JAVA Programming Language Homework VII: Threads & Collection

ID: **Name:**

1. Given the following Java code:

```
1.  class A extends Thread {
2.      public void m1( ) {
3.          System.out.print("A" ) ;
4.      }
5.
6.      public void m2( ) {
7.          synchronized(System.out) {
8.              try {
9.                  Thread.sleep(1000) ;
10.                 System.out.print("B") ;
11.             }
12.             catch(InterruptedException e) { }
13.         }
14.     }
15.
16.     public void run( ) {
17.         this.m1( ) ;
18.         this.m2( ) ;
19.     }
20.
21.     public static void main(String args[ ]) {
22.         A obj1 = new A( ) ;
23.         obj1.start( ) ;
24.         A obj2 = new A( ) ;
25.         obj2.start( ) ;
26.     }
27. }
```

Which of the following are possible results of attempting to compile and run the program?

A. ABAB
B. BABA
C. AABB

D. BBAA
E. ABBA

ANS: A

由於 m2 方法裡有一個 synchronized 的方法，以及暫停 thread 的敘述，所以流程如下：

- 呼叫 obj1.m1 輸出 A
- 暫停執行緒 1 秒
- 呼叫 obj1.m2 輸出 B
- 呼叫 obj2.m1 輸出 A
- 暫停執行緒 1 秒
- 呼叫 obj2.m2 輸出 B

2. Given the following Java code:

```
1.  class A implements Runnable {
2.      boolean obj1_ok = false;
3.      A( ){
4.          Thread obj1 = new Thread(this, “o”);
5.          Thread obj2 = new Thread(this, “x”);
6.          obj2.start( ) ;
7.          obj1.start( ) ;
8.      }
9.
10.     public synchronized void my( ) {
11.         if(Thread.currentThread( ).getName( ).equals(“x”)) {
12.             while( !obj1_ok) {
13.                 try {
14.                     System.out.print(“A”);
15.                     wait( ) ;
16.                 } catch(InterruptedException e) { }
17.             }
18.         }
19.         System.out.print(“B”);
20.         obj1_ok = true ;
21.         notifyAll( ) ;
```

```
22.    }
23.
24.    public void run( ) {
25.        my( ) ;
26.    }
27.    public static void main (String[ ] args) {
28.        A obj = new A( ) ;
29.    }
30. }
```

Which of the following are possible results of attempting to compile and run the program?

A. ABA
B. BAB
C. AAB
D. BBA
E. ABB

ANS: E

程式執行流程如下：

- obj1_ok = false
- 輸出 A（第 14 行）
- obj1 執行緒暫停（第 15 行）
- 輸出 B（第 19 行）
- obj1_ok = true
- 喚醒 obj1（第 21 行）
- 輸出 B（第 19 行）

3. Which interface offers the specified behavior as below?
   (1) Entries are stored as key/value pairs.
   (2) Old entries will be replaced if duplicated.

A. Map
B. Set

C. List
D. Tree
E. Collections

ANS: A

Map 是一組 keys，對應到各個物件，如果發現資料對已存在，將被取代。

4. To create an instance of a new Map which has same an iteration order with an existing instance of a Map, which concrete implementation of the Map interface should be used for the new instance?

A. TreeMap
B. HashMap
C. LinkedHashMap
D. The answer depends on the implementation of the existing instance
E. None of the above.

ANS: C

當建立新的 Map 實體時，它會執行 addAll 的方法。因為 LinkedHashMap 有一個雙向的 Link，作為維持 iteration 的功能。Hash 就沒有這個功能，當加入元素時，將分散至不同區域。而 TreeMap 則是用樹狀方式，從最上層找至最下層，很難有 iteration 的功能。

5. With an immutable class obj which contains a field of type int and a large array of primitives of type double, to develop a hashCode method based one of these three options, which of the three is most likely to optimize the performance of a Hashtable without violating any of the rules for coding a hashCode method?

A. Obtain the hashCode using both the int field and the array.
B. Obtain the hashCode using only the int field.
C. Obtain the hashCode using both the int field and the array, but only calculate the hashCode once and store the value for future use in an instance variable.

ANS: C

因 immutable class 內的值並不會改變，所以只要計算它的 hashCode 就足夠了。

6. Given the following Java code:

```
1.  class A {
2.      private int[ ] val;
3.      private int hash;
4.      public static void main (String[ ] args) {
5.          A a = new A(new int[ ]{1,2,3}) ;
6.          System.out.print(a.hashCode( )) ;
7.      }
8.      public int hashCode( ) {
9.          int h = hash, off = 0 ;
10.         if (h == 0) {
11.             int val_len = val.length, a = 0 ;
12.             while( a++ < val_len) {
13.                 h = 30*h + val[off] ;
14.                 off++ ;
15.             }
16.             hash = h ;
17.         }
18.         return h ;
19.     }
20.     // The equals method has been omitted for clarity
21.     A( int[ ] val) {this.val = val ;}
22. }
```

What is the result?

A. 963

B. 1085

C. 31706

D. 35535

E. 1895

ANS: A

當程式執行之初，hash 和 h 都是 0，第一次迴圈 h = 0*30+1=1；第二次 h = 1+30+2=32；第三次 h = 32+30+3=963。

7. Given the following Java code: [5 points]

```
1.      import java.util.*;
2.      class A {
3.          public static void main (String[ ] args) {
4.              Object a = new LinkedHashSet( );
5.              System.out.print((a instanceof Collection)+",");
6.              System.out.print((a instanceof Set)+",");
7.              System.out.print((a instanceof List)+",");
8.              System.out.print((a instanceof Map)+",");
9.          }
10.     }
```

What is the result of attempting to compile an run the program?

A. false,false,false,false
B. true,true,false,false
C. true,true,true,true,
D. false,false,true,true,
E. None of the above.

ANS: B

LinkedHashSet 是 Set 介面的其中一種實作，Set 介面又是 Collection 介面的延伸，所以他是兩者的實做類別。和 LinkedHashMap 一樣，LinkedHashSet 雖有 List 的特性，但他並不是 List 介面的延伸，也跟 Map 沒有關係。

8. To implement the most efficient way for a First In First Out queue, which of the following classes provide the most suitable solution?

A. ArrayList B. LinkedHashMap C. LinkedHashSet D. LinkedList
E. TreeMap F. TreeSet G. HashMap H. Hashtable I. Array

ANS: D

所有 hash 類別物件都不適用於 FIFO 的特性，因為他們並沒有維持元素的次序。同樣的 tree 類型也無法做到 queue 的特性。最後題目要求最有效的方法，LinkedList 比 ArrayList 有效，因為他用雙向 link 把各個元素連結起來，能簡單地用 addFirst()和 removeLast()來做到 queue 的功能，而 LinkedHashMap 和 LinkedHashSet 則是提供了多餘的 hash 功能。

9. Which of the following statements are true?

A. Garbage collection ensures programs will never run out of memory
B. You are not able to predict at what point Garbage Collection will occur.
C. Both references and primitives are subject to garbage collection
D. Once an object is not referred by any other objects it will be garbage collected immediately.

ANS: A, B

就算一個物件不被任何變數所參照，它也不會立刻從記憶體中被釋放；此外，Garbage collection 只能應用在物件上，不能應用在 primitive type。

10. Which statements about garbage collection are true?

A. You are able to run the garbage collector anytime you want.
B. In general, the garbage collector will start to run when low memory situations occurs.
C. Garbage collector immediately runs when you set the references to null.
D. When it runs it releases the memory allocated by an object.

ANS: B, D

JAVA 垃圾回收是無法被強制執行的，程式設計者只能建議 JAVA 虛擬機器快去收集垃圾。垃圾回收通常在系統資源不足時才會執行。