

1. 某进程中有3个并发执行的线程thread1、thread2和thread3，其伪代码如下所示。

```
//复数结构类型定义
typedef struct{
    floata;
    floatb;
}cnum;
cnum x, y, z; //共享变量

//计算两个复数和
cnum add( cnum p, cnum q ){
    cnum s;
    s.a =p.a + q.a;
    s.b =p.b + q.b;
    returns;
}

thread1{
    cnum w;
    w = add( x, y );
    .....
}

thread2{
    cnum w;
    w =add( y, z );
    .....
}

thread3{
    cnum w;
    w.a= 1;
    w.b= 1;
    z = add( z, w );
    y = add( y, w );
    .....
}
```

请添加必要的信号量和wait()、signal()操作，要求确保线程互斥访问临界资源，并且最大程度地并发执行。

简答题 (26 分) 26分

```
semaphore mutex_y_13=1;
semaphore mutex_y_23=1;
semaphore mutex_z =1;
```

```
thread1{
    cnum w;
    wait(mutex_y_13);
    w = add( x, y );
    signal(mutex_y_13);
    .....
}
```

```
thread2{
    cnum w;
    wait(mutex_y_23);
    wait(mutex_z);
    w =add( y, z );
    signal(mutex_z);
    signal(mutex_y_23);
```



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答案解析:

semaphoremutex_y1=1; //mutex_y1用于thread1与thread3对变量y的互斥访问。

semaphoremutex_y2=1; //mutex_y2用于thread2与thread3对变量y的互斥访问。

semaphoremutex_z=1; //mutex_z用于变量z的互斥访问。

互斥代码如下:

```
thread1{
cnum w;
wait(mutex_y1 );
w = add(x, y );
signal(mutex_y1 );
.....
}
thread2{
cnum w;
wait( mutex_y2 );
wait( mutex_z );
w =add( y, z);
signal( mutex_z );
signal( mutex_y2 );
.....
}
thread3{
cnum w;
w.a = 1;
w.b = 1;
wait( mutex_z );
z = add( Z, w);
signal( mutex_z );
wait( mutex_y1 );
wait( mutex_y2);
y = add(y, w);
signal( mutexyl );
signal( mutexy2);
.....
}
```

2. In a system, there are multiple producer processes which produce numbers to a buffer and multiple consumer processes which consume numbers from the buffer, where the buffer is shared among all producers and consumers. The following variables are shared among all processes:

```
int nextc=0, nextp=0,buf[10];
semaphore full; empty;mutex;
```


Producer and consumer processes are given in thefollowing C++-like pseudo programs

Producer Process:	ConsumerProcess:
int itemp;	int itemc;
while(1){	while(1){
1 itemp = rand(); // Generate a number	1 P(full);
2 P(empty);	2 P(mutex);
3 P(mutex);	3 itemc=buf[nextc];
4 buf[nextp]=itemp;	4 nextc=(nextc+1)%10;
5 nextp=(nextp+1)%10;	5 V(mutex);
6 V(mutex);	6 V(empty);
7 V(full);	7 cout<< itemc << endl;
}	}

- (1) What are the critical sections in the givenproducer and consumer processes?
- (2) How should the semaphores **full**, **empty**, and **mutex** be initialized?
- (3) If we switch the order of 2 and 3 in the producer process and the order of 1and 2 in the consumer process,would the system still work properly? Justify your answer.

Producer Process	ConsumerProcess
...	...
1 itemp = rand(); // Generatea number	1 P(mutex);
2 P(mutex);	2P(full);
3 P(empty);	3itemc=buf[nextc];
...	...

简答题 (12 分) 12分

<p>(1)Lines 4,5 in Producer, line 3,4 in Consumer</p> <p>(2)full=0,empty=10,mutex=1</p> <p>(3)No,a deadlocked will be created, if producer get mutex semaphore but there's no empty item, then no consumers continue and the system is deadlocked</p>	<div></div> <div><a data-bbox="1332 1227 1560 1283" href="https://api/uploads/10436956/blc">https://api/uploads/10436956/blc</div>
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答案解析:

(1) Producer: Lines4 and 5.
Consumer: Lines 3 and4.

(2) empty = 10,mutex = 1, and full = 0.

(3) No, the systemmay be deadlocked. For example, if a producer gets mutex semaphore but there isno more empty item, no consumers can continue and the system is deadlocked.

3. In the producer-consumer problem, the orderof wait operations cannot be reversed, while the order of signal operations can be reversed.

判断题 (4 分) 4分

- A. TURE
- B. FALSE

正确答案: A

4. As to semaphores, we can think an execution of signal operation as applying for a resource.

判断题 (4 分) 4分

- A. TURE
- B. FALSE

正确答案: B

5. Critical section can be enforced with a general semaphore whose initial value is greater than 1.

判断题 (4 分) 4分

- A. TURE
- B. FALSE

正确答案: B

6. Suppose 9 producers and 6 consumers share a buffer with size of 8. In order to use the buffer properly, the semaphore mutex of critical section of the buffer is initialized to _____。

单选题 (5 分) 5分

- A. 1
- B. 6
- C. 8
- D. 9

正确答案: A

7. Suppose 5 processes share mutual exclusive sections. If 3 processes are permitted to enter the mutual exclusive sections at the same time, then the semaphore of mutual exclusion sections should be initialized to _____。

单选题 (5 分) 5分

- A. 0
- B. 1
- C. 3
- D. 5

正确答案: C

8. Which of the following Critical Section problem solutions results in busy-waiting?

单选题 (5 分) 5分

- A. Monitor
- B. Special machine instruction
- C. Semaphore
- D. critical region

正确答案: B

9. Suppose that a process is executing "counter=counter+1" while another process is executing concurrently and independently "counter=counter-1", where the counter is a variable shared between the two processes. Given that the value of counter is five before execution, the possible value(s) after both processes finish their statement are .

单选题 (5 分) 5分

- A. Four
- B. Five
- C. Six
- D. All of above

正确答案: D

10. The mutual exclusion semaphore of two concurrent processes has the value 0 (zero) at this moment. It indicates that_____.

单选题 (5 分) 5分

- A. no process has entered the critical-section
- B. a process has entered the critical-section, and no process is being blocked
- C. a process has entered the critical-section, another process is waiting to enter the critical-section
- D. two processes have entered the critical-section

正确答案: B

11. The initial value of semaphore S is 2. if the value is -3 at present, how many processes are blocked on this semaphore .

单选题 (5 分) 5分

- A. 1
- B. 2
- C. 3
- D. 4

正确答案: C

12. Three processes are synchronizing on a shared code segment which is protected by a semaphore. If at most two processes are allowed to enter the code segment simultaneously, which of the following results shows the possible values that the semaphore may have?

单选题 (5 分) 5分

- A. 2, 1, 0, -1
- B. 3, 2, 1, 0
- C. 2, 1, 0, -1, -2
- D. 1, 0, -1, -2

正确答案: A

13. 有两个进程P1和P2描述如下:

shared data:

int counter = 6;

P1 :

Computing;

counter=counter+1;

P2:

Printing;

counter=counter-2;

两个进程并发执行, 运行完成后, counter的值不可能为_____。

单选题 (5 分) 5分

A. 4

B. 5

C. 6

D. 7

正确答案: C

14. 下列哪一个问题只包含进程互斥问题?

单选题 (5 分) 5分

A. 田径场上的接力比赛

B. 两个进程都要使用打印机

C. 一个生产者和一个消费者通过一个缓冲区传递产品

D. 公共汽车上司机和售票员的协作

正确答案: B

15. 假设一个正在运行的进程对信号量S进行了P (WAIT) 操作后, 信号量S的值变为-1, 此时该进程将_____。

单选题 (5 分) 5分

A. 转为等待状态

B. 转为就绪状态

C. 继续运行

D. 终止

正确答案: A