GIS Programming 1

People
Code
GIS
ORDBMS
Data

GIST 7010

Module 02 Lecture

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Lecture topics

- The core tools
- Variables and data-types
- Simple operators and their precedence
- Data-type conversion

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Learning Outcomes

- List the three core tools in programming
- Describe components of a Java console application
- Describe the Java compilation and execution process
- Define a variable as it relates to programming
- Explain the use and nonuse of data types in programming languages
- Discuss how to distinguish programming variables from each other

Rob's Rules

- When solving a problem in programming there are three core "tools" that we can use:
  - Variables
  - Branching/Decision Structures
  - Loops/Repeating
- Everything else that we will encounter typically deals with configuring and organizing the three core tools

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- There are 2 super categories of data-types in Java
  - Primitives (atomic, single value, C) and classes
- A console program falls into the later category
- A class, in this case, is a container for your code
- There are rules public static void main 'thingy'
- Your program (class) gets compiled into bytecode
- Your bytecode gets interpreted into machine-code

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Basic console class

- public class Main

  ```
  {   // marks the start of your class
  public static void main(String[] args)
     {    // marks the start of main – the method


           // Your code goes here


     }    // marks the end of main – the method
  }  // marks the end of your class
  ```

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Variables

Variables

- Variables are containers that hold values/data
- All of your programs will have variables
- Variables in Java are defined as a certain data type:
  - **String** myName;
- Variables are usually assigned a value
  - myName = **"Lisa Pringle"**;

Languages and Data-Types

- Some programming languages use data types and some do not
- The trend is that compiled languages do interpreted languages do not.
- One will always be able to find an exception
- C, C++, Java, Visual Basic .NET, C# are all compiled

Variables in General

- Variables can be organized into three conceptual categories of data-types
  - Numbers
    - Whole and Real
  - Text
    - Strings and single characters
  - Complex
    - Arrays, Dates and Classes

Primitive data types

- **byte** whole number ranging from:
  - -128 to 127 1-byte
- **short** whole number ranging from:
  - -32,768 to +32,767 2-bytes
- **int** whole number ranging from:
  - -2147483648 to 2147483647 4-bytes
- **long** whole number ranging from:
  - -9223372036854775808 to 9223372036854775807 8-bytes

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Primitive data types

- **float** Real number 7 sig-figs 4 bytes
- **double** Real number 15 sig-figs 8 bytes
- **boolean** true or false 1 bit (maybe)
- **char** 1 Unicode character 2 bytes
- http://download.oracle.com/javase/tutorial/java/nutsandbolts/datatypes.html

Other common data types

- **String** use to hold many characters Size depends on the number of characters
- **Date** Year, Month, Day, Time, Time Zone 24 bytes but this number lacks clear documentation

Data types

- Not every programming language uses data-types
- Many programming languages DO use data-types:
  - VB .NET, C#, Java, C++, C
- All RDBMS/ORDBMS use data-types!
- ArcGIS uses data types!
- We have to know the common data-types

Declaration

Declaring in Java

- Text:
  - String someString = "A Space "
  - char oneCharOnly = 'c'
- Number
  - int ten = 10;
  - double tenPoint2a = 10.2;
  - float tenPoint2b = 10.2f;
  - long bigNumber = 10000000000L;

Demo sample programs

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More on variables

- Variables can be distinguished by their:
  - Contents What they contain
  - Size How much memory they consume
- Simple variables typically contain:
  - Text
  - Numbers (real and whole)
- Variables can be complex

Complex variables

- Complex variables can be:
  - Heterogeneous   a combination of the different data types (think of a tool box)
  - Homogenous   a collection of the same data type (egg carton)
  - Nested (did you notice all the dots?)
- At their most complex (classes) they have:
  - Properties (variables or other classes)
  - Methods (subs and functions)

Workflow

Variable workflows

- Declare the variable as a certain data type
- Get the data: User, file, DB, Web Service
- Assignment: A value (data) has to be assigned to a variable
- Process the data
    - A variable's value can change
        - intAge = intAge + 1;
    - A variable's value can be used to set another variable's value
        - dblArea = dblHeight * dblWidth;

Order of operation

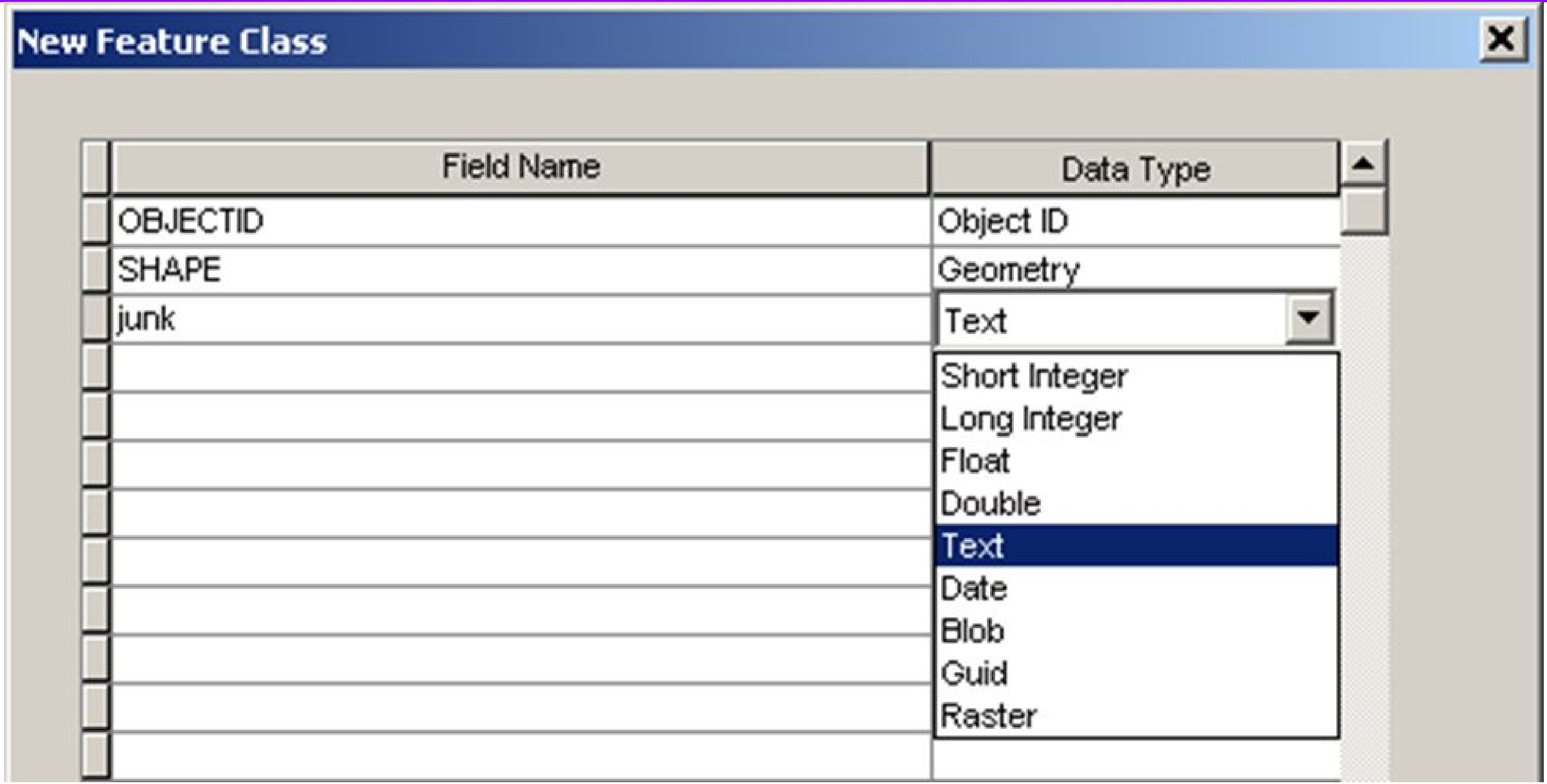
- For simple calculations:
    - Unary
        - (+, -, ++, --, ~)
    - Multiplication, division and Remainder
        - (*, /, %)
    - Addition and subtraction
        - (+, –)
- Complete list:
    - http://download.oracle.com/javase/tutorial/java/nutsandbolts/operators.html

Conversion BT data types

- All data-type languages need a way to convert between data-types
- Direct casting e.g. (double)myInt
- Widening is usually safe but narrowing can cause problems loss of data
- Wrapper classes can help you out too and each one has many conversion and testing methods

Structured data

ArcGIS feature class



Field Name	Data Type
OBJECTID	Object ID
SHAPE	Geometry
junk	Text

SQLite

- NULL
- INTEGER
  - Depending on the value 1, 2, 3, 4, 6, or 8 bytes
- REAL
  - 8-byte IEEE floating point number AKA (double)
- TEXT
  - database encoding e.g. UTF-8, UTF-16BE or UTF-16LE
- BLOB
  - The bytes exactly as entered

- ArcGIS field data types

- DBMS data types supported in ArcGIS

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The End

Questions
Answers
Clarification
Reexamine

Extended time