

●不可使用電子計算機

1. 25% Determine how many nonnegative integer solutions there are to $x_1+x_2+x_3+x_4=18$, if
 - (a) x_i ; for all $1 \leq i \leq 4$
 - (b) $x_i \leq 7$; for all $1 \leq i \leq 4$
2. 25% Apply the merge sort to the following list.
7,3,8,4,5,10,6,2,9
 - (a) Draw the splitting and merging trees for this procedure.
 - (b) Determine the (worst-case) time-complexity function of the merge sort.
3. 25% Show the steps and reasons to establish the validity of the following argument.

$$\frac{\begin{array}{l} \forall x [P(x) \vee Q(x)] \\ \forall x [(\neg P(x) \wedge Q(x)) \rightarrow R(x)] \end{array}}{\forall x [\neg R(x) \rightarrow P(x)]}$$

4. 25% The pseudocode in Figure 1 is an algorithm to sort n numbers. If a_n denotes the numbers of comparisons needed to sort n numbers based on Figure 1.
 - (a) Find the recurrence relation with initial $a_1=0$.
 - (b) Solve the relation of (a)

Procedure Sort (n : positive integer; x_1, x_2, \dots, x_n : real numbers)

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begin
  for  $i=1$  to  $n-1$  do
    for  $j=n$  downto  $i+1$  do
      if  $x_j < x_{j-1}$  then
        begin {interchange}
          temp =  $x_{j-1}$ 
           $x_{j-1} = x_j$ 
           $x_j = temp$ 
        end
      end
    end
  end

```

end Figure 1