

# 中原大學 95 學年度碩士班入學考試

3 月 18 日 16 : 00-17:30 資訊工程系

誠實是我們珍視的美德，  
我們喜愛「拒絕作弊，堅守正直」的你！

科目：計算機系統

(共 2 頁第 1 頁)

不可使用計算機

1. The program of Dining-Philosophers is shown in the following. (20%)

```
wait(chopstick[i]);
wait(chopstick[i+1 mod 5]);

eat;

signal(chopstick[i]);
signal(chopstick[i+1 mod 5]);

think;
```

- Which initial value will be set for all the semaphores of chopstick[i]? Why?
  - Please explain the situation of the deadlock.
  - Show that the four necessary conditions for deadlock indeed hold in this program.
  - Give a solution that will avoid deadlocks, and explain whether it solve starvation problem?
2. Consider the two-dimensional array Var A: array[1..100, 1..100] of integer; the sizeof(integer) = 2, and the array is row major. Where A[1][1] is at location 400, in a paged memory system with page of size 400 bytes. A small process in page 0 (locations 0 to 399) for manipulating the matrix; thus, every instruction fetch will be from page 0. For four page frames, how many page faults are generated by the following array initialization loops, using LRU replacement, and assuming page frame 1 has the process in it, and the other three are initially empty. (15%)
- main1( )  
for j:= 1 to 100  
for i:= 1 to 100  
A[i][j]:=0;
  - main2( )  
for i:= 1 to 50  
for j:= 1 to 100  
A[i][j]:=0;
  - Please draw the memory map when main1( ) program set A[32][30] to 0.

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3. Dual mode operation, I/O protection, memory protection, CPU protection and file protection could be used together to protect the operating system. For each mechanism, please describe how to protect the operating system. (15%)
4. Please define the following term: (18%)
  - a. Finite State Machine
  - b. Microprogramming
  - c. Pipeline Hazards
  - d. Branch Prediction
  - e. Superscalar
  - f. Dynamic Multiple Issues Execution (Out-of-order Execution)
5. Identify all of the data dependencies in the following code. Which dependencies are data hazards that will be resolved via forwarding? Which dependencies are data hazards that will cause a stall? (12%)

```
add    $3    $4    $2
sub    $5    $3    $1
lw     $6    200($3)
add    $7    $3    $6
```

6. Please design a complete datapath of “Pipelined Processor” with (a) Forwarding Unit (b) Hazard Detection Unit (c) Stall (d) Exception/Interrupt (e) Branch Prediction, for the following eight instructions: “add”, “sub”, “and”, “or”, “lw”, “sw”, “beq”, “j”. Then explain how it works. (20%)