Dt : 31/10/2023

Limitation of Object Locking process(Synchronized block):

=>In Object Locking process,all instance methods within the Object are under the lock and all the methods are available to one user at-a-time, which is not preferable in all situations.

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(b)synchronized method - Instance method locking process

=>The process of declaring instance method with synchronized keyword is known as synchronized method.

=>In synchronized method process,only one method of Object will be under the lock and the method is available to one user at-a-time.

structure synchronized method:

```
synchronized return_type method_name(para_list)
{
 //method_body
}
```

Ex-program:

p1 : Available.java

```
package p1;
public class Available {
   public static int available=1;
```

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```
}
```

p1 : Selection.java

```
package p1;
import java.util.*;
public class Selection
{
    public synchronized void select(int n,String name)
    {
    if(n<=Available.available) {
         System.out.println(n+" Tickets booked for
"+name+" Time: "+new Date());
         try {
              Thread.sleep(2000);
         }catch(Exception e) {e.printStackTrace();}
         Available.available=Available.available-n;

    }else {
         System.out.println("Tickets not available for
"+name);
    }
    }
}
```

p1 : User1.java

```
package p1;
public class User1 implements Runnable
{
   public Selection ob=null;
   public User1(Selection ob)
   {
        this.ob=ob;
   }
     @Override
   public void run()
   {
      ob.select(1, "Alex");
```

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```
    }
}
```

p1 : User2.java

```
package p1;
public class User2 implements Runnable
{
        public Selection ob=null;
        public User2(Selection ob)
        {
             this.ob=ob;
        }
          @Override
        public void run()
        {
            ob.select(1, "Ram");
        }
}
```

p2 : DemoThread6.java(MainClass)

```
package p2;
import p1.*;
public class DemoThread6
{
     public static void main(String[] args)
     {
         Selection ob = new Selection();
        User1 ob1 = new User1(ob);//Con_call
        User2 ob2 = new User2(ob);//Con_call

        Thread t1 = new Thread(ob1);
        Thread t2 = new Thread(ob2);

        t1.start();
        t2.start();
     }
}
```

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(c)static synchronization - Class Locking process

=>The process of declaring static method with synchronized keyword is known as static synchronization.

=>In Static synchronization the lock is applied on the class and which is known as Class Locking process

=>In Static synchronization all the static members of class are available to one user at-a-time

structure static synchronized method:

```
synchronized static return_type method_name(para_list)
{
 //method_body
}
```

Ex-program:

p1 : Available.java

```
package p1;
public class Available {
    public static int available=1;
}
```

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p1 : Selection.java

```
package p1;
import java.util.*;
public class Selection
{
    public synchronized static void select(int n,String
name)
    {
    if(n<=Available.available) {
        System.out.println(n+" Tickets booked for
"+name+" Time: "+new Date());
        try {
            Thread.sleep(2000);
        }catch(Exception e) {e.printStackTrace();}
        Available.available=Available.available-n;

    }else {
        System.out.println("Tickets not available for
"+name);
    }
    }
}
```

p1 : User1.java

```
package p1;
public class User1 implements Runnable
{
    @Override
   public void run()
   {
       Selection.select(1, "Alex");
   }
}
```

p1 : User2.java

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```
package p1;
public class User2 implements Runnable
{
        @Override
        public void run()
        {
            Selection.select(1, "Ram");
        }
}
```

p2 : DemoThread7.java(MainClass)

```
package p2;
import p1.*;
public class DemoThread7
{
     public static void main(String[] args)
     {
         User1 ob1 = new User1();//Con_call
         User2 ob2 = new User2();//Con_call

         Thread t1 = new Thread(ob1);
         Thread t2 = new Thread(ob2);

         t1.start();
         t2.start();
     }
}
```

==========
=

**imp*

2.Thread Communication process:

=>The process of establishing communication b/w threads is known as Thread Communication process,and which is also known as Inter Thread

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Communication process(ITC).

=>we use the following methods from java.lang.Object class to perform Thread Communication process:

(a)wait()

(b)notify()

(c)notifyAll()

(a)wait():

=>wait() method will make the thread wait(stop the thread) until it receives msg in the form of notify() or notifyAll()

(b)notify():

=>notify() method will unlock the resource and send the msg to the waiting thread.

(c)notifyAll():

=>notifyAll() method also will unlock the resource and send the msg to multiple waiting threads.

Ex-program:

Demonstarting Thread-Communication-process using Producer-Consumer problem

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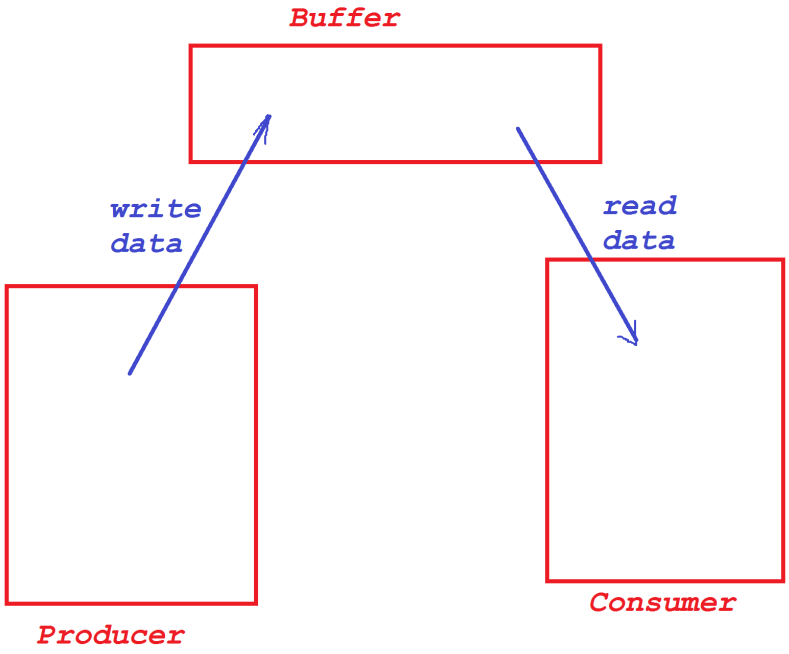
Layout:



Producer will write the data to buffer
Consumer will read the data from the buffer

> *Consumer must wait until Producer writes the data to Buffer,else leads to DeadLock or generate Wrong results*

p1 : Producer.java

```
package p1;
public class Producer implements Runnable
{
    public StringBuffer sb;
    public Producer()
    {
        sb = new StringBuffer();
```

```
    }
    @Override
    public void run()
    {
       try {
           synchronized(sb) {
                for(int i=1;i<=10;i++){
                    sb.append(i+":");
                    System.out.println("Producer writing
data to buffer...");
                    Thread.sleep(2000);
                }//end of loop
                sb.notify();//send message to waiting
thread
           }//end of lock
       }catch(Exception e) {e.printStackTrace();}
    }
}
```

p1 : Consumer.java

```
package p1;
public class Consumer implements Runnable
{
    public Producer prod;
    public Consumer(Producer prod)
    {
        this.prod=prod;
    }
    @Override
    public void run()
    {
        try {
            synchronized(prod.sb)
            {
                System.out.println("Consumer
started...but blocked on wait...");
                prod.sb.wait();
                System.out.println("====Display using
Consumer===");
```

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```
                System.out.println(prod.sb.toString());
            }//end of lock
        }catch(Exception e) {e.printStackTrace();}
    }
}
```

p2 : DemoThread8.java(MainClass)

```
package p2;
import p1.*;
public class DemoThread8 {
    public static void main(String[] args) {
        Producer p = new Producer();
        Consumer c = new Consumer(p);

        Thread t1 = new Thread(p);
        Thread t2 = new Thread(c);

        t2.setPriority(Thread.MAX_PRIORITY);
        t1.setPriority(Thread.MIN_PRIORITY);

        t2.start();
        t1.start();
    }
}
```

o/p:

Consumer started...but blocked on wait...

Producer writing data to buffer...

Producer writing data to buffer...

Producer writing data to buffer...

Producer writing data to buffer...

Producer writing data to buffer...

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Producer writing data to buffer...

Producer writing data to buffer...

Producer writing data to buffer...

Producer writing data to buffer...

Producer writing data to buffer...

====Display using Consumer===

1:2:3:4:5:6:7:8:9:10:

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