

# Assignment # 2

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1. (source: DSEndSem-2008) For a given problem with inputs of size  $n$ , algorithms A, B, C are executed. In terms of running time, one of the algorithms is  $O(n)$ , one  $O(n \log(n))$  and one  $O(n^2)$ . Some measured running times of these algorithms are given below:

input Size	512	1024	2048
A	70	350	450
B	50	300	2053
C	135	150	182

Identify which algorithm is which and explain the observed running times. Which algorithm would you select for different values of  $n$ ?

2. (source: adapted DSEndSem-2008) Write whether the following statements are true/false with justification.
  - (a)  $\log_2(n!) = \Omega(n \log(n))$
  - (b)  $O(f(n)) - O(f(n)) = 0$
  - (c)  $O(f(n) + g(n)) = f(n) + O(g(n))$  if  $f(n)$  and  $g(n)$  are positive for all  $n$
  - (d) All functions of the form  $f(n) = An^k$  (with A and k being constants) are in the class  $O(2^n)$ .
  - (e) All sorting methods for an array of  $n$  elements take time  $O(n^5)$
  - (f) All comparison based sorting algorithms take  $\Omega(n \log(n))$
3. Show that  $e^{O(z^m)} = 1 + O(z^m)$  for all fixed  $m \geq 0$
4. (source: DSEndSem-2008) Compute the time complexity of the code snippet given below in terms of input size  $n$ . Note that  $j$  is an integer.

```
• while(n){  
    j=n;  
    while(j>1){  
        j-=n/j;  
    }  
    n/=2;  
}
```

- ```
while(n){  
    j=n;  
    while(j>1){  
        j-=n/log(j);  
    }  
    n/=2;  
}
```