Part I : (1-8, 5% ; 9, 15%)

1. Some 32-bit microprocessor (e.g. 80386...) may operate in either real mode or protected mode. Use an example to explain the protected mode addressing scheme, and the functions it can be performed.

2. The format of a 32-bit processor address is shown in fig.1 . Draw a scheme to show a two-way set associative cache organization of this cache memory system.

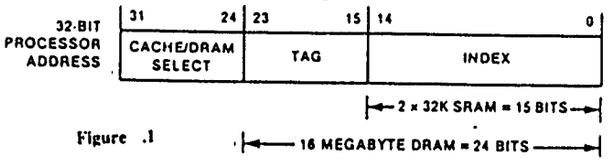


Figure .1

3. Describe a DMA procedure, and explain every step in detail.

4. According to the concept of modern operating system, what are the functions that the PCB (process control block) performs.

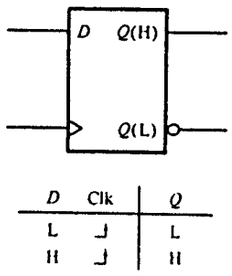
5. List 5 privilege instructions, and explain their functions.

6. Compare the RISC architecture with the CISC , indicate at least four differences in the design approach.

7. Describe how to use a four-way pipelining scheme to design the RISC instructions.

8. List at least 5 characteristics about the Fault-Tolerant systems.

9. The transition table for the 7474 D flip-flop is shown in fig. 2. In this table, C, D and Z are the clock, input and output.
   (a). Fine the output equations Y_0 , Y_1 .
   (b). Implement this circuit with SR latches.
   (c). Complete the design of the circuit so as to eliminate all races and hazards.



D	Clk	Q
L	⌋	L
H	⌋	H

(a)

y_1, y_0 \ C, D	00	01	11	10	Z
a 00	(00)	01	(00)	(00)	0
b 01	00	(01)	11	–	0
c 11	10	(11)	(11)	(11)	1
d 10	(10)	11	–	00	1

Y_1, Y_0

(b)

Figure .2 The transition table for the 7474 *D* flip-flop.

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Part II

1. The following recursive program computes the Fibonacci numbers.

```
function fibonacci( N:integer ) :integer ;
  begin
  if  N <= 1
     then fibonacci := 1
     else fibonacci := fibonacci(N-1) + fibonacci(N-2) ;
  end ;
```

   a) Discuss its Complexity. (5%)

   b) Write out a nonrecursive algorithm (in any language) to compute the Fibonacci numbers in linear time. (7%)

2. Quicksort has the following recursive structure:

```
procedure quicksort(l,r:integer);
   var i:integer ;
   begin
   if r > l then
      begin
      i := partition(l,r) ;
      quicksort(l,i-1) ;
      quicksort(i+1,r)
      end
   end ;
```

   a) Write out the parition function in any language. (Use a[r] as the partitioning element. (5%)

   b) Show how the array 13 2 7 15 4 1 19 6 9 10 11 are partitioned. (5%)

   c) Write a procedure similar to quick sort to select the kth smallest of numbers in a array. (8%)

3. Kruskal's algorithm finds a minimum cost spanning tree of a graph. In this approach a minimum cost spanning tree is built edge by edge. Describe briefly Kruskal's algorithm in plain language (i.e. Chinese or English), and show the stages in constructing a minimum cost spanning tree for the following graph. (15%)