一、FILL IN BLANKS (1 point * 20)

1. system call . 2. privilege 3. ready , waiting .

4. kernel . 5. trap 6. J1, J3, J2

7. the number of processes waiting on the semaphore queue . wait , signal 。

8. shared memory message passing 。

9. process . memory , I/O devices

10. Progress , bounded waiting . 11. CPU 12. Monitor 13. safe

二、Select the best answer for each blank (1 point * 14)

1. B 2. D 3. B A 4. B 5. C 6. C
7. D 8. C 9. D 10. B 11. A 12. D 13. A

三、Judge the following statements, if right tick √, or X (1 point * 10)

1. (√) 2. (X) 3. (X) 4. (√). 5. (X)
6. (X) 7. (√) 8. (X) 9. (√). 10. (√)

四、Essay question (14 points)

1. (6 points) explains the following terms

(1) critical section

Critical section is a program code segment in which the critical resource is accessed.

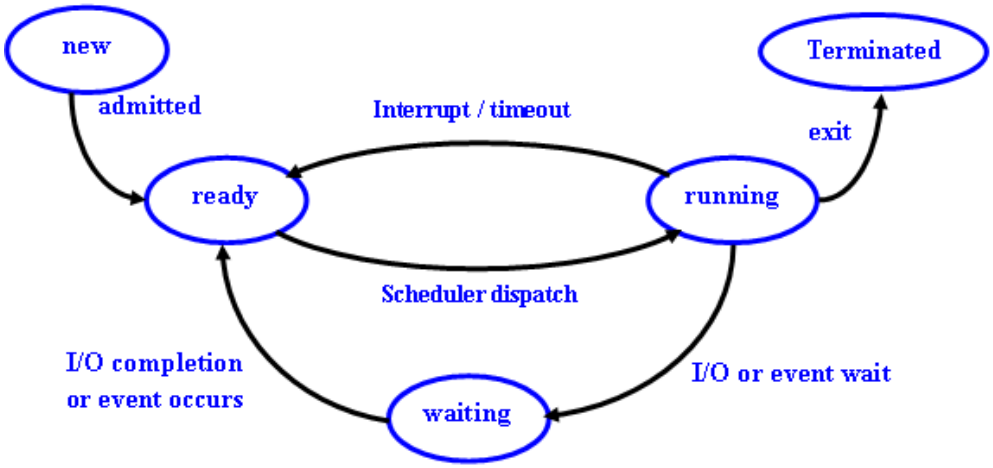
(2) deadlock

A process requests resources; if the resources are not available at that time, the process enters a wait state. Waiting processes may never again change state, because the resources they have requested are held by other waiting processes. This situation is called a deadlock.

(3) interrupt

An interrupt is a signal sent to the CPU by an external device, typically an I/O device.

2. (5 points).



3. (3 points) Please list the three classic problems of process synchronization described in the text book.

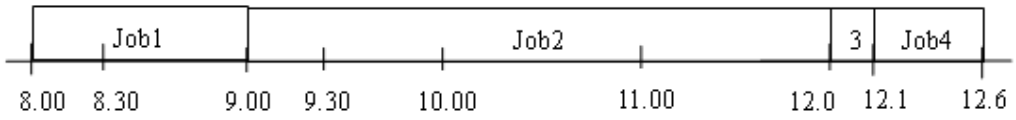
The Bounded-Buffer producer-consumer problem

The Readers-Writers Problem

The Dining-Philosophers Problem

五、（15 points）

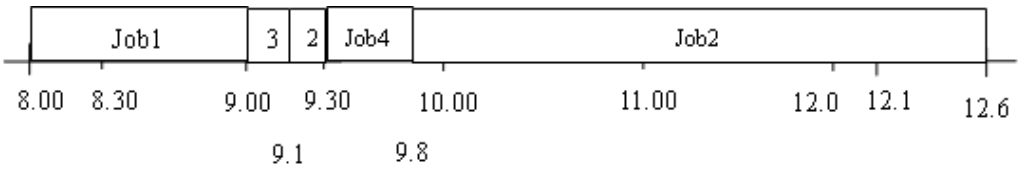
(1)



T1=9.0-8.0=1　　T2=12.0-8.3=3.7　　T3=12.1-9.0=3.1　　T4=12.6-9.3=3.3

T=(T1+T2+T3+T4)/4=(1+3.7+3.1+3.3)/4=11.1/4=2.775

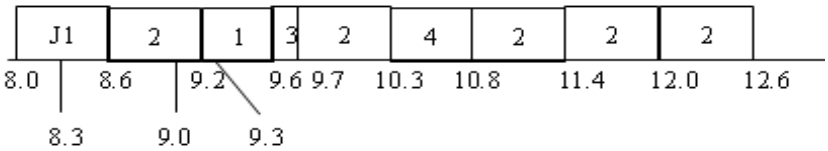
(2)



T1=0　　T2=(9.1-8.3)+(9.8-9.3)=0.8+0.5=1.3　　T3=0　　t4=0

T=(T1+T2+T3+T4)/4=(0+1.3+0+0)/4=1.3/4=0.325

(3)



T1=9.2-8.6=0.6　　T2=(8.6-8.3)+(9.7-9.2)+(10.8-10.3)=0.3+0.5+0.5=1.3　　T3=9.6-9.0=0.6

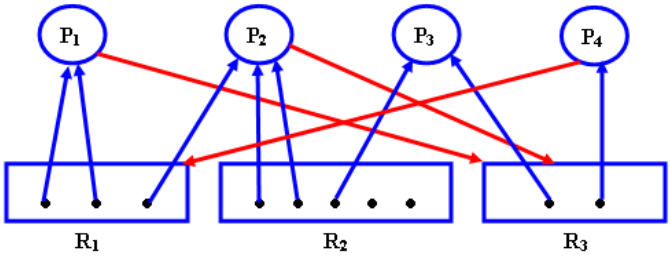
T4=10.3-9.3=1.0

T=(T1+T2+T3+T4)/4=(0.6+1.3+0.6+1.0)/4=3/4=0.875

六、 (13 points)

a) Total resources in the system are (R1, R2, R3) = (3, 5, 2),

b)



c) System is in an unsafe state

Need=

	needs		
	R_1	R_2	R_3
P_1	0	0	1
P_2	1	3	2
P_3	1	3	1
P_4	2	0	0

Resources available=(0, 2, 0) can not satisfy the requirements need from any processes, so there exists no safe sequence of processes, so system is in an unsafe state.

d) System is not deadlocked.

According to deadlock detection algorithm,

Work=(0,2,0) finish[i]=false for i=1,2,3,4

Because request3=(0,0,0)<need3 and request3<work

So, finish[3]=true, work=(0,3,1)

Because request1=(0,0,1)<=need3 and request1<work

So, finish[1]=true, work=(2,3,1)

Because request2=(0,0,1)<need2 and request2<work

So, finish[2]=true, work=(3,5,1)

Because request4=(1,0,0)<need4 and request4<work

So, finish[4]=true, work=(3,5,2)

Finish[i]=true for all i, so the system is not deadlock.

七、(14 points)

ANSWER:

SEMAPHORES

SCOOP=1; Used for mutual exclusion use of the coop.
STIGER=0; Used for synchronization between the process tiger-hunter and feeder.
SPIG=0; Used for synchronization between the process pig-hunter and kitchener.
MUTEX=1; Used for mutual exclusion operation on variable pigcount.
PIGROOM=2; used to record the rooms left for keeping pigs.

VARIABLE

Pigcount=0; used to record the number of pigs kept in the coop.

CODE SECTIONS:

```
(1)  wait(SCOOP);
(2)  signal(STIGER);
(3)  wait(STIGER);
(4)  signal(SCOOP);
(5)  wait(PIGROOM);
     wait(MUTEX);
          pigcount++;
          if (pigcount==1)   wait(SCOOP);
     signal(MUTEX);
(6)  signal(SPIG);
(7)  wait(SPIG);
(8)  wait(MUTEX);
          pigcount--;
          if (pigcount==0)   signal(SCOOP);
     signal(MUTEX);
     signal(PIGROOM);
```