorRecord", ["color1", "color2", "age"])

  my_record = ColorRecord("red", "blue", 25)

  print(my_record.color1) # Output: red
  print(my_record.color2) # Output: blue
  print(my_record.age)   # Output: 25

Sets

- A set is a data structure that stores a collection of unique elements.
- Think of it like a mathematical set: it can contain various items, but it doesn't allow duplicates, and the order of the items doesn't matter.
- https://docs.python.org/3/tutorial/datastructures.html#sets



Sets Example Python 3

```
# Creating a set:
my_set = {1, 2, 3, 4, 5}  # Using curly braces
another_set = set([3, 4, 5, 6, 7]) # Using the set() constructor with a
list

# Adding elements:
my_set.add(6)  # Adds 6 to the set (if it's not already there)
my_set.add(2) # Adding a duplicate does nothing
print(my_set)    # Output: {1, 2, 3, 4, 5, 6} (order may vary)

# Removing elements:
my_set.remove(3)  # Removes 3 from the set
print(my_set)    # Output: {1, 2, 4, 5, 6}
```

Next Time

Common/standard algorithms