```
»»(Client)°·ÎÆSerrer
  2_Ó»ÓÒ̼Ë»£±ÊËõ·ÊÓËõÃ×£CLIENT¢° CLIENT¢¡Õ2̼Ë»¹ÏÒÌ»¶Ì´Ó»£SERVER¢£SERVER¢¡µµ¡À×Õ2̼Ë»µ´Ó×
Ò±Đ°ËĐÒ´½Đ¡ÎÁĐμÒÌ´Ó»°2̼˻ּμĺĐ£ĨÃÊÓÁÒ¸ÌÊμ¶Ï£Đ°μ»¹(SEMAPHORE)
аµ(SEMAPHORE)
  ÃÌ´Ó»ÓÒ ÓÖÓ¹µĐ°µ¡Đ°µÓ2 ×Ì£S1°S2¡µ´Ó»¿Ò¹½Ê´Ó×ÒÊ£ÆĐ°µ´Ó×ÌS1£µ´Ó»ÕÃÓÖÐÄ´Ó×ÒÊ£ ÆĐ°µ´Ó×ÌS2¡
  аμμ×Ì×»¿ÒÊ£ ¡S1¡S2¡°¡S2¡S1¡
  μÓ» ¼Ë»·Ò ˙Ó×ÒÊ£ ¼Ë»½Îаμ·³Ò ÏÏ£; ARE YOU OPEN;
  Èаµ´Ó×ÌS1£Ô¸Đ°µ½×»µ×ÌS2£ ²ÇϸË.³ÉÊаµ¼Ë»»´Ò¸ÏÏ£¡OPEN¡¡
  Èаµ´Ó×ÌS2£Ô¸Đ°µ·»µÏϽÊ¡CLOSED¡¡ µ´Ó»Í³´Ó×ÒÖ°£¸´Ó»½ÏÆĐ°µ·³Ò¸ĪÏ£¡READY¡(ÒǾĐ£¿Ò½Ê´Ó×Ò)¡Đ°µÊµÏÏ¡
READY;Ö°£Á¼×È×ÌS1;
¶ÏÀĐ©©Đ°µ(SEMAPHORE)©©µÃÊ
  1141(DOCUMENTATION 1)ÖÄ12ÕµĐ°µµÏĨÃÊ;ÆÖ°À£
  ¡¶ÏÀĐаμμΕ̈́Ó¿Äμ±Ê·(IDENTIFIER)°×Ì(state);
  ¡ÓϼÁ±(Priority List)
  ¡ÍĐÍ(Communication Diagram)
  ¡×Ì×»Í(State Transition Diagram)
   ¡`Receive Procedures' @@ËÓÀÃʵÇаµÊµÏÏ£¡ ReadyỡAre you open¡Ö°£Đ°µËÓ»´µÏÏ¡ ÓϾÁ±ÖËÒĐÒÊÒÎаµÓ
¿ÄÔÍÒ'Êμ¶ͺÏĬ£¶Đ°µÓÖÄËе´ÀÕÐĬÏ¡Ĩ¼1ÖµÓϼÁ±ÖÊ£·ÎÆserverµĬϵÓϼ Ó¿,»>clientiϵÓϼ¡ÓÈ£sever(2)µĬĬµÓϼ Ó
server(3)µÏϵÓÏ<sup>1</sup>/<sub>4</sub>;
¶ÏÀĐ©©¿»»(CLIENT)©©µÃÊ
  ´Î<sup>1</sup>/<sub>4</sub>2(Document 2)Ä<sup>1</sup>/<sub>2</sub>Õμ¿»»μΙΪ́ÃÊ¡CLIENTÀĐμÒ、¶Ï¿Ò´ÓÒÏÈÖ×ÌÖμÒ、:SA£SB»SC¡
 ¡μĸCLIENTÃÓ·3´Ó×Ò£²ÇÓÖÓ¹µSEVER(¹¼´Ó»)Ò²ÔÃÓ´À¸CLIENT(¹¼¹¼Ë»)µ´Ó×Ò£Ô¸CLIENT´Ó×ÌSA ¡
 ¡µÄ CLIENTÏÍ ÎÒ SEVER£Ô CLIENT´Ó×ÌSB¡
  ×Ò£CLIENT±Đ¾¹Đ°µSEMAPHORE²Ä·ÎSEVER;
 ¡µÄSEVERÕÔÖÐÄCLIENTµ´Ó×Ò£Ô, CLIENT´Ó×ÌSC;
  Òͺ¿»»CLIENTµ×Ìx»¿ÒÊ£¡SA¡SB¡£¡SB¡SC¡£¡SC¡SA¡µ¿»»´Ó×ÌSB£Ë¿Ò½ÊĐºµ·ÀµÏÏ£¡CLOSED¡¡Ôʵ¡CLOSED¡Öº£Ë±
Đμ´Ò¶Ê¹¼(¡WAITING PERIOD¡)²ÄÔÒ´.³ÏÏ£¡are you open¡£,аμ¡È¹¿,»»ÊμμĬϲÊ¡CLOSE¡¶Ê¡OPEN¡£Ä˾×±μ×ÌSCŁÏÓ´Đ
°µÓ¹µSEVER(¼´Ó»)·³´Ó×Ò¼ÏĬ¡S£Job¡¡ÓÊ£ SEVERÖдÓ×Ò¡µ´ÓÖÐͱÖ°£ SEVER½ÍÊ.³2 ÏÏ£
 ¡Ò¸Ê£¡READY¡(¾Đ)£·¸Đ°µ¡
 ¡ÁҸʡC£READY¡£·¸CLIENT¡CLIENTʵ´ÏϰÓ×ÌSC×±µ×ÌSA¡
  Ŀҹ⁄4¶´Ó»ÊÀÏ»(ιÕ)µ£ ˶ÓËʵµÈ°´Ó×Ò¶¿Òͳ¡
<sup>3</sup>⁄<sub>4</sub>ÀÀË£ËÉÖ<sup>2</sup>»<sup>3</sup>Ï¡ÈÖ¡µÇС
ĺĐ
  ´Î¼3(DOCUMENT 3)ÖĽÕµĺĐ½ἹįÆÖͺ³ËÓĬÏÀмÏĬ·³Õ°½ÊÕÖ¼µӴ¡ÔĬÏÁ±(MESSAGE LIST)֣ĿÒÕµÃÖĬÏÀеËãÃ
ÖÏĬÓÒ ±Ê·£Ò ĬĬ·³Õ£Ò ĬĬ¹⁄2ÊÕ£ÓÊ»°°ĬĬÄÈ;
  ΊΪ·<sup>3</sup>ÕÔÊ¿Τ·<sup>3</sup>±Ê·ÎΑμΙΪ£Ô½ÊÕÔÊ¿Τ£1´ÀͺΪΪ£<sup>1</sup>¼ÖĐ
   ¡RECEIVE PROCEDURE¡A
  ÈÔÍÒÊ¿T£Ó¶ ĬĬ·³ÕĬÍÒ½ÊÕ·³ĬĬ£Ô½ÊÕÔÊ¿T£1´ÀËÓÕĐĬĬ£ÆÏ°ËĐ×Õ·³ÕÔ½ÊÕÓĬÁ±ÖµËС
×ÈÎA
  Ò 3/42 ÇÓ Í (LAN) ÔÊ ¿ O°° ÏÁ¶Ï£
```

Object:CLIENT¢£Client.State=SA,

```
Waiting_Period=2,Number_of_Servers=1
      Object:CLIENT¢,Client.State=SA,
      Waiting_Period=1,Number_of_Servers=1
      Object:SERVER¢
      Object:SEMAPHORE¢,Semaphore.State=S1
  <sup>1</sup>¾ÓÍ£Ò.³ÏÁÏÏ£
      At tine 1:CLIENT¢sends a message with the
            identifier "Are_you_open?"
     At time 2:CLIENT¢sends a message with the
            identifier "Are_you_open?"
     At time 4:SERVER¢sends a message with the
            identifier "Are you open?"
     At time 5:CLIENT¢sends a message with the
            identifier "Are_you_open ?"
ι¼£ÖÊ£¶ÓаµSEMPHORE¢£·ÎÆ¢°¿»»CLIENT¢°CLITENT¢ÔÊ¿±Ö(ֵʿ6)ÕжÏʵµĬĨ£.³µĬĨ,´ÓÊÃ×̹¼(»Õ)×±µÊÃ×Ì¡
ÎÌA.1
  ÔÊ¿££ È CLIENT ¢ÊμΙΙ; C_JOB¡£½»·ÉÊÃÊ£½′°ĐÔΙ¾5(Documentation 5)
ÎÌA.2
  ÔÊ¿££ È CLIENT ¢ÊµÏÏ¡ C_JOB¡£½»·ÉÊÃÊ£½´°ĐÔμ5(Documentation 5)
ÎÌA.3
È·ÉÏÁʹ⁄4£
  jÔÊ¿8£SERVER¢·Éӱʷ¡Ready;µÏÏ¡
  ¡ÔÊ¿10£CLIENT¢Êμӱʷ¡C JOΒ¡μΙΪ́;
  jÔÊ¿12£SERVER¢·Éӱʷ¡Ready¡µÏÏ¡
Ç̰μ44ֵʿ±(ֵʿ13)
×ÈÎB
 342ÇÓ±Àգ˰°Á¶Ð°µ©©·ÎÆ£(SEMAPHORE¢£SEMAPHORE¢, SERVER¢£SEVER¢)
 ¶ÓÃͺ¿»»CLIENT,Number_of_Server=2¡ĨÁÄÊÓ2ͺ´Ó»£Î⁴⁄42Ö¶ÏÀĐμ¶ÒĐÒ×Đͺ±¡¿ÔĴ⁴⁄46ÖÕμͺ±:
      `Receive Procedures`: C Job and Wait
 ÔÎ<sup>1</sup>⁄46ÖÄ»¿ÒÕμÔÊ¿ΟμÇ¿μÃÊ¡
 ÔÏÁÊ¿£½ÊµÏÁĐÏ£
  At time O:CLIENT¢ receives a message "C_Job"of a user.
  At time O:CLIENT¢ receives a message "C Job"of a user.
  At time 4:SEMAPHORE¢ receives a message "Ready".
   ͺ¾CLIENT¶ÏÀĐμͺ±£ÔÀÕμ¾ÓÍLANÖ½»·ÉÊã
  ÔÎ<sup>1</sup>/<sub>4</sub>6Ö±<sup>3</sup>ÕÈ<sup>1</sup>°i
×ÈÎC
 ×ÈÎBÖ¶Ó¶ÏÀĐCLIENTµ¶Ò¸±£¶ÓÓ¶¸Đ°µ©©·ÎƶµÀÕµ¾ÓÍÀˣҾʲ¹Á¡
×ÈÎC.1
   ±¶ÏÀĐCLIENTµ¶Ò(²¿Î¹¼2)£Êµ¾ÓÍLAN(¾Ó¶¸Đ°µ£·Îƶ)µ¹ÄÈÏ£
```

```
¶ÏCLIENT(I)¿ÒÊÓ¾ÓÍLANÖȰÒ、ÎÆ¡µÊ£CLIENT(I)ÔÒ、Ê¿ÖÄÓÒ、Ć×Ò±ÎÆÖУÒ、CLIENTµÃ、Ć×ÒÖıĆÓÒ´¡
  ¶ÏCLIENT(I).<sup>3</sup>ĬĬ¡are_you_open£¡<sup>31</sup>μ·Ĭ¶¸Đ°μ£ÖμÊμÄĐ<sup>11</sup>⁄4ÖÊÎÖ£»ÕÊÊμ¡CLOSED¡»ÕÊμÒ¸¡OPEN¡¡μ¶ÏCLIENT(I)μ´<sup>11</sup>⁄4Ö
£CLIENT(I)Òµ´Ò¶Ê¹¼²ÄÔ´.3;are_you_open£;°Äµ½´ĐÈμ7;
×ÈÎC£2
  \circÏÊ\cdot\cdot_\pm¶ÏÀĐCLIENT£Ê\muCLIENT(I)ÏÔ¿ÒÓ¶_{\cdot}Ó×ÒÔÍÒÊ¿ÖÐ(\pm¶_{\cdot}SEVERÍÊÖÐ)_{\mu}Ê£Ã_{\cdot}CLIENT(I)_{\mu}Ó×Ò×ÊÊ_{\mu}CLIENT(I)_{i}JO
B¡MAXMUMµÏÖ¡
  °Äµ½´ĐÈμ8;
Documentation 1
                                       PRINT
Object type: SEMAPHORE
                         аμ
  POSSIBLE Identifiers:(SEMAPHORE¢,SEMAPHORE¢,..) ©
  ©
    State:{S1,S2},initial state is S1.
                                              ©
  ©
    Priority List:SERVER¢,SERVER¢,...,CLIENT¢,CLIENT¢,...
  Communication Diagram
                           ĺĐĺ
             Are you open(CLIENT(I), SEMAPHORE(J)) ;
                                   Closed(SEMAPHORE(i), CLENT(J))
Open (SEMAPHORE(I), CLIENT(J)) ;
   ©
                                      ©
   ©
            State Transition Diagram xìx»Í
                                           0
   ©
                                      ©
   ©
   ©
             00000000000000
   ©
             ©
   ©
             S1
                           S2
                                        ©
   ©
   ©
             00000000000000
                                          0
   ©
                                      ©
   ©
                                      ©
   ©
                                      ©
   Ready (SERVER(I), SEMAPHORE(J))
                    ©
                  (15.3-1)
```

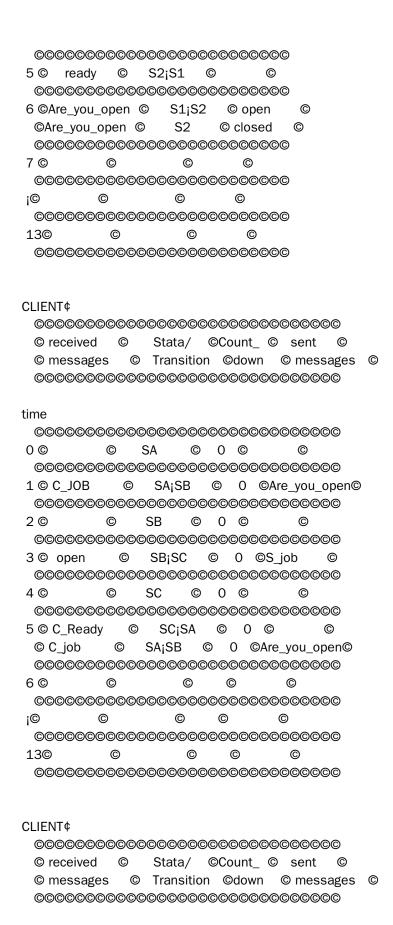
Receive Procedures ½Ê¹³

```
begin
 if State=S1
 then State ¡S2
    Send ("Open (Semaphore ,Client)")
 else
 if State=S2
 then Send ("Closed(Semaphore, Client)")
procedure Ready (Server, Semaphore)
begin
 State;S1
end
Documentation 2
                                      PRINT
                    ¿»»(¿Ê×COMPUTER)
Object type :CLIENT
  © Possible Identifiers:(CLIENT¢,CLIENT(2),CLIENT(3),...)
                                                     ©
  © State:(SA,SB,SC);initial state is SA.
  © Priority List CLIENT, SERVER ¢, SERVER (2),..., SEMAPHORE ¢,
  ©
             SEMAPHORE(2),...,USER¢,USER(2),...
  ©
  © Countdown: {t©t;N;initial value is 0.
                                                0
                                          (C)
  © Waiting Period {t©t;N and t>0}
                                                ©
  © Semaphore Index: {i@i =1,2,...,Number of Servers }
                                                      ©
  © Number of Servers :(i@i¡N and i>0}
                                                  0
  Communication Diagram ÍÐÍ
          ©
                        i
         ©
                        0
         0
                        ©
                Try_later(CLIENT(I), USER(J), EXPLANATION)
C_JOB (USER(i)£CLIENT(J),DOCUMENT(K))
                       0
         i
   S Job(CLIENT(i), CLIENT(j), DOCUMENT(K))
                                            0
   0
              State Transtition Diagram
                                        ©;©©©
   ©
        ©
                  ©;SA©©© ×Ì×»Í
   © ©;©
                           Wait(CLIENT(i)CLIENT(i))
C Ready(SEMAHORE(i),CLIENT(j)) SC;©© SB
                                                 i
   © ©
                    ©
             @Are_you_open(CLIENT(i),SEDMAPHORE(j))
   © @Open(SEMAPHORE(i),CLIENT(j)) Closed(SENAPHORE(i),CLIENT(j))
                    i
```

procedure Are_you_open(Client,Semaphore)

```
Receive Procedures ½Ê13
procedure C_job (User,Client,Document)
begin
  if State =SA
  then State ;SB
     Send ("Are_you_open(Client,SEMAPHORE (Semaphore Index))")
 else
  if State =SB
 then Send ("Try_later (Client, User, Client is busy )")
 else
   if State =SC
   then Send ("Try_later(Client,user,All_Servers are busy )")
end
procedure open (Semaphore ,Client )
begin
 if State =SB
 then State;SC
    Send ("s_job (Client, Server, Document)")
end
procedure Closed (Semaphore ,Client)
begin
Countdown ¡Waiting Period
 Send ("Wait(Client, Client)")
end
procedure Wait (client, Client)
begin
 Countdown ¡Countdown-1
 if Countdown>0
 then Send ("wait(Client,Client)")
 else Send ("Are_you_open(Client,SEMAPHORE (Semaphore Index))")
 end
procedure C_Ready (Server, Client)
begin
 State ¡SA
 end
Documentation 3
                                              PRINT
Communication Structure Diagram ÍÐ1/21Í
           0000000000
                  USER ©©©©Ó»
           0000000000
             ©
             C_Job
                     Try_Later©©©¹Ò»¶ÔÊ
                     ©
           0000000000
     © S_Job © CLIENT ©©©©¿»»(´´ÖCOMPUTER)
```

```
¡ Are_you_open ¡
    © ©
          ©
               ©
                   ©
                © Closed
    © ©
         open
      0
          ©
                  0
      0
         0000000000
         © SEMAPHORE ©©©Đ°µ
    \odot
         0000000000
    \odot
              i
                Ready©©©¾Đ(Ò×±°Á)
    © C Ready
    © ©
    0 000000000000
    @@@@j@
              SERVER ©© ·ÎÆ(´´Ö´Ó»)
          000000000
             (15.3-3)
 ΪΊÁ±
MESSAGE LIST
              (i,j,k;N)
                         ÄÈ
±Ê٠
          .зÕ
                 ½ÊÕ
indentifier
            sender
                      receiver
                               content
Are_you_open ?
               CLIENT(i)
                         SEMAPHORE
C_JOB
                                DOCUMENT(k)Î<sup>1</sup>/<sub>4</sub>(K)
             USER(i)
                      CLIENT(j)
C_READY
              SERVER(i)
                        CLIENT(j)
CLOSED
              SEMAPHORE(i) CLIENT(j)
OPEN
             SEMAPHORE(i) CLIENT(j)
                       SEMAPHORE(j)
READY
             SERVER(i)
                                 DOCUMENT(k)Î<sup>1</sup>/<sub>4</sub>(K)
S JOB
             CLIENT(i)
                       SERVER(j)
                                ECEPLANATION ËÃ
Try Later
            CLIENT(i)
                      USER(j)
Wait
            CLIENT(i)
                     CLIENT(i)
Documentation 4, Answer Subtask a.3
                               PRINT
                                       Commpetitor Code
SEMATPHORE¢
 © received ©
                           sent ©
                Stata/ ©
 © messages
            © Transition © messages ©
 000000000000000000000000000
time
 S1
                     ©
                             ©
          0
 0000000000000000000000000000
1 ©
          0
               S1
                     ©
                             (C)
 00000000000000000000000000
                         © open
                                   ©
2 ©Are_you_open © S1;S2
 00000000000000000000000000
3 @Are_you_open @
                   S2
                         © closed
 00000000000000000000000000
4 ©
          0
               S2
                     ©
                             ©
```



time

00000000000000000	00000000000000	
0 © SA ©	0 © ©	
000000000000000000	00000000000000	
1 © SA ©	0 © ©	
000000000000000000	0000000000000	
2 ©C_JOB © SA¡SB	© 0 @Are_you_open©	
000000000000000000000000000000000000000	0000000000000	
3 © SB ©	0 © ©	
000000000000000000	0000000000000	
4 @Closed © SB	© 0¡1 ©wait ©	
000000000000000000	0000000000000	
5 © wait © SB	© 1¡0	
000000000000000000		
6 © ©	© ©	
00000000000000000	0000000000000	
i© © ©	© ©	
000000000000000000	0000000000000	
13© © ©	© ©	
00000000000000000	0000000000000	
(Í5.3-4)		
(/		
Documentation 5	PRINT	
000000000000000000000000000000000000000	0000000000000000	
©	©	
© Question A.1	©	
•	ed if CLIENT¢receives a message ©	
© "C Job"at time 4?	©	
© ÔÊ¿4,CIIENT¢ÊµÏÏ"C_Job",		
©	©	
- 000000000000000000000000000000000000	0000000000000000	
0000000000000000000	0000000000000000	
©	©	
© Question A.2	©	
	ed if CLIENT¢receives a message ©	
© "C_Job"at time 4?	©	
© ÔÊ¿4,CIIENT¢ÊµÏÏ"C_Job",	-	
©	©	
000000000000000000000		
(Í5.3-6)		
(1818 3)		
Documentation 6,Subtask B	PRINT	
	00000000000000000000	
©The changed`Receive Proced		
©Procedure C_Job (User,Clien		
©begin	©	
© if State=SA	©	
© then State;SB	©	
	1 step 1 until Number_of_Servers ©	
	en(Client,SEMAPHORE(Semaphore_Index))")	©
Scha (Ale_you_ope	m(onent,outment fronth(oemaphore_maex)))	9

```
© else
                                              ©
© if
     State=SB
© then Send("Try_later(Client,User,Client_is_busy)")
                                                         (C)
  else
© if
     State=SC
  then Send("Try_later(Client, User, All_Servers_are_busy)")
                                                           0
  end
                                             0
©
© procedure Wait (Client, Client)
                                                    ©
© begin
                                              ©
©
   if State=SB
©
   then Countdown; Countdown -1
                                                      (C)
©
            Countdown>0
                                                  (C)
      if
(C)
             Send("Wait(Client, Client)")
      then
                                                     (C)
©
      else
                                              ©
©
      if
            Countdown<0
©
      then
             Countdown;0
©
             for Semaphore_Index ;1 step 1 until
       else
0
            Number_of_Servers Send( "Are_you_open
©
            (Client, SEMAPHORE (Semaphore_Index))")
                                                          ©
© end
© At time 0 the situation in the LAN is as follows:
©Object:CLIENT¢, client.state=SA, Waiting Period=2, Number of servers=2 ©
©Object:CLIENT¢, client.state=SA, Waiting Period=1, Number of servers=2
©Object:SEMAPHORE¢,Semaphore.State=S1
©Object:SEMAPHORE¢,Semaphore.State=S1
                                                            ©
                                                            0
OAt the following times the following messages are received:
©At the 0: CLIENT¢ receives a mssage"c Job"of a user.
                                                            0
©At the 0: CLIENT¢ receives a mssage"c_Job"of a user.
                                                            ©
©At the 4: SEMAPHORE¢ receives a mssage"Ready".
©What happens in the extended LAN according to the changed object type ©
©CLIENT?
                                                ©
©Mark the correct answer.
©(a) the print job of CLIENT¢will be printed on SERVER¢and SEVER¢
    the print job of CLIENT¢will be not be printed
0
©
©(b) the print job of CLIENT¢will be printed once SERVER¢
                                                          0
0
    the print job of CLIENT¢will be printed once SERVER¢
                                                          ©
(C)
©(c) the print job of CLIENT¢will be printed once SERVER¢
                                                          ©
    the print job of CLIENT¢will be printed once SERVER¢
                                                          0
0
(C)
©(d) the print job of CLIENT¢will be printed once SERVER¢
                                                           0
    the print job of CLIENT¢will be printed once SERVER¢
                                                          (C)
©
©(e) the print job of CLIENT¢will not be printed
    the print job of CLIENT¢will be printed on SERVER¢ and SERVER¢ ©
```