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*DATA TYPES*

1. **Explanation about the data with example?**

* Data is a collection of row facts which does not have a proper meaning.
* The main use of data is it will occupy less memory space and easy to maintain and we can do any operations on data.

**Example:** Student data:

Rno =23

Avg = 97%

1. **What is an information with example?**

* To providing a proper meaning to data is called information.

**Example:** student 23 is passed with 97%.

1. **What is the purpose of data type?**

* The main purpose of data type is to allocate a enough memory space for the input of the program in the main memory of the computer either by using static memory allocation (or) Dynamic memory allocation.
* And to represent type of variables as well to represent type of return types

1. **What are the different types of data types in java?**

* In java the datatypes are class field into 2 types they are

1. Primitive data types and
2. Non primitive datatypes

* The primitive data types include boolean, char, byte, short, int, long, float and double.
* The non-primitive data types include [Classes](https://www.javatpoint.com/object-and-class-in-java), [Interfaces](https://www.javatpoint.com/interface-in-java), and [Arrays](https://www.javatpoint.com/array-in-java).

1. **Explain about data types?**

* In java every variable has a type, every expression has a type and all types are strictly defined.
* All the assignments should be checked by the compiler for the type compatibility.
* Hence java language considers as strongly typed language.
* Java is not considered as pure object-oriented programming language because several OOP features (like multiple inheritance, operator overloading) are not supported by java.
* Even java contains non-object primitive datatypes.
* Except boolean and char all the remaining datatypes are signed datatypes i.e we can represent both +ve and –ve numbers.

**Example:**

int a;

a=10; //Valid

a=10, 20, 30; //Not Valid

A screenshot of a cell phone

Description automatically generated

1. **Explanation about primitive data types?**

* In Java language, primitive data types are the building blocks of data manipulation.
* These are the most basic data types available in [Java language](https://www.javatpoint.com/java-tutorial).
* Java is a statically-typed programming language.
* It means, all [variables](https://www.javatpoint.com/java-variables) must be declared before its use.
* That is why we need to declare variable's type and name.

1. **What are the problems in primitive data types?**

* Primitive data types are those whose variables are allows us to store only single value.
* But they never allow us to store multiple values of the same data type or different data types.

1. **Write the list of primitive data types?**

* There are 8 types of primitive data types:
  + boolean data type
  + byte data type
  + char data type
  + short data type
  + int data type
  + long data type
  + float data type
  + double data type

1. **What are the different types of primitive data types?**

* In java programming language we have 8 primitive data types which are classified into 4 categories they are

1. Integer category data types
2. Floating point category data types
3. Character category data types and
4. Boolean category data types.
5. **How the programmer can choose an appropriate data type?**

# In any category of data type contains multiple data types then it is mandatory to the programmer to choose an appropriate data type.

# For choosing an appropriate data type we need to calculate that range of a data type.

# Range makes us to understand how much it can store at maximum side and how much it can store at negative side.

1. **What is the formula for calculating the range of the data type with example?**

# The following formula will be used for calculating range of any data type.

# 

# Example:

# Range of short data type = (2)16bits

# =1to65536

# = 0to 65535

# = +32767.5 to -32767.5

=+32767 to -32768

1. **What is the basic aim of integer category data types?**

* The basic aim of the integer category data types is to store integer data in the main memory of the computer by allocating sufficient amount of memory space.

1. **Explain about integer category data types with example?**

* Integer category contains 4 data types and they are given in the following table.

|  |  |  |  |
| --- | --- | --- | --- |
| Sr/no | Data type | Size in byte | Range |
| 1 | byte | 1 | +127 to -128 |
| 2 | short | 2 | +32767 to -32768 |
| 3 | int | 4 | +x to-(x+1) |
| 4 | long | 8 | +y to –(y+1) |

1. **Explain about byte data type?**

* The byte data type is an example of primitive data type.
* It is an 8-bit signed two's complement integer.
* Its value-range lies between -128 to 127 (inclusive).
* Its minimum value is -128 and maximum value is 127.
* Its default value is 0.
* The byte data type is used to save memory in large arrays where the memory savings is most required.
* It saves space because a byte is 4 times smaller than an integer.
* It can also be used in place of "int" data type.

**Example:**

byte a = 10,

byte b = -20

byte b = 130; (C.E: possible loss of precision)

byte b = true; (C.E: Incompatible types found: Boolean required: byte)

* byte datatype is best suitable if we are handling data either from file or form network.

1. **Explain about short data type?**

* The short data type is a 16-bit signed two's complement integer.
* Its value-range lies between -32,768 to 32,767 (inclusive).
* Its minimum value is -32,768 and maximum value is 32,767.
* Its default value is 0.
* The short data type can also be used to save memory just like byte data type.
* A short data type is 2 times smaller than an integer.

**Examples:**

short s = 10;

short s = 32767;

short s = 65535;(C.E: possible loss of precision)

short s = true; (C.E: Incompatible types)

* short is best suitable datatype for 16-bit process. But currently these are completely outdated and hence the corresponding datatypes also no one is using.

1. **Explain about int data type?**

* The int data type is a 32-bit signed two's complement integer.
* Its value-range lies between - 2,147,483,648 (-2^31) to 2,147,483,647 (2^31 -1) (inclusive).
* Its minimum value is - 2,147,483,648and maximum value is 2,147,483,647.
* Its default value is 0.
* The int data type is generally used as a default data type for integral values unless if there is no problem about memory.

**Example:** int a = 100000, int b = -200000

* The most commonly used datatype is int.
* The size of int is always fixed irrespective of platform hence the chance of failing java program is very less if u r changing the platform hence the java is considered as Robust.

1. **Explain about long data type?**

* The long data type is a 64-bit two's complement integer.
* Its value-range lies between -9,223,372,036,854,775,808(-2^63) to 9,223,372,036,854,775,807(2^63 -1)(inclusive).
* Its minimum value is - 9,223,372,036,854,775,808and maximum value is 9,223,372,036,854,775,807.
* Its default value is 0.
* The long data type is used when you need a range of values more than those provided by int.

**Example:** long a = 100000L, long b = -200000L **:**

The amount of distance traveled by light in 1000days can be represented by long datatype only and int is not enough.

* If int is not enough to hold big values then we should go for long-datatype

1. **What is the basic aim of Decimal/Floating point category data types?**

* The basic aim of float category data types is to store real constant values π and etc in the main memory of the computer by allocating sufficient amount of memory space.

# Explain about Decimal/float category data type?

# Decimal category contains 2 types of data types they are given in the following table

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Size (in bytes) | Range | Number of Decimal places |
| Float | 4 | +x to –(x+1) | 7 |
| Double | 8 | +y to –(y+1) | 15 |

# In some books numbers of decimal places are given 8 and 16 for float and double which are including dot (.) but in the above table we are showing excluding the dot(.).

1. **Explain about Float data type with example?**

# The float data type is a single-precision 32-bit IEEE 754 floating point.

# Its value range is unlimited.

# It is recommended to use a float (instead of double) if you need to save memory in large arrays of floating point numbers.

# The float data type should never be used for precise values, such as currency.

# Its default value is 0.0F.

# If we store any real constant values in a variable of float data type then such real constant value stored in the main memory in such a way that after the dot(.) It takes 7 decimal places.

# And the real constant value must be followed by a letter ‘f’ otherwise we get compile time error.

# The following calculations shows (IEEE 754: floating point calculation) how real constant values stored in the main memory in bit representation of float data type.

**Example:**

# float f1 =3.4f;

# 

# Explain about Double data type with example?

# The double data type is a double-precision 64-bit IEEE 754 floating point.

# Its value range is unlimited.

# The double data type is generally used for decimal values just like float.

# The double data type also should never be used for precise values, such as currency. Its default value is 0.0d.

# If we store any real constant value in a variable of double data type then such real constant value store in the main memory in such a way that after the dot (.) it takes 15decimal places

# And a real constant value may or may not be followed by a letter ‘d’.

# In our Java program if we use any real constant value directly then such real constant value is by default treated as highest data type in float category that is double data type.

# Example:

# double d1 = 3.4d; (or) double d1 =3.4;

# 

# float f1 =3.5; => Error

# Explain an example of float and double data type in different programming languages?

# In the below table 3.5 is by default treated as double and it cannot be directly stored in a variable of float data type.

# Note:

# In ‘C’ language:

|  |  |  |
| --- | --- | --- |
| In C-language | In Java |  |
| Float a =3.4;If (a==3.4) float{printf(“OK”);}else{printf(“Cancel”);}printf(“Over”);Output:Cancel Over | Float a =3.5;If (a==3.5) *double*{S.O.P(“OK”);}else{S.O.P(“Cancel”);}S.O.P(“Over”);Output:OK Over | This happens due to floating point calculation3.4:011.0110011 float011.011001100110011 doubleWhich are not equal3.5:011.1000000011.10000000000000Which are equal except 5 all other one having float |

* To overcome this problem we need to write “f” for all floating datatype.

1. **Explain about character category data types?**

* In character category data types are classified for two types they are
* Character and
* String.

1. **What is character with example?**

* Character is an identifier which is enclosed with in single quotes.
* The char data type is a single 16-bit Unicode character.
* Its value-range lies between '\u0000' (or 0) to '\uffff' (or 65,535 inclusive).
* The char data type is used to store characters.

**Examples:**

‘a’, ‘A’, ‘$’ and etc.

1. **What is string with example?**

* A collection/sequence of characters enclosed with in double quotes is called string.

**Examples:**

“swap”, “om sai ram” and etc.

1. **What data type is required for storing the character data type?**

* To store the character data in the main memory of the computer in C, CPP, Java Programming languages we use Character data type.

1. **How many bytes will occupy for character data type in C,CPP programming languages?**

* In C, CPP programming languages the character data type takes “1” byte because C, CPP follows ASCII character set.

1. **How many bytes will occupy for character data type in JAVA programming languages?**

* In java programming language character data type takes 2 bytes because java follows UNICODE character set.

1. **The Java Programming language is available in how many international languages?**

* Java Programming language is available in 8 international languages (English, Latin, Greek and etc).

1. **Define ASCII with example?**

* ASCII Stands for American Standard Code for Information Interchange.
* ASCII Character set is followed by those programming languages which are available in only one international language called English.  
  **Examples:**

C, CPP, COBOL follows ASCII character set because these programming languages are available   
 on only one programming language.

1. **What is the size of ASCII character programming language?**

* The size of the ASCII character programming language is 256 bytes (28 = 256).

1. **Define UNICODE with example?**

* UNICODE Stands for Universal International Standard Character Encoding.
* UNICODE Character set is followed by those programming languages which are available more than one international languages including English.

**Examples:**

Java, .Net and etc.

1. **What is the size of UNICODE character programming language?**

* The size of the UNICODE character programming language is 65536 bytes (216 = 65536).

1. **Write the list of language standards before Unicode System?**

* Before Unicode, there were many language standards they are
* **ASCII** (American Standard Code for Information Interchange) for the United States.
* **ISO 8859-1** for Western European Language.
* **KOI-8** for Russian.
* **GB18030 and BIG-5** for Chinese, and so on.

1. **What are the major problems of language standards which are before Unicode System?**

* The major problems of language standards which are before Unicode System

1. A particular code value corresponds to different letters in the various language standards.
2. The encodings for languages with large character sets have variable length.Common characters are encoded as single bytes, other require two or more byte.

* To resolve these problems, a new language standard was developed that is called Unicode System.
* In Unicode, character holds 2 byte, so java also uses 2 byte for characters.

**Lowest value:** \u0000

**Highest value:** \uFFFF

|  |
| --- |
|  |

1. **By using the UNICODE character set in what is the major disadvantage?**

* As per English language, java programming language is concerned for storing one character it requires one byte and rest of one byte is simply wasted which is one of the major drawback of java programming language.

1. **Define Boolean category data type with example?**

* The basic aim of the Boolean category data type is to store the logical values (feeling that they are existing but in reality they won’t take physical memory space in main memory).

**Example:**

True, False.

1. **How the logical values are stored in java programming language ?**

* In java Programming language logical values are stored by using Boolean data type.

1. **Explain about Boolean category data type?**

* Boolean data type of java implemented by using a general purpose register called flip flop which will store one bit of memory space( ‘1’ for True and ‘0’ for false).
* Boolean data type of java takes ‘0’ bytes of main memory space because Boolean values are not storing in main memory but they are storing in registers called flip flop.

1. **What are the default values of primitive data types in java?**

* The default value of integer category variable is “0” (zero).
* The default value of float category variable is “0.0”.
* The default value of character category variable is “nothing”.
* The default value of Boolean category variable is “false”.

1. **Write an example and explain in detail why character category data types requires 1 byte memory space in C while 2 bytes in java?**

* The C language supports only single international language because it follows ASCII character set it requires single byte to store.
* Java language supports more than one international language including English because it follows UNICODE character set it requires more than one byte to store.
* Consider in Latin “A” is represented as “A~”.To store such letters we require 2 bytes.
* For English language in java it require 1 byte of memory space to store the value and other 1 byte of memory is wasted which is also not cleared by garbage collector.

1. **Explain about non primitive data types?**

* Derived data types are those whose variables are allows us to store multiple values of same data type.
* But they never allow us to store multiple values of different data types.

1. **Explain about non-primitive data types with example?**

* In every programming language the concept of arrays comes under non primitive data types.

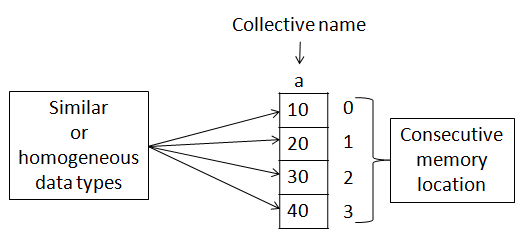
**Example:**

int a[] = {10, 20, 30}; //Valid

int b[] = {10, ‘A’, 23.5}; // Invalid

1. **Define an array with diagram representation?**

* An array is collective name given to the group of consecutive memory location which is all referred by similar / homogeneous data type of elements.

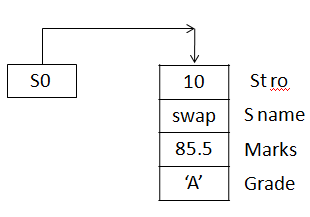


1. **Explain about user defined data type with example?**

* User defined data type are those whose variable are allows us to store multiple values of either same data type or different data types or both data types by using language facilities.

**Example:**

Student S0 = new Student ();



1. **How we can create user defined data types in C programming language?**

* In C Programming language to create user defined data types we use the concepts like
* Structures (Struct),
* Unions (Union),
* Enumeration (Enum) and etc.

1. **How we can create user defined data types in Java programming language?**

* In Java Programming language to create user defined data types we use
* classes (Class),
* Interfaces (Interface),
* Enumeration (Enum) and etc.

1. **Define flip flop?**

* A flip flop is circuit that has two stable states and it can be used to store state information.
* A flip-flop is usually controlled by control [signals](http://www.wikipedia.org/wiki/Signals) that can include a [clock signal](http://www.wikipedia.org/wiki/Clock_signal). The [outputs](http://www.wikipedia.org/wiki/Output) usually include the [complement](http://www.wikipedia.org/wiki/Logical_complement) as well as the normal output.

1. **What is the default value of reference data type?**

* The default value of reference data type is “null”.
* So any data type which contains default value is null then such data type is called reference data type.

