HW-3

Your Name : Desireddy Sai Sankeerthana

Your Student ID : 50465523

problem 1 :

(a) $T(n) = 5T(n/3) + O(n)$

$a = 5 \quad b = 3 \quad c = 1$

$\log_b a = \log_3 5 = 1.464 > 1$

Acc to master's theorm, if $\log_b a > c$ then asymptoic upper
$c < \log_b a$

bond is $O(n^{\log_b a})$

$\therefore \boxed{T(n) = O(n^{\log_3 5})}$

(b) $T(n) = 3T(n/3) + O(n)$

$a = 3 \quad b = 3 \quad c = 1 \qquad c = \log_b a$

$\log_b a = \log_3 3 = 1 = 1$

Acc to master's theorm, if $\log_b a = c$, then asymptotic upper bound is $O(n^c \log n)$

$\therefore \boxed{T(n) = O(n \log n)}$

(c) $T(n) = 4T(n/2) + O(n^2\sqrt{n})$

$n^2\sqrt{n} = n^2 \cdot n^{1/2} = n^{5/2}$

$a = 4$ $b = 2$ $c = 5/2 = 2.5$ $c > \log_b a$

$\log_b a = \log_2 4 = 2 < 2.5$

$\therefore$ if $\log_b a < c$ then asymptotic upper bound is $O(n^c)$

$\boxed{\therefore T(n) = O(n^{2.5})}$ $\Rightarrow T(n) = O(n^2\sqrt{n})$

(d) $T(n) = 8T(n/2) + O(n^2)$

$a = 8$ $b = 2$ $c = 2$

$\log_b a = \log_2 8 = 3 > 2$

$\therefore$ if $\log_b a > c$ then asymptotic upper bound is $T(n) = O(n^{\log_b a})$

$\boxed{\therefore T(n) = O(n \log_2 8)}$

problem2:

$A = (3, 0, 1, 0, 4, 1, 7, 1, 6, 3)$

$B = (2, 9, 4, 6, 3, 1, 6, 0, 1, 3)$

$(3x^9 + 6x^8 + x^7 + 7x^6 + x^5 + 4x^4 + x^2 + 3) \times$

$(3x^9 + x^8 + 6x^6 + x^5 + 3x^4 + 6x^3 + 4x^2 + 9x + 2)$

this gives output of 11235330870604938676

	$3x^9$	$6x^8$	x^7	$7x^6$	x^5	$4x^4$	x^2	3
$3x^9$	$9x^{18}$	$18x^{17}$	$3x^{16}$	$21x^{15}$	$3x^{14}$	$12x^{13}$	$3x^{11}$	$9x^9$
x^8	$3x^{17}$	$18x^{16}$	x^{15}	$7x^{14}$	x^{13}	$4x^{12}$	x^{10}	$3x^8$
$6x^6$	$18x^{15}$	$36x^{14}$	$6x^{13}$	$42x^{12}$	$6x^{11}$	$24x^{10}$	$6x^8$	$18x^6$
x^5	$3x^{14}$	$6x^{13}$	x^{12}	$7x^{11}$	x^{10}	$4x^9$	x^7	$3x^5$
$3x^4$	$9x^{13}$	$18x^{12}$	$3x^{11}$	$21x^{10}$	$3x^9$	$12x^8$	$3x^6$	$9x^4$
$6x^3$	$18x^{12}$	$36x^{11}$	$6x^{10}$	$42x^9$	$6x^8$	$24x^7$	$6x^5$	$18x^3$
$4x^2$	$12x^{11}$	$24x^{10}$	$4x^9$	$28x^8$	$4x^7$	$16x^6$	$4x^4$	$12x^2$
$9x$	$27x^{10}$	$54x^9$	$9x^8$	$63x^7$	$9x^6$	$36x^5$	$9x^3$.	$27x$
2	$6x^9$	$12x^8$	$2x^7$	$14x^6$	$2x^5$	$8x^4$	$2x^2$	6

```
poly multiply (A, B, n)
if n = 1 then return (A[0] B[0])
AL ← A[0 . . . n/2 - 1]
AH ← A[n/2 . . . n - 1]
BL ← B[0 . . . n/2 - 1]
BH ← B[n/2 . . . n - 1]
CL ← multiply (AL, BL, n/2)
CH ← multiply (AH, BH, n/2)
CM ← multiply (AL + AH, BL + BH, n/2)
c ← array of (2n - 1) 0's
for i ← 0 to n-2 do
    c[i] ← c[i] + cL[i]
    c[i+n] ← c[i+n] + cH[i]
    c[i+n/2] ← c[i+n/2] + cM[i] - cL[i] - cH[i]
return c
```

Problem 3:

```
CountRange (x[], n, lo, hi)
    c ← 0
    for i from lo to hi {
        if x[i] == n {
            increment c
        }
    }
    return c
```

lo = low
hi = high

```
Majority( n[], lo, hi)
    if (lo Equals to hi) {
          return n[lo]
    }
  Calculate  mid  = (hi - lo)/2 + lo;
  left  = majority(n, lo, mid)
  right  =  majority (n, mid+1, hi)
  if ( lo == hi) {
          return left
  }
  Calculate  count of left & rightarrays
          leftcount  =  Count Range (n, left, lo, hi)
          rigutCount  =  Count Range (n, right, lo, hi)

      return  leftcount > rigutCount ? left : right.
```

dividing the array into 2 parts to find majority ele 1 part is left & 1 part is right

lo = lowest h = highest

problem 4:

```
  Localminima ( l, r ):
      if  l = r  then  return l
      ~~calcul~~
      Calculate  m = ⌊(l+r)/2⌋
      if  A[m] < A[m+1]  then
            return  Localminima( l, m)
      else
            return  Localminima(m+1, r)
```

$l = 1$ $r = n$, n is distinct numbers of given array. $A[l-1] > A[l]$ & $A[r] < A[r+1]$

if $l < r$ break $A[l \ldots r]$ into $A[l \ldots m]$ & $A[m+1 \ldots r]$

if $A[m] < A[m+1]$ then local minima(l, r) where $A[l-1] > A[l]$

$A[m] > A[m+1]$ localminima$(m+1, r)$ where $A[r] < A[r+1]$

$l = r$ then $A[l-1] > A[l]$