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Java, Python, Fortran, Scheme Comparison – Program 4

1. Variables – In Java all variables must be explicitly declared with their types because it is a statically typed language where as in Python you never have to declare a type, the assignment statement binds a name to an object which can be of any type and can be assigned later to a different type, this is because Python is a dynamically typed language. In Fortran, variables must be declared before normal statements and must be explicitly declared they can be changed and assigned new things throughout the program but must be declared before normal statement is executed. In Scheme when a variable is declared it cannot be changed or modified, anywhere else in the program this is because scheme is a functional language and does not need a type to be declared by Scheme is also a dynamically typed language.
2. Aggregate Data Types – In Fortran, an array must have an explicit type and can only hold items of that type the size can be declared at a later time in the program but the array will be dynamically created. You can also declare your own types in Fortran known as types. In Java container objects like a Vector or an Array List can hold generic objects but when you get an object from the list you must cast it to its type whereas in Python a list can hold many kinds of objects in one list and their type is remembered when you retrieve it from the list. A list in Python can be looked at as a more flexible array in Java. The list does not need a fixed size for declaration and it doesn’t only house a single type of object. Scheme has lists which can contain any kind of variable but again cannot be modified after the list has been declared because again scheme avoids state changing and mutable data.
3. Expressions – Expressions function the same way, you just must declare the types in Java for certain kinds of expressions and those types must match, as explained with the language being static. In Java there are a lot more keywords and reserved words that must be used in certain statements where in Python they are much simpler without the need for all those key and reserved words. For Fortran expressions must be of the same type on both sides, but the unequal operator is /= instead of != in Python and Java. In Scheme the syntax for comparison and expressions follow as such (+,-,=, ect right variable left variable)
4. Assignment Statements – In Fortran you can only assign an object to corresponding types or an error will be generated. In Python you can just create an object and assign it to anything and that is what the object will be, this is again because the language is dynamically typed. As stated in the Variables section, an assignment statement binds a name to an object which can be of any type and can be assigned later to a different type, this is because Python is a dynamically typed language. If in Java you try and assign an object of the wrong type to a variable you will get a type exception. Like python scheme does not need a type declared any object can be assigned to any type but cannot be changed after initially defined
5. Statement Level Control Structures – For the most part statement level control structures work the same in all 3 languages, the syntax for what is and is not in the structure differs. In Java brackets are used to show what is contained in the loop whereas in Python no brackets are used and indentation of the statements with the structure define if it is or is not in the structure. The brackets are very useful and help with readability for Java. Neither have the all the same control structures as Python does not have a switch like Java does, but the ones in common (if, while) work near identical to each language. In Fortran what is contained within the control structure is the lines of code between for example the if and the endif and again a do and end do. Fortran has a do instead of a for but both work the same way. Scheme everything is done recursively for loops, there are if statements that functions mostly the same to the other languages and scheme also has cond which functions almost identical to an if statement.
6. Subprograms – Subprograms functions similar in all three languages, all can be passed arguments and return values (in Fortran that is functions, subprograms can modify a value but not explicitly return one), but in Python no definition is needed for what kind of value will be returned or passed, due to it being a dynamic language. In Python you can also not know the exact number of arguments you need to pass beforehand. When it comes to classes multiple can be defined in the same file for Python whereas each new class must be in their own file for Java. In subprograms and functions in Fortran, the parameters and return values must have their intent declared i.e. if they will be modified in the function or not and if it will be returned (only in functions). Scheme has functions which like python do no need types for the parameters or return values and center mostly around recursive calculations.
7. Error Handling Capabilities – Both Java and Python contain some form of error handling capabilities in Python it is the try and except, in Java it’s the try catch. You can have multiple except blocks in Python like you can have catch more than one exception in Java. In Java you must add a throw before the exception so that it can be caught and certain exception must be caught/ thrown so the program can be compiled, these are called checked exceptions which must be handled always. However, in Fortran the error handling capabilities are quite limited. There is no try catch, the error handling is mostly kept to the input on the command line i.e. entering a real when an integer was supposed to be entered. You create a variable that will hold a number returned from the read function which will show if the read was successful or unsuccessful and it is up to you how it will be handled. Scheme does not have explicit error catching capabilities like a try and catch I have seen ways to deal with errors in the language but were not explained how to be implemented.
8. Type Checking Requirements – Because Python is dynamically typed you can declare variables without giving a specific type, the type is automatically given when the data is assigned and is checked at runtime. In Java the type must be explicitly defined and type checking occurs at runtime. As stated above for assignment statements, if in Java you try and assign an object of the wrong type to a variable you will get a type exception the same goes for Fortran as stated above. There is type checking in scheme for comparison, if the two objects are not of the same type an error will be generated, for example you cannot compare a string to an integer. You can check the type of an object by specifying the type and the object like (integer? n) if n is an integer then it will return #t for true, if not #f for false.

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For this program I was not able to include error handling capabilities because scheme does not really support any error handling to catch explicit errors and deal with them appropriately.