

L13: Semaphores IV

(puestas en común HW5 y HW6)

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HW5 + HW6

Homework:

- HW1: Creación de threads en Java
- HW2: Provocar una condición de carrera
- HW3: Garantizar la exclusión mutua con espera activa
- HW4: Garantizar la exclusión mutua con semáforos
- **HW5: Almacén de un dato con semáforos**
- **HW6: Almacén de varios datos con semáforos**

Fecha de Cierre:

Lunes 23-Marzo-2015 23:59

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Producers/Consumers with Unbounded Store

Use variable products to count the number of products:

products : *number of products*

- *Producers* increase products after producing
- *Consumer* decrease products before consuming
(and block if 0)

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Producers/Consumers with Unbounded Store

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products : *number of products*

- *Producers* increase products after producing
- *Consumer* decrease products before consuming
(and block if 0)

How?



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Producers/Consumers with Unbounded Store

Use variable products to count the number of products:

products : *number of products*

- *Producers* increase products after producing
- *Consumer* decrease products before consuming
(and block if 0)

How?

Use a semaphore as counter!

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Producers/Consumers with Unbounded Store

```
class AlmacenUnbounded implements Almacen {
//...
    class Cell {
        public Producto prod;
        public Cell next;
        Cell (Producto p, Cell n) {
            prod = p;
            next = n;
        }
    }
    private Cell head = null;
    private Cell tail = null;
//...
}
```



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Producers/Consumers with Unbounded Store

```
class AlmacenUnbounded implements Almacen {  
//...  
    class Cell {/*... */}
```

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Producers/Consumers with Unbounded Store

```
class AlmacenUnbounded implements Almacen {
//...
    class Cell { /*... */ }
    public void almacenar(Producto producto) {

        Cell the_cell = new Cell(producto, null);
        if (head==null) { // INV: tail==null
            head = the_cell;
            tail = the_cell;
        } else {
            head.next = the_cell;
            head = head.next;
        }
    }
}
```

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Producers/Consumers with Unbounded Store

```
class AlmacenUnbounded implements Almacen {  
//...  
    class Cell { /*... */ }  
    public void almacenar(Producto producto) {  
  
        //inserts a new Cell(producto,null)  
  
    }  
}
```

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Producers/Consumers with Unbounded Store

```
class AlmacenUnbounded implements Almacen {
//...
    class Cell { /*... */ }
    public void almacenar(Producto producto) {

        //inserts a new Cell(producto,null)

    }

    public Producto extraer() {
        Producto result;

        result = tail.prod;
        if (tail == head) {

            call - call.next;

```

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Producers/Consumers with Unbounded Store

```
class AlmacenUnbounded implements Almacen {
//...
    class Cell { /*... */ }
    public void almacenar(Producto producto) {

        //inserts a new Cell(producto,null)

    }
    public Producto extraer() {
        Producto result;
```

// extract tail prod
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Producers/Consumers with Unbounded Store

```
class AlmacenUnbounded implements Almacen {
//...
    class Cell { /*... */ }
    public void almacenar(Producto producto) {
        mutex.await();
        //inserts a new Cell(producto,null)
        mutex.signal();
    }
    public Producto extraer() {
        Producto result;
```

```
        mutex.await();
```

```
        // extract from unbounded store
```

```
        return result;
```



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Producers/Consumers with Unbounded Store

```
class AlmacenUnbounded implements Almacen {
//...
    class Cell { /*... */ }
    public void almacenar(Producto producto) {
        mutex.await();
        //inserts a new Cell(producto,null)
        mutex.signal();
        products.signal();
    }
    public Producto extraer() {
        Producto result;
        products.await();
        mutex.await();
        // extract from prod
```

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return result;

Producers/Consumers with Almacen1

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Producers/Consumers with Almacen1

Use variable `empty` to denote if store is empty

Use variable `full` to denote if store is full

- *Producers:*
 - decrease `empty` before producing (block if 0)
 - increase `full` after producing
- *Consumers:*
 - decrease `full` before consuming (block if 0)
 - increase `empty` after consuming



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Producers/Consumers with Almacen1

Use variable `empty` to denote if store is empty

Use variable `full` to denote if store is full

- *Producers:*
 - decrease `empty` before producing (block if 0)
 - increase `full` after producing
- *Consumers:*
 - decrease `full` before consuming (block if 0)
 - increase `empty` after consuming

How?



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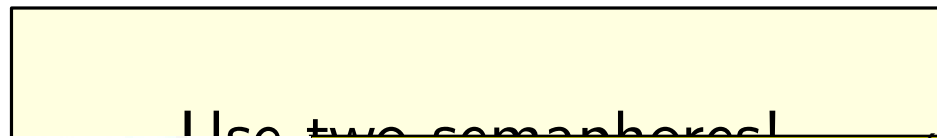
Producers/Consumers with Almacen1

Use variable `empty` to denote if store is empty

Use variable `full` to denote if store is full

- *Producers:*
 - decrease `empty` before producing (block if 0)
 - increase `full` after producing
- *Consumers:*
 - decrease `full` before consuming (block if 0)
 - increase `empty` after consuming

How?



Use two semaphores

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Almacen1

```
public void almacenar(Producto producto) {  
    empty.await();  
    mutex.await();  
    almacenado = producto;  
    mutex.signal();  
    full.signal();  
}
```

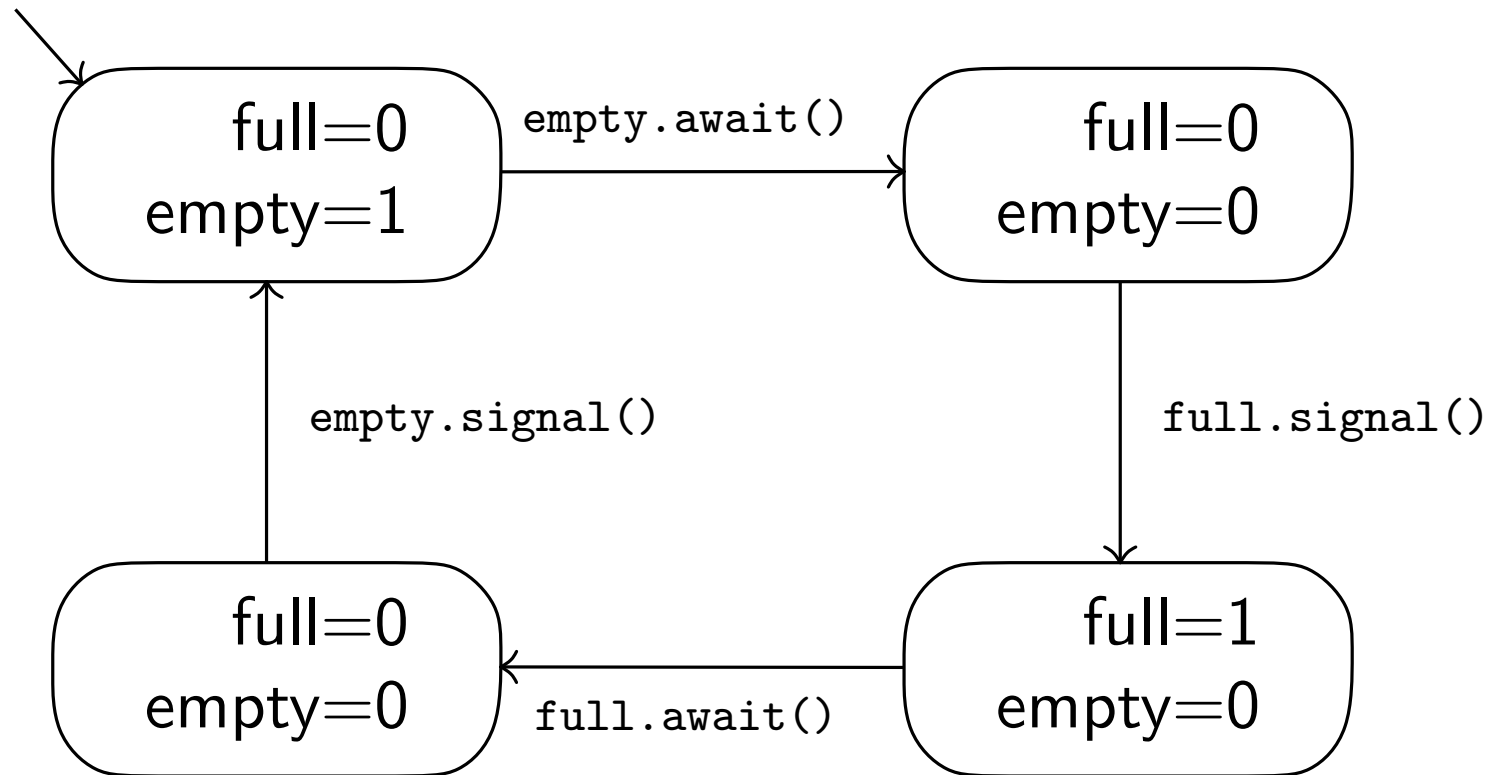
```
public Producto extraer() {  
    Producto result;  
  
    full.await();  
    mutex.await();  
    result = almacenado;  
    almacenado = null;  
    mutex.signal();  
    empty.signal();  
}
```

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Almacen1: Abstracción

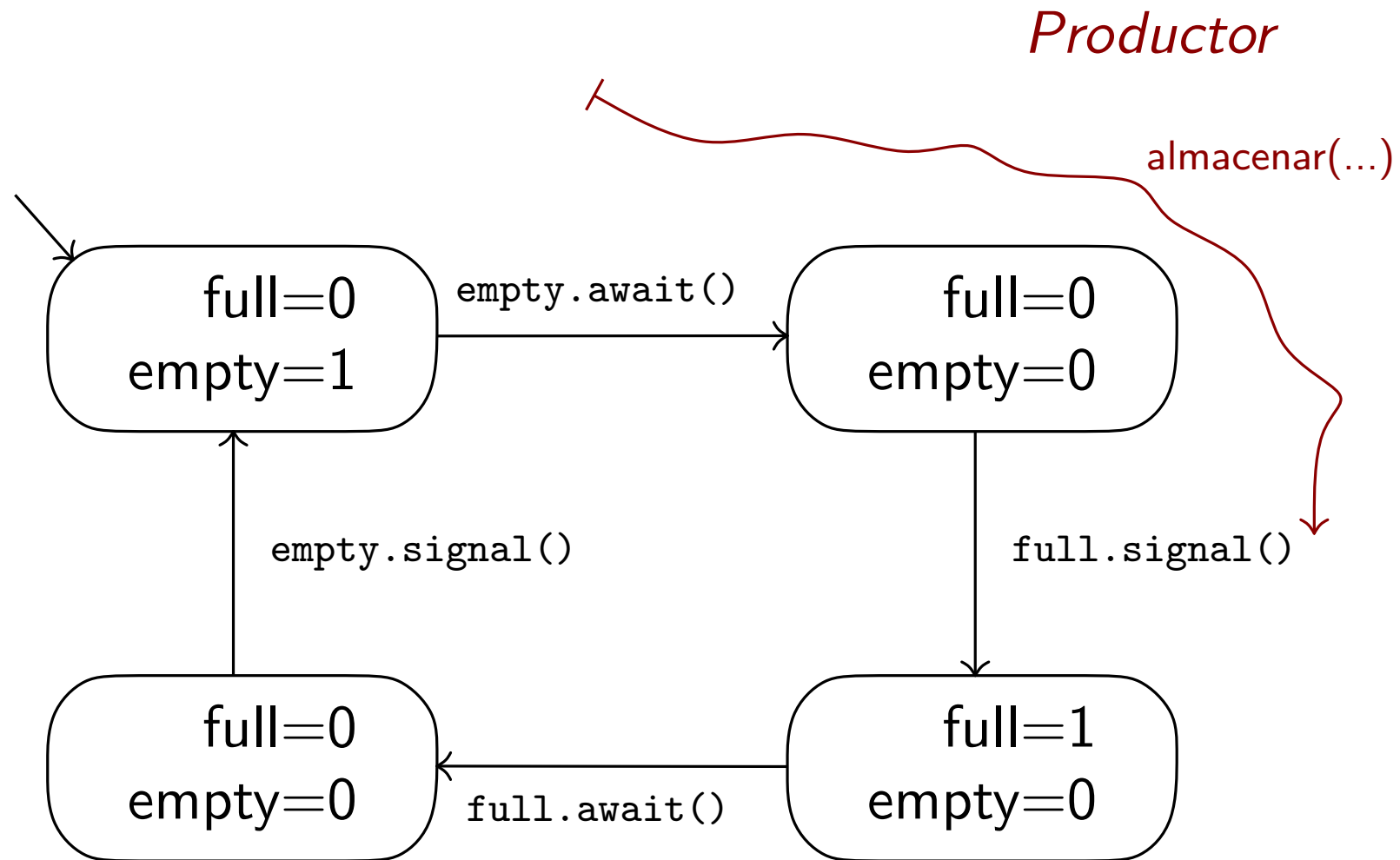


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Almacen1: Abstracción



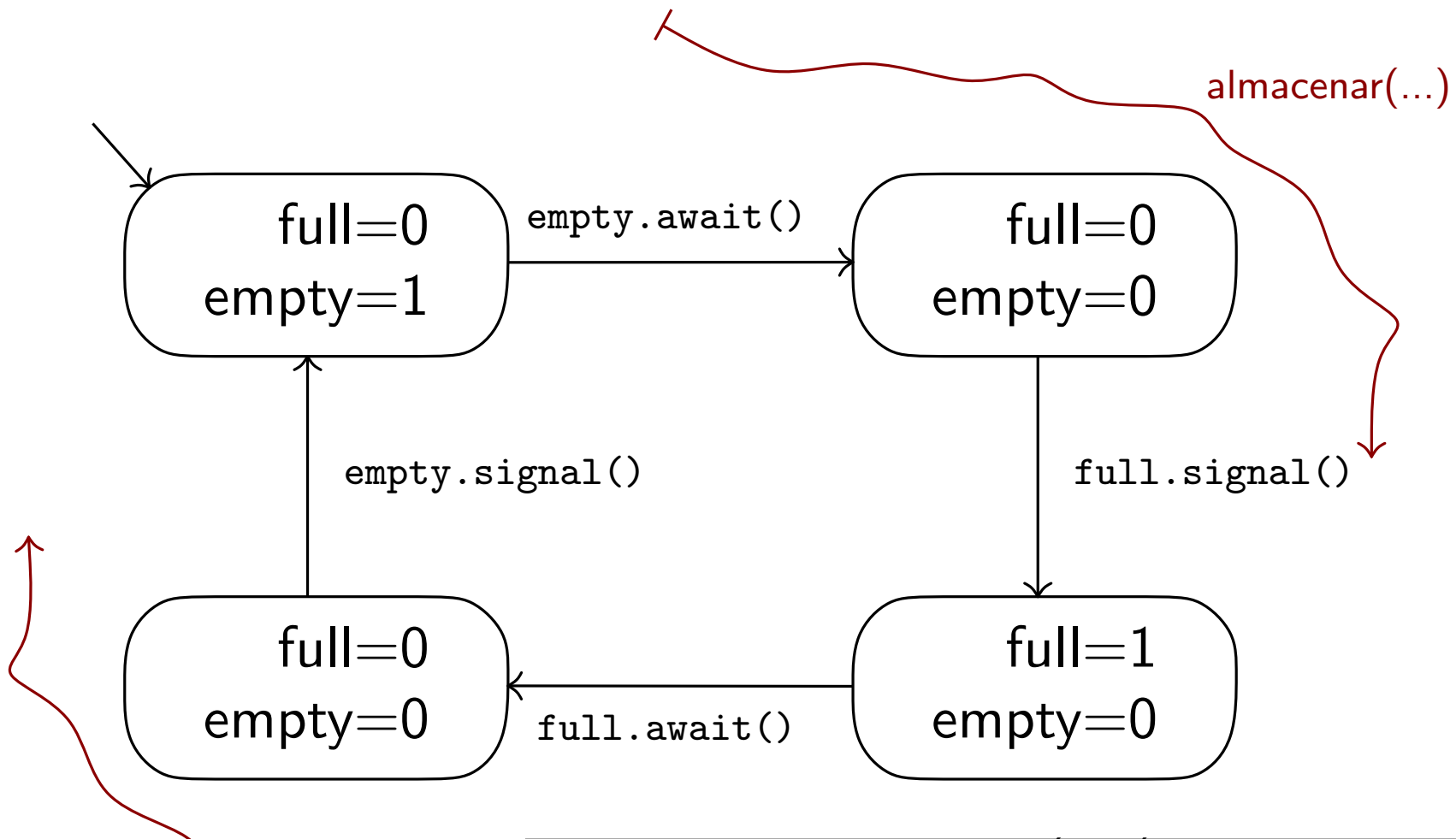
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Almacen1: Abstracción

Productor



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Almacen1 (sol 2)

```
public void almacenar(Producto producto) {
    empty.await();
    // mutex.await();
    almacenado = producto;
    // mutex.signal();
    full.signal();
}
```

```
public Producto extraer() {
    Producto result;

    full.await();
    // mutex.await();
    result = almacenado;
    almacenado = null;
    // mutex.signal();
    empty.signal();
}
```

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Producers/Consumers with AlmacenN

Use variable `holes` to denote available spaces

Use variable `products` to denote available products

- *Producers:*

- decrease `holes` before producing (block if 0)
- increase `products` after producing

- *Consumers:*

- decrease `products` before consuming (block if 0)
- increase `holes` after consuming

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Producers/Consumers with AlmacenN

Use variable `holes` to denote available spaces

Use variable `products` to denote available products

- *Producers:*

- decrease `holes` before producing (block if 0)
- increase `products` after producing

- *Consumers:*

- decrease `products` before consuming (block if 0)
- increase `holes` after consuming

How?



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Producers/Consumers with AlmacenN

Use variable `holes` to denote available spaces

Use variable `products` to denote available products

- *Producers:*

- decrease `holes` before producing (block if 0)
- increase `products` after producing

- *Consumers:*

- decrease `products` before consuming (block if 0)
- increase `holes` after consuming

How?

Use two counting semaphores:

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AlmacenN

```
public void almacenar(Producto producto) {  
    holes.await();  
  
    mutex.await();  
    almacenado[aInsertar] = producto;  
    nDatos++;  
    aInsertar++;  
    aInsertar %= capacidad;  
    mutex.signal();  
  
    products.signal();  
}
```



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AlmacenN

```
public void almacenar(Producto producto) {  
    holes.await();  
  
    mutex.await();  
    // actual product insertion  
    mutex.signal();  
  
    products.signal();  
}
```

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AlmacenN

```
public void almacenar(Producto producto) {  
    holes.await();  
  
    mutex.await();  
    // actual product insertion  
    mutex.signal();  
  
    products.signal();  
}
```

```
public Producto extraer() {  
    Producto result;  
    products.await();  
  
    mutex.await();  
    result = almacenado[aExtraer];  
    almacenado[aExtraer] = null;  
    nDatos--;
```

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```
    holes.signal();
```

AlmacenN

```
public void almacenar(Producto producto) {
    holes.await();

    mutex.await();
    // actual product insertion
    mutex.signal();

    products.signal();
}
```

```
public Producto extraer() {
    Producto result;
    products.await();

    mutex.await();
    // actual product consumption
    mutex.signal();
    return result;
}
```



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