

**CS202**

**Section 1**

**Quiz No. 2: Recurrence Equation & Insertion Sort**

**September 29, 2015**

**Solutions**

**Q-1)**

Complexity of a recursive algorithm is given as follows:

$$T(n) = T\left(\frac{n}{2}\right) + 3$$
$$T(1) = 1$$

Find the solution in asymptotic notation.

**A-1)**

$$\begin{aligned} T(n) &= T\left(\frac{n}{2}\right) + 3 \\ &= T\left(\frac{n}{4}\right) + 3 + 3 \\ &= T\left(\frac{n}{8}\right) + 3 + 3 + 3 \\ &\vdots \\ &= T\left(\frac{n}{2^k}\right) + 3 * k \\ &= T(1) + 3 * k \\ \frac{n}{2^k} &= 1 \implies n = 2^k \implies k = \log n \\ T(n) &= 1 + 3\log n \implies O(\log n) \end{aligned}$$

**Q-2)**

As an input an unsorted array is given as follows:

8	15	7	22	32	15
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Please run the insertion sort algorithm on this array and calculate total number of comparisons and total number of moves.

**A-2)****Comp. | Move**

8	15	7	22	32	15
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1	0
---	---

8	15	7	22	32	15
---	----	---	----	----	----

1	1
---	---

8	7	15	22	32	15
---	---	----	----	----	----

1	1
---	---

7	8	15	22	32	15
---	---	----	----	----	----

1	0
---	---

7	8	15	22	32	15
---	---	----	----	----	----

1	0
---	---

7	8	15	22	32	15
---	---	----	----	----	----

1	1
---	---

7	8	15	22	15	32
---	---	----	----	----	----

1	1
---	---

7	8	15	15	22	32
---	---	----	----	----	----

1	0
---	---

7	8	15	15	22	32
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Total number of comparisons: 8

Total number of moves: 4