

八十六學年度 資訊 系(所) 組碩士班研究生入學考試
 科目 計算機導論 科號 0801 共 5 頁第 1 頁 *請在試卷【答案卷】內作答

1. (8%) Manually execute the following C program. What's the result returned by *mystery(5)* in the main program?

```

int mystery (n)
int n;
{
    return mysteryhelper(n, 10);
}
int mysteryhelper(n,s)
int n,s;
{
    if (n == 0) return s;
    else {
        return (mysteryhelper ( n-1, s) +
                mysteryhelper ( n-1, s));
    }
}
    
```

2. (16%) Manually execute the following program.

(a) If by assuming Call-by-Name in the parameter-passing, what's the value in the array *a* and the variable *i*? (*a*[1]=?, *a*[2]=?, *a*[3]=?, *i*=?) in the program point "P"

```

program parameter-passing;
var i: integer;
    a: array [1..3] of integer;
procedure mess(v: integer);
var i: integer;
begin
    v := v + 1;
    a[i] := 5;
    i := 3;
    v := v + 1;
end;
begin
    for i:= 1 to 3 do a[i] := 0;
    a[2] := 10;
    i := 2;
    mess(a[i]);
    ←----- P ----->
end.
    
```

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(b) Similarly, manually execute the program above. If by assuming Call-by-reference in the parameter-passing, what's the value in the array a and the variable i ? ($a[1]=?, a[2]=?, a[3]=?, i=?$) in the program point "1"?

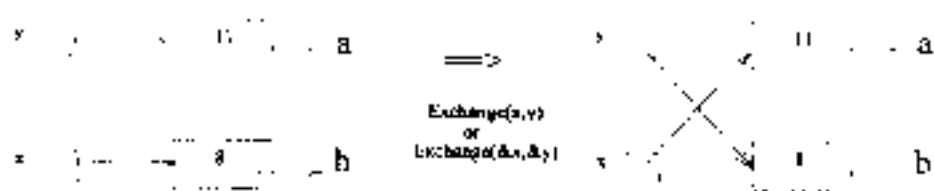
3. (20%) You can use either Pascal or C to answer this problem.

A linked list consists of a collection of elements called nodes, each of which stores two items of information:

- (i) a data value of the list, and
- (ii) a pointer, whose value is the address of the node containing the next data value in the list.

(a) (4%) Define two data types `node_ptr` and `listnode`, where a variable of type `node_ptr` can be used as a pointer to a variable of type `listnode` and a variable of type `listnode` consists of a real number and a pointer of type `node_ptr`.

(b) (3%) Write a procedure (or function) `Exchange`. The procedure can be used to exchange the contents of two variables of type `node_ptr`.



(c) (3%) Write a function `Find_Tail` which can be use to find the last node of a non-empty list. (See Fig. 1.) The function takes the pointer to the first node of the list as input. The output returned by the function is the pointer to the last node of the list.

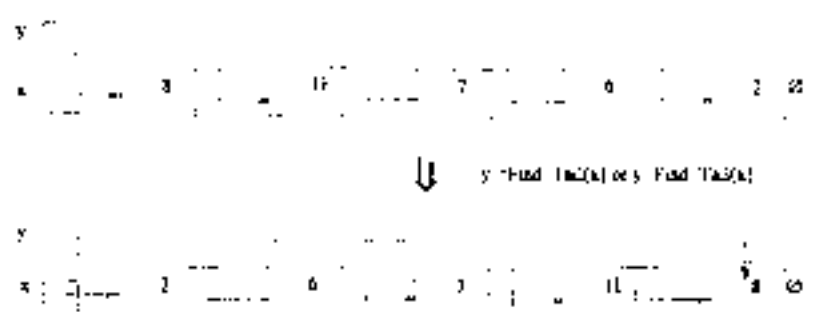


Fig. 1.

(d) (10%) Write a procedure (or function) `Reverse_List` that can be use to reverse a list. (See Fig. 2.) (Note that the input may be an empty list.)

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Fig. 2.

4. (5%) Let Y be a pre-defined constant and A be an array declared as follows.

```
var A: array[1..431, 1..Y] of integer.
```

```
/* a two-dimensional array of 432 rows and Y columns */
```

Assume that A is stored in row major order in the main memory and each integer needs two bytes. If $A[3, 4]$ is stored at address 2000 and $A[111..12]$ is stored at address 10872, what is the value of Y ?

5. (5%) Show how five 2-to-1 multiplexers (with no added gates) could be connected to form a 6-to-1 MUX.

6. (8%) The internal connection diagram for a PLA is given in Fig. 3.

(a) Write the equation realized by the PLA.

(b) Specify the truth table for a ROM which would realize the same functions as the PLA.

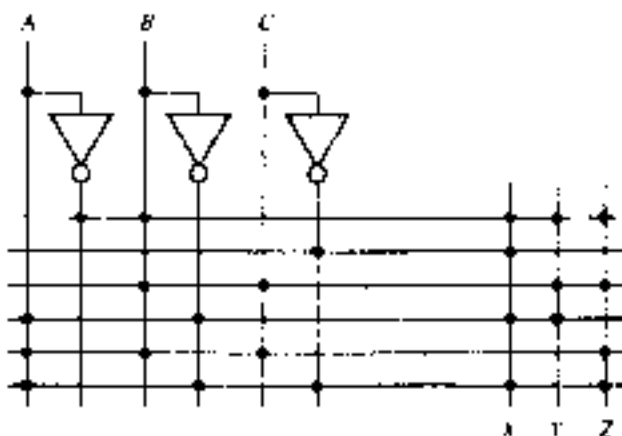


Fig. 3.

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7. (5%) The following network shown in Fig. 4 implements a counter in which each flip flop is a T flip-flop. Assume the initial state is 000. Give the counting sequence of the counter.

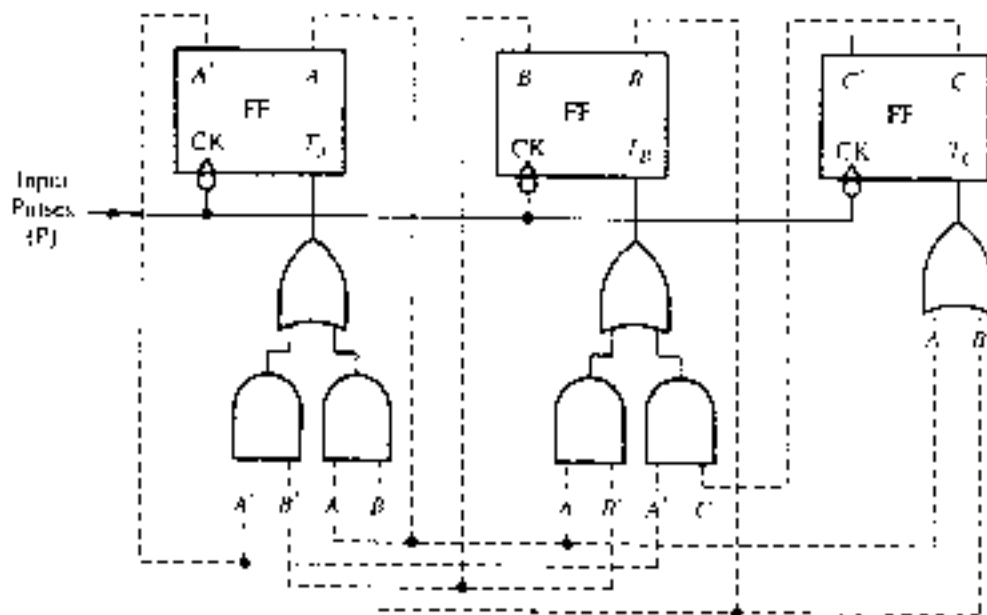


Fig. 4.

8. (5%) Which of the following sets of operations are functionally complete? (You may assume that 0 and 1 are available as gate inputs.) Justify your answers.

- (a) OR and NOT
- (b) AND and OR
- (c) Exclusive-OR and OR
- (d) Equivalence and OR

9. (16%) Prove or disprove the following statements.

- (a) The running time of the straightforward recursive method for computing F_n , based on the recursion, $F_n = F_{n-1} + F_{n-2}$, is $O(n^2)$.
- (b) The running time of quicksort is $O(n^2)$ when the input array is sorted in nonincreasing order.
- (c) The prefix form of the infix expression $A/B**C+D*E-A*C$ is $+1/A**BC*DE*AC$.
- (d) We can implement a stack using one queue.

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10. (6%) Suppose that we have numbers between 1 and 1000 in a binary search tree and want to search for the number 363. Which of the following sequences could *not* be the sequence of nodes examined?

- (a) 2, 252, 401, 398, 330, 344, 397, 363.
- (b) 924, 220, 911, 244, 898, 258, 362, 363.
- (c) 925, 202, 911, 240, 912, 245, 363.
- (d) 2, 399, 387, 219, 266, 382, 381, 278, 363.
- (e) 935, 278, 347, 621, 299, 392, 358, 363.

11. (6%) Give an efficient algorithm to determine if an undirected graph is *bipartite*.

A *bipartite graph* is an undirected graph $G = (V, E)$, in which V can be partitioned into two sets V_1 and V_2 such that $(u, v) \in E$ implies either $u \in V_1$ and $v \in V_2$ or $v \in V_1$ and $u \in V_2$.