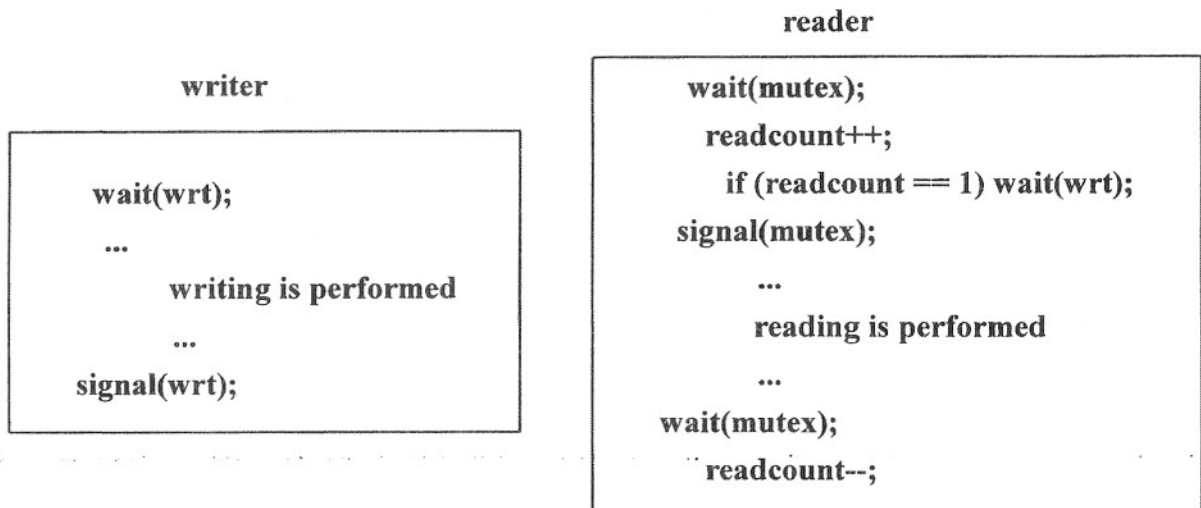


國立清華大學 命題紙

96 學年度 資訊工程學 系 (所) _____ 組碩士班入學考試

科目 計算機系統 科目代碼 2102 共 四 頁第 一 頁 *請在【答案卷卡】內作答

1. (6%) (a) Explain the effects of this statement: `if (readcount == 1) wait(wrt);` in the following reader program.
- (3%) (b) Please explain why there is no write count in the writer program.



- 2 (5%) We already know that only `BUFFER_SIZE-1` elements can be used in the following program. What happen if we put `BUFFER_SIZE` elements in this buffer(there is no score if you only answer that the buffer is useless). You must describe how and why the buffer can no longer be used correctly.

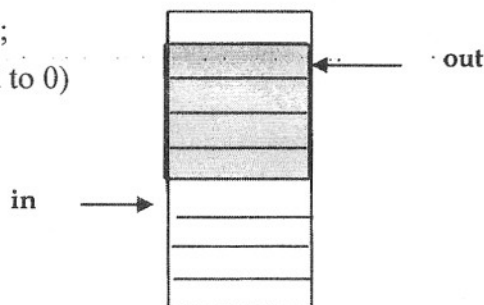
Implement the buffer as a circular array:

```

var buffer: array[1..n] of item;
in, out: 0..n-1; (initialized to 0)
    
```

```

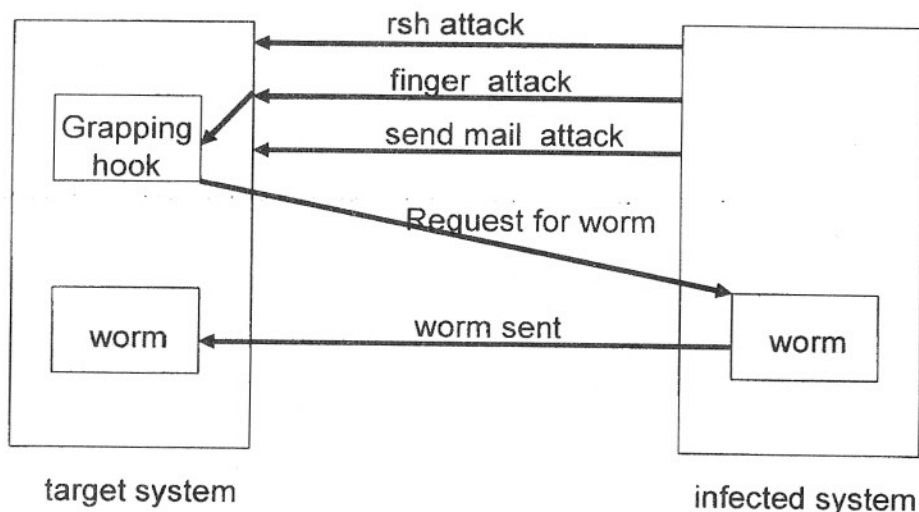
next free: in
first available: out
empty: in=out
    
```



3. (6%) Please write down the three methods that are used by system calls to pass parameters between a running program and the operating system.

科目 計算機系統 科目代碼 2102 共 四 頁第 二 頁 *請在【答案卷卡】內作答

4. (5%) Assume that you are given a computer with an OS supporting the multi-programming feature. Your Boss asks you to modify the OS to provide time-sharing function. You decide to add a hardware timer to the computer and modify the scheduler of your OS to provide the time-sharing function. Now, your Boss takes away the hardware timer from the computer to reduce cost. Can your OS still support time-sharing by modifying the scheduler? Please briefly explain your answer (no score if you only answer "yes" or "no".)
5. (3%) (a) What is thrashing ?
 (3%) (b) What is working set concept ?
 (3%) (c) Explain how the working set concept could be used to solve the thrashing problem.
6. (6%) Consider the following page reference string: 1,2,3,2,4,2,1,6,4,3,2,6,5,6,2,3,7,6,5
 How many and where page faults would occur for the following replacement algorithms?
 Assume we have a number of four frames. Remember all frames are initially empty, so your first unique pages will all cost one page fault each. (2 points each)
 (a) LRU replacement
 (b) Second-Chance replacement
 (c) Optimal replacement
7. (5%) (a) Explain the features of Internet worms and viruses.
 (5%) (b) Robert Tappan Morris, Jr. invented the first Internet worm program in 1988 as shown in the following figure. Please explain how it works.

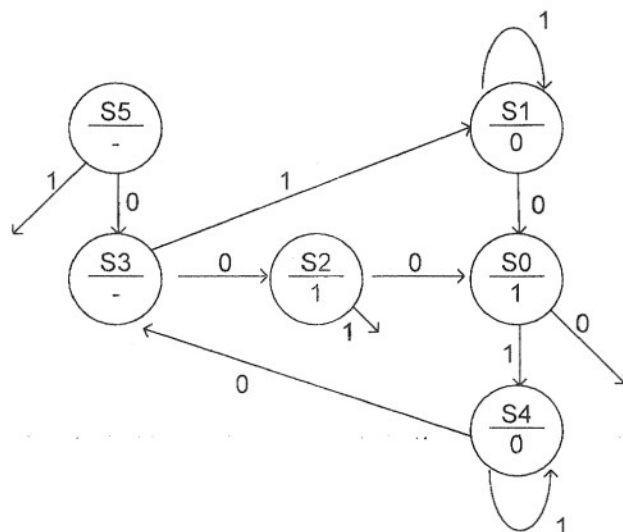


國立清華大學 命題紙

96 學年度 資訊工程學 系(所) _____ 組碩士班入學考試

科目 計算機系統 科目代碼 2102 共 四 頁第 三 頁 *請在【答案卷卡】內作答

8. (7%) Given an incompletely specified state graph of a Moore machine with one input X as shown in the following Figure. Find an equivalent completely specified state graph with the minimum number of states. Note that “-” within a circle means output don’t care; an outgoing edge without next state means next state don’t care. (Hint: use state table and implication chart to minimize the number of states)



9. (7%) Finite State Machine (FSM) can be divided into two types, Moore machine and Mealy machine. Please use an example to demonstrate that Mealy machine would have glitches or spikes at the output.
10. (11%) Your company uses a benchmark C to evaluate the performance of a computer A used in your company. But the computer A can only execute integer instructions, and it uses a sequence of integer instructions to emulate a single floating-point instruction. The computer A is rated at 200 MIPS on the benchmark C. Now, your boss would like to attach a floating-point coprocessor B to the computer A such that the floating-point instructions can be executed by the coprocessor for performance improvement. Note that, however, the combination of computer A and the coprocessor B is rated only at 60 MIPS on the same benchmark C. The following symbols are used in this problem:
- I : the number of integer instructions executed on the benchmark C.
 - F: the number of floating-point instructions executed on the benchmark C.
 - N: the number of integer instructions to emulate a floating-point instruction.
 - Y: time to execute the benchmark C on the computer A alone.
 - Z: time to execute the benchmark C on the combination of computer A and the coprocessor B.
- a.(5%) Write an equation for the MIPS rating of computer A using the symbols above.
 - b.(3%) Given $I = 5 \times 10^6$, $F = 5 \times 10^5$, $N = 30$, find Y and Z.
 - c.(3%) Do you agree with your boss from the performance point of view? Please state the reasons to justify your answer.

國立清華大學 命題紙

96 學年度 資訊工程學 系 (所) _____ 組碩士班入學考試

科目 計算機系統 科目代碼 2102 共 四 頁第 四 頁 *請在【答案卷卡】內作答

11. (10%) Suppose that a computer's address size is 32 bits (using byte addressing), the cache size is 32 Kbytes, the block size is 1-word, and the cache is 4-way set associative. (a)(5%) what is the number of sets in the cache. (b)(5%) what is the total number of bits needed to implement the cache. Please show your answer in the exact total number of bits.
12. (5%) A virtual memory system often implements a TLB to speed up the virtual-to-physical address translation. A TLB has the following characteristics. Assume each TLB entry has a valid bit, a dirty bit, a tag, and the page number. Determine the exact total number of bits to implement this TLB.
- It is direct-mapped
 - It has 16 entries
 - The page size is 4Kbytes
 - The virtual address space is 4Gbytes
 - The physical memory is 1Gbytes
13. (10%) Suppose that we have a system with the following characteristics:
- A memory and bus system supporting block access of 4 words.
 - A 64-bit synchronous bus clocked at 200 MHz, with each 64-bit transfer taking 1 clock cycle, and 1 clock cycle required to send an address to memory.
 - 2 clock cycles needed between each bus transaction. (Assume the bus is idle before an access).
 - A memory access time of 4 words is 300 ns.
- Find the sustained bandwidth for a read of 256 words. Provide your answer in MB/sec.