

ADVANCED PROGRAMMING 2015-16

Programming Assignment 2

The assignment involves a programming activity and includes an optional *problem*. The submission must include all required files for compiling and executing the proposed solution. It is allowed to develop the solution into teams, however the proposed solution should be discussed individually.

Introduction:

In this programming assignment, you will design and implement a concurrent object. Designing a concurrent object involves determining what services it should provide and what their behavior should be. The focus of the assignment is on the concurrency issues. The goal is to familiarize yourself with Java's concurrency constructs, learn to reason about correctness of a concurrent program, and experience the trade-offs between synchronization and performance.

Let us consider the following interface:

```
public interface myDictionary<K,V>{
    //if the key is not already associated with a value,
    //associate it with the given value.
    public V put(K key, V value)

    //Removes the entry for a key only if currently
    //associated to a given value
    public Boolean remove(K key, V Value)

    //Replaces the entry for a key only if currently
    //associated to some value.
    public V replace(K key, V value)

    //Replaces the entry for a key only if currently
    //associated to the given value old.
    public V replace(K key, V old, V new)

    //Results the value for the key, if present
    public V get (K key)

    //Returns the number of elements in the dictionary
    //(its cardinality).
    public int size()
}
```

Your task is to design and develop the class `myConcurrentDictionary<K, V>` that implements the interface `myDictionary<K,V>`. In the implementation you have to consider the class `DictionaryEntry<K,V>` outlined below:

```
static final class DictionaryEntry<K,V> {  
final K key;  
volatile V value;  
volatile DictionaryEntry <K,V> next;  
  
//to be completed with suitable methods  
  
}
```

The problem set (mandatory)

1. Design and implement `myConcurrentDictionary<K, V>` exploiting a *fine-grained synchronization* technique.
2. Design and implement `myConcurrentDictionary<K, V>` exploiting a *lazy synchronization* technique.
3. Compare and evaluate the two implementations through suitable test cases.

The problem set (optional)

1. Design and implement `myConcurrentDictionary<K, V>` exploiting a *lock-free synchronization* technique.
2. Evaluate the implementation through suitable test cases.

Grading

The breakdown for the programming assignment is as follows:

- Problem set (Mandatory): 60%
- Problem set (Optional): 30%
- Other factors (code quality): 10%

Submission

The AP homework should be submitted by e-mail by **06-12-2015 (midnight)** to gian-luigi.ferrari@unipi.it with the subject prefix **[AP-HW2]**.

The submission must include all required files for compiling and executing the proposed solution.