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- (10 points) What is the following sorting method?  
(a) internal sort (b) external sort (c) comparative sort (d) distributive sort
  - (10 points) What are partial order and linear order on a set?
  - (10 points) What is the radix sort? Give an example that the radix sort is done well.
  - (15 points) What is the topological sort? Write down the algorithm and give an application example of the sort.
  - (5 points) Which of the following justifies the use of B-trees of order  $m$  over balanced binary trees in implementing any index structures?  
(a) The number of accesses to secondary storage in searching for a particular key value is reduced.  
(b) No rebalancing procedure is necessary  
(c) The height of the tree can be arbitrarily reduced, by increasing  $m$ .  
(d) Less overall storage is utilized.
  - (10 points) A 2-3 tree is a tree in which each vertex which is not a leaf has 2 or 3 children, and every path from the root to a leaf is one of the same length. Let  $T$  be a 2-3 tree of height  $h$ . Answer the following questions.  
(a) The upper and lower bound of the number of vertices of  $T$ .  
(b) The upper and lower bound of the number of leaves of  $T$
  - (20 points) Write an algorithm to convert an infix arithmetic expression to postfix expression with a stack. Show the contents of the stack as converting the following expression.  $(A+B)*D - E/(F+C) + G$ .
  - (20 points) Prove that the number of permutations of  $n$  distinct numbers produced by a stack is equal to the number of distinct binary trees with  $n$  nodes.