Assignment 1 of algorithm design

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1. In the table below, for each term, specify Dominant term (A part of the expression that is more important in calculating time)and then obtain O-big .

Expression	Dominant term(s)	$O(...)$
$5 + 0.001n^3 + 0.025n$		
$500n + 100n^{1.5} + 50n \log_{10} n$		
$0.3n + 5n^{1.5} + 2.5 \cdot n^{1.75}$		
$n^2 \log_2 n + n(\log_2 n)^2$		
$n \log_3 n + n \log_2 n$		
$3 \log_8 n + \log_2 \log_2 \log_2 n$		
$100n + 0.01n^2$		
$0.01n + 100n^2$		
$2n + n^{0.5} + 0.5n^{1.25}$		
$0.01n \log_2 n + n(\log_2 n)^2$		
$100n \log_3 n + n^3 + 100n$		
$0.003 \log_4 n + \log_2 \log_2 n$		

2. Calculate the time complexity (T(n)) of the following algorithms:

Function_1
while $n > 1$ do
    for $i = 1$ to n do
        $x = x + 1$;
    end for
    $n = \lfloor n/2 \rfloor$;
end while

```
sum=0;
for(i=1;i<=n;i*=2)
    for(j=1;j<=n;j++)
        sum++;
```

3. Show and prove which of the following correctly represents f(n)=2^(2n)
   a) O(2^n)
   b) Ω(2^n)
   c) Θ(2^n)
   d) None of these

4. In each row, sort the functions in terms of asymptotic growth rate(رشد مجانبی)

a) $10^n, n^{\log n}, n^{\sqrt{n}}$

b) $10, \sqrt{n}, n, \log n, \dfrac{100}{n}$

c) $2^n, n^{3/2}, n\log n, n^{\log n}$

5. 4. Find the time complexity of the following examples (HINT: Use master method)
   a) $T(N) = 8T(N/2) + N^2$
   b) $T(N) = 2T(N/2) + N^2$
   c) $T(N) = 2T(N/2) + N^2/\log (N)$
   d) $T(N) = 2T(N/2) + N(\log(N))$

6. For the following algorithm :
   a) Calculate running time(T(n))
   b) Solve Recurrence of T(n), once with Substitution and once with recursion tree

```
void test(int n)
{
    if(n>0)
    {
        for (i=1, i<n , i=i*2)
        {
            printf("Y.d", i);
        }
        test(n-1);
    }
}
```