

大葉大學九十學年度研究所碩士班招生考試試題紙

系 所 組 別	考 試 科 目 (中 文 名 稱)	考 試 日 期	備 註
電機工程學系 丙組	系統設計	4 月 22 日 第 三 節	共兩頁

註：考生可否攜帶計算機或其他資料作答，請在備註欄註明（如未註明，一律不准攜帶）

1. Reduce the following boolean expressions to the required number of literals.

- (a) $ABC + A'B'C + A'BC + ABC' + A'B'C'$ to five literals. (5%)
 (b) $(A + C + D)(A + C + D')(A + C' + D)(A + B')$ to four literals. (5%)

2. Simplify the following boolean expressions to a minimum number of literals.

- (a) $ABC + A'B + ABC'$ (5%)
 (b) $AB' + C + (A' + B)C'$ (5%)

3. Design a combinational circuit that accepts a three-bit number and generates an output binary number equal to the square of the input number. (15%)

4. A sequential circuit has one input and one output. The state diagram is shown in Fig. 1, where the binary number before the symbol / denotes the input value and the number after / denotes the output value. Design the sequential circuit with T flip-flops. (Note that the state table, state equations, and logic diagram must be shown in your answer.) (15%)

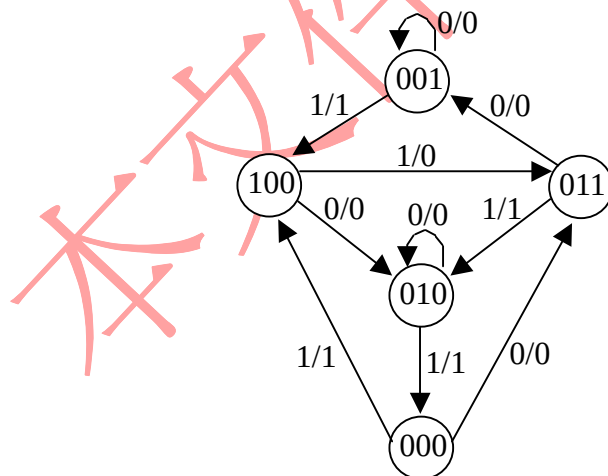


Figure 1

5. Answer the following questions about cache memory.

- (a) Explain how a cache works. (4%)
 (b) Give two different replacement methods when a cache is full. Discuss the advantages and disadvantages of both methods. (8%)

(c) Illustrate two ways of mapping a main memory address into a cache in terms of different hardware organizations of a cache. (8%)

6. Consider the following sequence of memory references from a 480-word program :

16, 41, 164, 190, 98, 369, 110, 273, 209, 478, 433, 341

(a) Give the reference string assuming a page size of 100 words. (5%)

(b) Assuming 200 words of main memory available to the program, find the number of page faults for the reference string obtained in (a) if the FIFO replacement algorithm is used. (5%)

(c) What is the number of page faults for the LRU (Least Recently Used) replacement algorithm? (5%)

(d) What is the number of page faults for the optimal replacement algorithm? (5%)

7. Consider the following two-process software solutions (a) and (b) for the critical section problem. If they are incorrect, show examples of execution sequences which violate one of the three requirements for the critical section problem.

The two processes P_0 and P_1 share the following variables:

var *flag*: **array**[0..1] **of** *boolean*; (initially *false*)
turn: 0..1;

The program below is for process P_i ($i = 0$ or 1) with process P_j ($j = 1$ or 0) being the other one.

(a)

```

repeat
  flag[i] := true;
  while turn ≠ i
    do begin
      while flag[j] do skip;
      turn := i;
    end;
    ...
    critical section
    ...
  flag[i] := false;
  ...
  remainder section
  ...
until false;

```

(5%)

(b)

```

repeat
  flag[i] := true;
  while flag[j] do skip;
  ...
  critical section
  ...
  flag[i] := false;
  ...
  remainder section
  ...
until false;

```

(5%)