MCQ Chapter 12 Transform and Conquer Algorithms

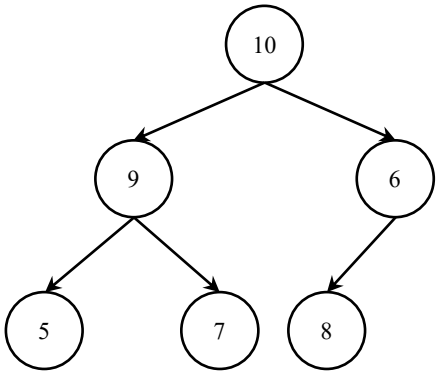
1. How does Gaussian Elimination Algorithm can be made optimal?
    a. LU Decomposition
    b. Implementing using Greedy Approach
    c. Matrix Multiplication Optimization
    d. Forwarding Process

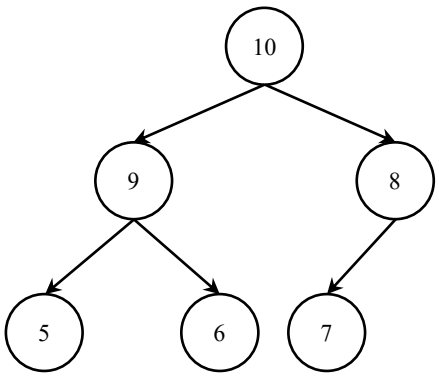
    Ans: a) LU Decomposition
2. What is the complexity of Gaussian Elimination method?
    a. $O(n \log n)$
    b. $O(n^3)$
    c. $O(n^2)$
    d. $O(n)$

    Ans: b) $O(n^3)$
3. What is true under Crout's method of Decomposition?
    a. Complexity of the algorithm is $O(n^2 \log n)$
    b. Results in Three Matrices such that $A = U\ D\ V$
    c. It is linearly solvable
    d. It ensures the diagonal elements of the U matrix is 1

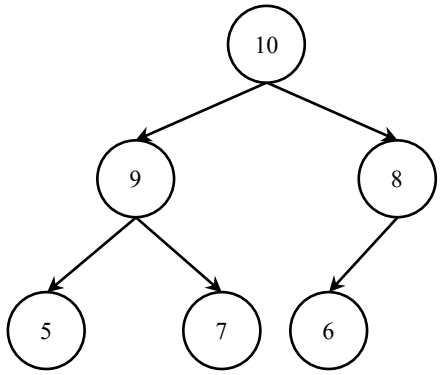
    Ans: d) It ensures the diagonal elements of the U matrix is 1
4. Which of the following step optimizes the process of finding matrix determinants?
    a. Involving LU Decomposition
    b. Introducing Divide and Conquer Method
    c. Introducing Greedy Approach
    d. Introducing Approximation Algorithm

    Ans: a) Involving LU Decomposition
5. Max Heap of the array A = [10, 9, 6, 5, 7, 8] is

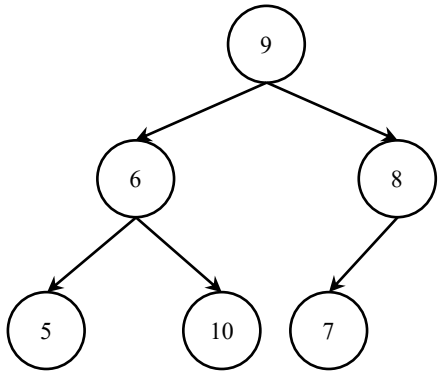
    a.


    b.


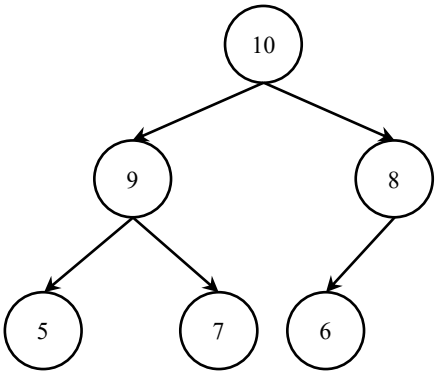
c.



d.



Ans: c)



6. Total time required for Heap Sort is
    a. $O(n \log n)$
    b. $O(n^2)$
    c. $O(n^3)$
    d. $O(n)$

    Ans: a) $O(n \log n)$

7. Horner's Method involves evaluating a polynomial in _____ time
    a. Linear
    b. Quadratic
    c. $n \log n$
    d. $\log n$

    Ans: a) Linear

8. Upper bound of Number of multiplication in Binary Exponentiation Algorithms is _____

a. $2\lfloor log_2 n \rfloor$
b. $\lfloor log_2 n \rfloor$
c. $log\, n$
d. n

Ans: a) $2\lfloor log_2 n \rfloor$

9. In which case of the following the problem reduction from Problem A to Problem B can not take place?
   a. Total time for transforming and Solving the reduced problem is lower than solving the original
   b. Lower Bound of Problem A $\geq$ Lower bound of Problem B
   c. Lower Bound of Problem A is always lesser than the lower bound of Problem B
   d. Output of Problem A is same as the problem B

   Ans: c) Lower Bound of Problem A is always lesser than the lower bound of Problem B

10. What is the LU decomposition of $A = \begin{bmatrix} 3 & 1 & 1 \\ 6 & 4 & 1 \\ 1 & 1 & 1 \end{bmatrix}$?
    a. $L = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ \frac{1}{3} & \frac{1}{3} & 1 \end{bmatrix}$ and $U = \begin{bmatrix} 3 & 1 & 1 \\ 0 & 2 & -1 \\ 0 & 0 & 1 \end{bmatrix}$
    b. $L = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix}$ and $U = \begin{bmatrix} 3 & 1 & 1 \\ 0 & 2 & -1 \\ 0 & 0 & 1 \end{bmatrix}$
    c. $L = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ \frac{1}{3} & \frac{1}{3} & 1 \end{bmatrix}$ and $U = \begin{bmatrix} 3 & 1 & 1 \\ 0 & 1 & -1 \\ 0 & 0 & 1 \end{bmatrix}$
    d. $L = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ \frac{1}{3} & \frac{1}{3} & 1 \end{bmatrix}$ and $U = \begin{bmatrix} 3 & 1 & 1 \\ 0 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$

    Ans: a) $L = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ \frac{1}{3} & \frac{1}{3} & 1 \end{bmatrix}$ and $U = \begin{bmatrix} 3 & 1 & 1 \\ 0 & 2 & -1 \\ 0 & 0 & 1 \end{bmatrix}$

11. $det(U)$ in Crout's method of decomposition is _____
    a. 1
    b. $\sqrt{|A|}$
    c. $|A|$
    d. $min\{|A|, |A|^2\}$

    Ans: a) 1

12. The U matrix by Crout's method of LU Decomposition is ____
    a. $\begin{bmatrix} 1 & \frac{1}{3} & \frac{1}{3} \\ 0 & 1 & -\frac{1}{2} \\ 0 & 0 & 1 \end{bmatrix}$

b. $\begin{bmatrix} 1 & 3 & 3 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{bmatrix}$

c. $\begin{bmatrix} 1 & \frac{1}{3} & \frac{1}{3} \\ 0 & 1 & \frac{1}{2} \\ 0 & 0 & 1 \end{bmatrix}$

d. $\begin{bmatrix} 1 & \frac{1}{3} & -\frac{1}{3} \\ 0 & 1 & -\frac{1}{2} \\ 0 & 0 & 1 \end{bmatrix}$

Ans: a) $\begin{bmatrix} 1 & \frac{1}{3} & \frac{1}{3} \\ 0 & 1 & -\frac{1}{2} \\ 0 & 0 & 1 \end{bmatrix}$

13. Inverse of the matrix $A = \begin{bmatrix} 3 & 2 \\ 2 & 7 \end{bmatrix}$ is _____

a. $\frac{1}{17}\begin{bmatrix} 7 & -2 \\ 2 & 3 \end{bmatrix}$

b. $\frac{1}{17}\begin{bmatrix} 7 & -2 \\ -2 & 3 \end{bmatrix}$

c. $\frac{1}{17}\begin{bmatrix} -7 & -2 \\ 2 & 3 \end{bmatrix}$

d. $\frac{1}{17}\begin{bmatrix} 7 & -2 \\ -2 & -3 \end{bmatrix}$

Ans: a) $\frac{1}{17}\begin{bmatrix} 7 & -2 \\ 2 & 3 \end{bmatrix}$

14. Which of the following is True?

a. $|A| = |L||U^{-1}|$

b. $(|A| = |U|)_{Crout'sMethod}$

c. $(|A| = |L|)_{Crout'sMethod}$

d. $|A| = |L|$

Ans: c) $(|A| = |L|)_{Crout'sMethod}$

15. Solution for the following equation using Gaussian Elimination Method is

$$3x_1 + x_2 + x_3 = 11$$

$$6x_1 + 4x_2 + x_3 = 29$$

$$x_1 + x_2 + x_3 = 7$$

a. (2,4,1)

b. (1,4,2)

c. (2,1,4)

d. (1,2,4)

Ans: a) (2,4,1)