

MIDTERM EXAMINATION
Spring 2010
CS502- Fundamentals of Algorithms (Session - 6)

Time: 60 min
Marks: 38

Question No: 1 (Marks: 1) - Please choose one

Random access machine or RAM is a/an

- ▶ Machine build by Al-Khwarizmi
- ▶ Mechanical machine
- ▶ Electronics machine
- ▶ **Mathematical model**

Question No: 2 (Marks: 1) - Please choose one

_____ is a graphical representation of an algorithm

- ▶ Σ notation
- ▶ Θ notation
- ▶ **Flowchart**
- ▶ Asymptotic notation

Question No: 3 (Marks: 1) - Please choose one

A RAM is an idealized machine with _____ random-access memory.

- ▶ 256MB
- ▶ 512MB
- ▶ **an infinitely large**
- ▶ 100GB

Question No: 4 (Marks: 1) - Please choose one

What type of instructions Random Access Machine (RAM) can execute? Choose best answer

- ▶ Algebraic and logic
- ▶ Geometric and arithmetic
- ▶ **Arithmetic and logic**
- ▶ Parallel and recursive

Question No: 5 (Marks: 1) - Please choose one

What will be the total number of max comparisons if we run brute-force maxima algorithm with n elements? <http://vustudents.ning.com>

- ▶ n^2

- ▶ $n^{\frac{n}{2}}$
- ▶ n
- ▶ n^8

Question No: 6 (Marks: 1) - Please choose one

What is the solution to the recurrence $T(n) = T(n/2) + n$. <http://vustudents.ning.com>

- ▶ $O(\log n)$
- ▶ $O(n)$
- ▶ $O(n \log n)$
- ▶ $O(n^2)$

Question No: 7 (Marks: 1) - Please choose one

Consider the following code:

```
For(j=1; j<n; j++)
    For(k=1; k<15; k++)
        For(l=5; l<n; l++)
            {
                Do_something_constant();
            }
```

What is the order of execution for this code.

- ▶ $O(n)$
- ▶ $O(n^3)$
- ▶ $O(n^2 \log n)$
- ▶ $O(n^2)$

Question No: 8 (Marks: 1) - Please choose one

Consider the following Algorithm:

```
Factorial (n){
    if (n=1)
        return 1
    else
        return (n * Factorial(n-1))
}
```

Recurrence for the following algorithm is:

- ▶ $T(n) = T(n-1) + 1$
- ▶ $T(n) = nT(n-1) + 1$
- ▶ $T(n) = T(n-1) + n$
- ▶ $T(n) = T(n-1) + 1$

Question No: 9 (Marks: 1) - Please choose one

What is the total time to heapify?

- ▶ $O(\log n)$
- ▶ $O(n \log n)$

- ▶ $O(n^2 \log n)$
- ▶ $O(\log^2 n)$

Question No: 10 (Marks: 1) - Please choose one

When we call heapify then at each level the comparison performed takes time

- ▶ **It will take $\Theta(1)$**
- ▶ Time will vary according to the nature of input data
- ▶ It can not be predicted
- ▶ It will take $\Theta(\log n)$

Question No: 11 (Marks: 1) - Please choose one

In Quick sort, we don't have the control over the sizes of recursive calls

- ▶ **True**
- ▶ False
- ▶ Less information to decide
- ▶ Either true or false

Question No: 12 (Marks: 1) - Please choose one

Is it possible to sort without making comparisons?

- ▶ **Yes**
- ▶ No

Question No: 13 (Marks: 1) - Please choose one

If there are $\Theta(n^2)$ entries in edit distance matrix then the total running time is

- ▶ $\Theta(1)$
- ▶ **$\Theta(n^2)$**
- ▶ $\Theta(n)$
- ▶ $\Theta(n \log n)$

Question No: 14 (Marks: 1) - Please choose one

For Chain Matrix Multiplication we can not use divide and conquer approach because,

- ▶ We do not know the optimum k
- ▶ **We use divide and conquer for sorting only**
- ▶ We can easily perform it in linear time
- ▶ Size of data is not given

Question No: 15 (Marks: 1) - Please choose one

The Knapsack problem belongs to the domain of _____ problems.

- ▶ **Optimization**
- ▶ NP Complete
- ▶ Linear Solution
- ▶ Sorting

Question No: 16 (Marks: 1) - Please choose one

Suppose we have three items as shown in the following table, and suppose the capacity of the knapsack is 50 i.e. $W = 50$.

Item	Value	Weight
1	60	10
2	100	20
3	120	30

The optimal solution is to pick

- ▶ Items 1 and 2
- ▶ Items 1 and 3
- ▶ **Items 2 and 3**
- ▶ None of these

Question No: 17 (Marks: 2)

Describe an efficient algorithm to find the **median** of a set of 10^6 integers; it is known that there are fewer than 100 distinct integers in the set

<http://vustudents.ning.com>

Question No: 18 (Marks: 2)

How we can avoid unnecessary repetitions for recursive calls?

Question No: 19 (Marks: 2)

Draw the cost table for chain matrix multiplication problem with initial state.

Question No: 20 (Marks: 3)

Solve it,

$$T(n) = \frac{1}{2} \sum_{q=1}^2 (T(q-1) + T(2-q) + 2)$$

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Question No: 21 (Marks: 3)

What are Catalan numbers? Give the formula.

Question No: 22 (Marks: 5)

What is the effect of calling Max-Heapify(A, i) when $i > \text{heap-size}[A]/2$?

Question No: 23 (Marks: 5)

Write the pseudo code for 0/1 knapsack algorithm developed using dynamic programming technique.

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