Question 1 [5 Marks]

What is the value of following recurrence.

$T(n) = T(n/4) + T(n/2) + cn^2$
$T(1) = c$

$T(0) = 0$

Where c is a positive constant

✗ A $O(n^3)$

✓ B $O(n^2)$

C $O(n^2 Logn)$

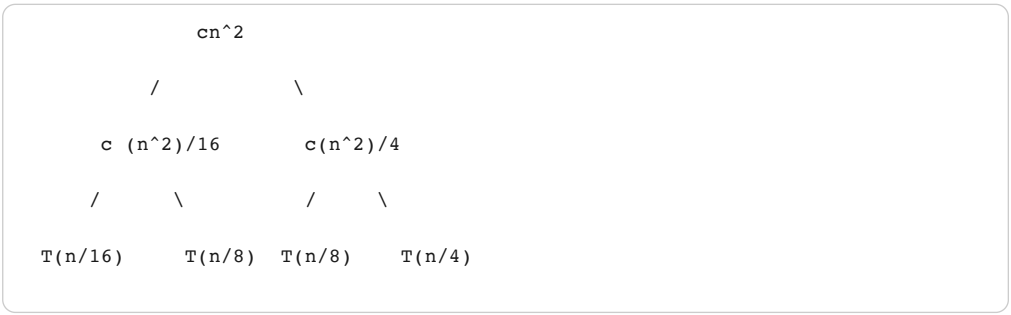
D O(nLogn)

Explanation

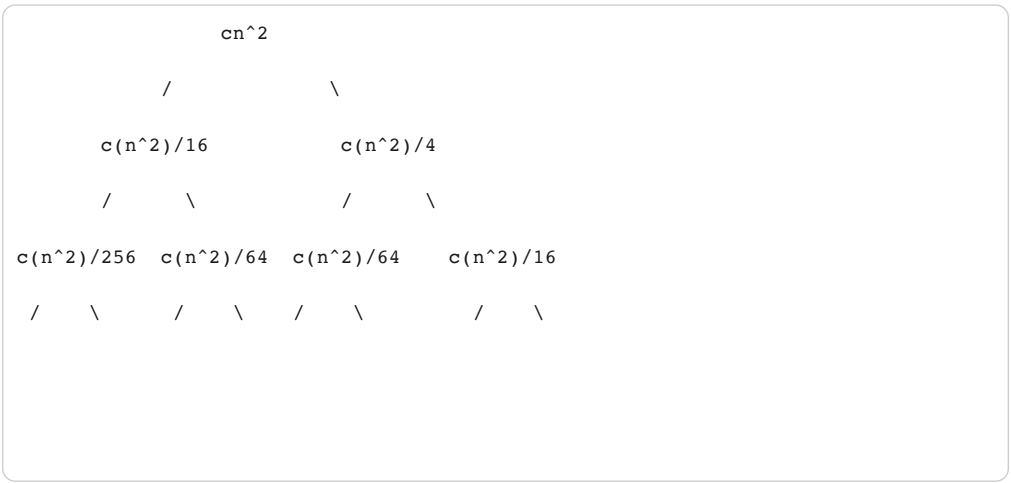
Following is the initial recursion tree for the given recurrence relation.

```
          cn^2
        /      \
    T(n/4)     T(n/2)
```

If we further break down the expression T(n/4) and T(n/2), we get following recursion tree.



Breaking down further gives us following



To know the value of T(n), we need to calculate sum of tree nodes level by level. If we sum the above tree level by level, we get the following series
T(n) = c(n^2 + 5(n^2)/16 + 25(n^2)/256) + ...
The above series is geometrical progression with ratio 5/16
To get an upper bound, we can sum the above series for infinite terms. We get the sum as (n^2) / (1 - 5/16) which is O(n^2)

Refer following video lecture for more details.
http://www.youtube.com/watch?v=whjt_N9uYFI (http://www.youtube.com/watch?v=whjt_N9uYFI)

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