國立中央大學資訊工程學系博士班104學年度第二學期資格考試題紙

1. (10%)Why are segmentation and paging sometimes combined into one scheme?
2. In the consumer-producer example program, a ring buffer queue is used to store the produced item that will be take off by the consumer later.
   There are two example program, the following one(figure 5.9, 5.10) uses semaphore to implement it.(p240, Fig 6.10/6.11　8th edition)
   2-1 (5%)What are the shared variables in figure 5.9, 5.10?
   2-2 (5%)Why this program need to use semaphore primitive ?

```
   int n;
   semaphore mutex = 1;
   semaphore empty = n;
   semaphore full = 0

do {
      . . .
   /* produce an item in next_produced */
      . . .
   wait(empty);
   wait(mutex);
      . . .
   /* add next_produced to the buffer */
      . . .
   signal(mutex);
   signal(full);
} while (true);
```

Figure 5.9 The structure of the producer process.

```
do {
   wait(full);
   wait(mutex);
      . . .
   /* remove an item from buffer to next_consumed */
      . . .
   signal(mutex);
   signal(empty);
      . . .
   /* consume the item in next_consumed */
      . . .
} while (true);
```

Figure 5.10 The structure of the consumer process.

2-3. (5%) The following figure 3.13 and 3.14 are another example program. What are the shared variables in these producer and consumer program?

背面還有 Please Turn Over

2-4.(5%)　In what conditions the program need NOT to use the lock synchronization primitive to support the correct processing? (p118, fig 3.14/3.15　8th edition)

```
#define BUFFER_SIZE 10

typedef struct {
   . . .
}item;

item buffer[BUFFER_SIZE];
int in = 0;
int out = 0;
```

```
while (true) {
     /* produce an item in next_produced */

     while (((in + 1) % BUFFER_SIZE) == out)
        ; /* do nothing */

     buffer[in] = next_produced;
     in = (in + 1) % BUFFER_SIZE;
}
```

Figure 3.13 The producer process using shared memory.

```
item next_consumed;

while (true) {
     while (in == out)
        ; /* do nothing */

     next_consumed = buffer[out];
     out = (out + 1) % BUFFER_SIZE;

     /* consume the item in next_consumed */
}
```

Figure 3.14 The consumer process using shared memory.

2-5(5%). If kernel monitor(R.C.A. Hoare Monitor) approach is adopted to support producer and consumer program. Any processes that can not call consumer or producer function in monitor simultaneously. That means the monitor restricts the parallel processing of these two functions. What is your suggestion to support multiprocessor parallel processing?

背面還有 Please Turn Over

2-6(5%). Prior to version 2.6, Linux was a nonpreemptive kernel. What is the approachs used in Linux 2.6 ?

3. (10%) Define the difference between preemptive and nonpreemptive scheduling. Explain why strict nonpreemptive scheduling is unlikely to be used in a computer center.

4. (30%) Suppose that the following processes arrive for execution at the times indicated. Each process will run the listed amount of time. You may make some reasonable assumptions and write them down explicitly, if they are necessary to answer the following questions.
   (a) Please draw Gantt charts that illustrate the execution of these processes using the following scheduling algorithms: FCFS, non-preemptive SJF, and preemptive SJF.
   (b) Which of the algorithms in (a) results in the minimum average turnarround time (over all processes)? Be sure to justify your answer.
   (c) Which of the algorithms in (a) results in the minimum average waiting time (over all processes)? Be sure to justify your answer.

Process	Arrival Time	Burst Time
P1	0	10
P2	5	3
P3	3	5
P4	4	4

5. (20%) Are the following statements about IP addresses true or false? Be sure to justify your answer for false statements. For each statement, you will get 4 points for correct answer, zero point for blank, or -2 point for incorrect answer.
   (a) Domain Name Service (DNS) can be used to acquire IP addresses.
   (b) Address Resolution Protocol (ARP) can be used to acquire IP addresses.
   (c) Network Address Translation (NAT) is used to map MAC addresses to IP addresses.
   (d) IP Multicasting is adopted in Dynamic Host Configuration Protocol (DHCP).
   (e) IPv6 addresses are 128 bits long.