2009 Paper 5 Question 5

Concurrent Systems and Applications

(*a*) Reflection.

(*i*) Give Java code fragments demonstrating *two* different ways of obtaining a `Class` object that describes an array of `java.lang.String`s. [2 marks]

(*ii*) Given an object `x`, write a Java expression that uses reflection to create a new object of the same datatype as `x`. [2 marks]

(*iii*) The `clone()` method creates an exact copy of an object, including all of its fields. Briefly describe how you might implement this functionality using reflection, ignoring inherited fields. Assume that the object is not an array, has a zero-argument constructor, and contains only primitive fields. (You need not give code for an actual complete implementation.) [4 marks]

(*b*) Generics.

(*i*) Suppose a class `B` is a subclass of `A`. Is the class `Set<B>` a subclass of `Set<A>`? Explain why or why not, with regard to type safety. [2 marks]

(*ii*) The default clone method returns an `Object` that must be cast to the correct type. Using generics, give a declaration of a static `myclone` method that takes a single argument of any type and returns an object of the same type. [2 marks]

(*iii*) The `Contraster` interface is used to compare two objects. Its declaration is:

```
interface Contraster<T> {
  boolean greaterThan(T obj1, T obj2);
}
```

Suppose we want to declare a class `SortedList<E>` whose constructor takes a single `Contraster` argument that will be used to compare its elements. Give a declaration for the constructor that permits the choice of contraster implementation to be as general as possible, and explain your reasoning. [4 marks]

(*c*) Reference objects.

The `get()` method of the `PhantomReference` class always returns `null`. Why is this so, and why must a `PhantomReference` always be used together with a `ReferenceQueue`? [4 marks]