CS & IT ENGINEERING

Algorithms

Analysis of Algorithms

DPP (Discussion Notes)

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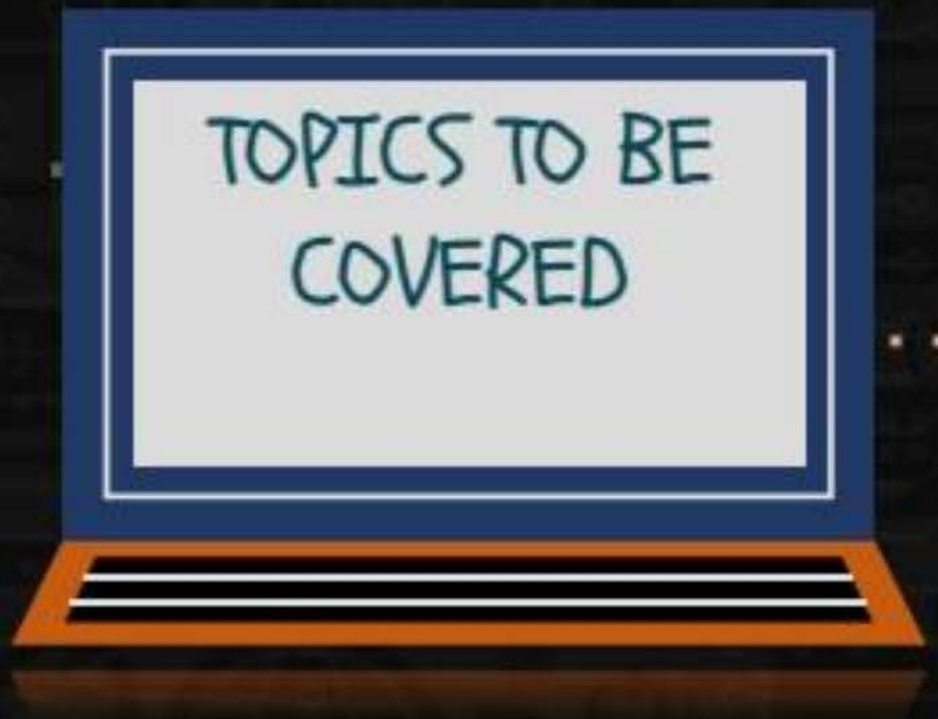


01 Question

02 Discussion

Q.1

Sort the functions in ascending order of asymptotic(big-O) complexity

$f_1(n) = n$, $f_2(n) = 80$, $f_3(n) = n^{\log n}$, $f_4(n) = \log\log^2 n$, $f_5(n) = (\log n)^{\log n}$

[MCQ]

$f_4 < f_1$

f_2

$f_5 > f_4$

A. $f_2(n), f_4(n), f_1(n), f_5(n), f_3(n)$

B. $f_2(n), f_1(n), f_4(n), f_5(n), f_3(n)$

C. $f_2(n), f_1(n), f_4(n), f_3(n), f_5(n)$

D. $f_1(n), f_1(n), f_4(n), f_3(n), f_2(n)$

$\log\log^2 n = \log(\log n * \log n)$

$\log(m*n) = \log m + \log n$

$= \log\log n + \log\log n = 2\log\log n$

$f_4 = 2^{\log\log n}$

$f_5 = \log n^{\log n}$

$f_4 \quad | \quad f_5$

$\log\log n \quad < \quad \log n^{\log n}$

$f_5 > f_4$

$f_5 > f_1$

$f_1 \quad | \quad f_5$

$n \qquad \log n^{\log n}$

$\log n = \log \log n^{\log n}$

$\log n = \log n * \log\log n$

Q.2

Consider two function $f(n) = 10n + 2\log n$ and $g(n) = 5n + 2(\log n)^2$, then which of the following is correct option?

[MSQ]

a, b

A. $f(n) = \theta(g(n))$

B. $f(n) = O(g(n))$

C. $f(n) = \omega(g(n^2))$

D. None of the above

$f(n) = 10n + 2\log n = O(n)$

$g(n) = 5n + 2(\log n)^2 = O(n)$

$f(n) = O(g(n))$

$g(n) = O(f(n))$

$f(n) = g(n)$

if O possible then O Ω Θ also

Q.3 Consider two function $f(n) = \sqrt{n}$ and $g(n) = n \log n + n$ then $f(n)/g(n)$ is equivalent to how many of the following given below?

_____.

[NAT]

2

A. $O(n^{-1/2})$ True

B. $O(n^{-1/2})$ True

C. $\Omega(1/\log n)$ False

D. $\theta(n^{-1/2})$ False

$f(n) = \sqrt{n}$

$g(n) = n + n\log n$

$$\frac{f(n)}{g(n)} = \frac{\sqrt{n}}{\sqrt{n}(1+\log n)} = \frac{1}{\sqrt{n}(1+\log n)}$$

$$= \frac{1}{\sqrt{n}+\sqrt{n}\log n}$$

(a)

$f(n) < c \cdot g(n)$ o

$f(n) \leq c \cdot g(n)$ O

$o(n^{-1/2}) = \frac{1}{\sqrt{n}}$

$f(n)$ $g(n)$

$\frac{1}{\sqrt{n}+\sqrt{n}\log n} = O\left(\frac{1}{\sqrt{n}}\right)$ True

$\leq$

$\leq$

If o possible then O also possible

If w " " Ω " " ω

Q.4

[MCQ]

Consider the following C-code

```
void foo (int n)
                {
                int a = 1;
                if (n = = 1)
                return;
for (; a ≤ n; a++)
                {
   printf("GATEWALLAH");
   break;
                }
                }
```

What is the worst time complexity of above program?

A. O(1)

B. O(n)

C. O (log n)

D. $O\sqrt{n}$

Q.5

Consider the following asymptotic functions :

$f1 = 2^n$ $\Rightarrow 2^n$ $\Rightarrow 2^n$

$f2 = 1.001^n$ $\Rightarrow (1.001)^n$ $\Rightarrow (1.001)^n$

$f3 = e^n$ $\Rightarrow e^n$ $\Rightarrow (2.71)^n$

$f4 = n!$ $\Rightarrow n!$

[MCQ]

Which of the following is correct increasing order of above functions?

$f_4 > f_3 > f_1 > f_2$

A. f3, f4, f1, f2

B. f2, f4, f1, f3

C. f3, f2, f1, f4

D. f2, f1, f3, f4

$n! = n^n$

Q.6

How many of the following expressions correctly describes $T(n) = n\log(n^2)$? ____

[NAT]

2

A. $\theta(n)$

B. $O(n)$ ✗

C. $\Omega(n)$ ✓

D. $O(n^2)$ ✓

$T(n) = n\log n^2$

$= n2\log n \Rightarrow 2n\log n$

O

$f(n) \leq c \cdot g(n)$

Ω

$f(n) \geq c \cdot g(n)$

(b) $n \log n \neq O(n)$

(a) $n \log n \pm \Theta(n)$

(c) $n \log n \geq \underset{W}{\Omega}(n)$

(d) $\Rightarrow n \log n = O(n^2)$

$\leq$

Q.7 Consider two function $f_1(n) = n^{2^n}$ and $f_2(n) = n^{n^2}$ then which of the following is true. [MCQ]

A. $f_1(n) = (Of_2(n))$ ✗

B. $f_1(n) = \theta(f_2(n))$ ✗

C. ✓ $f_1(n) = \omega(f_2(n))$

D. None of these

① $f_1(n) > f_2(n)$

$2^n = O(n^2)$

(b) $2^n \neq \theta(n^2)$

(c) $2^n \geq \omega(n^2)$

$f_1(n) = n^{2^n}$

$f_2(n) = n^{n^2}$

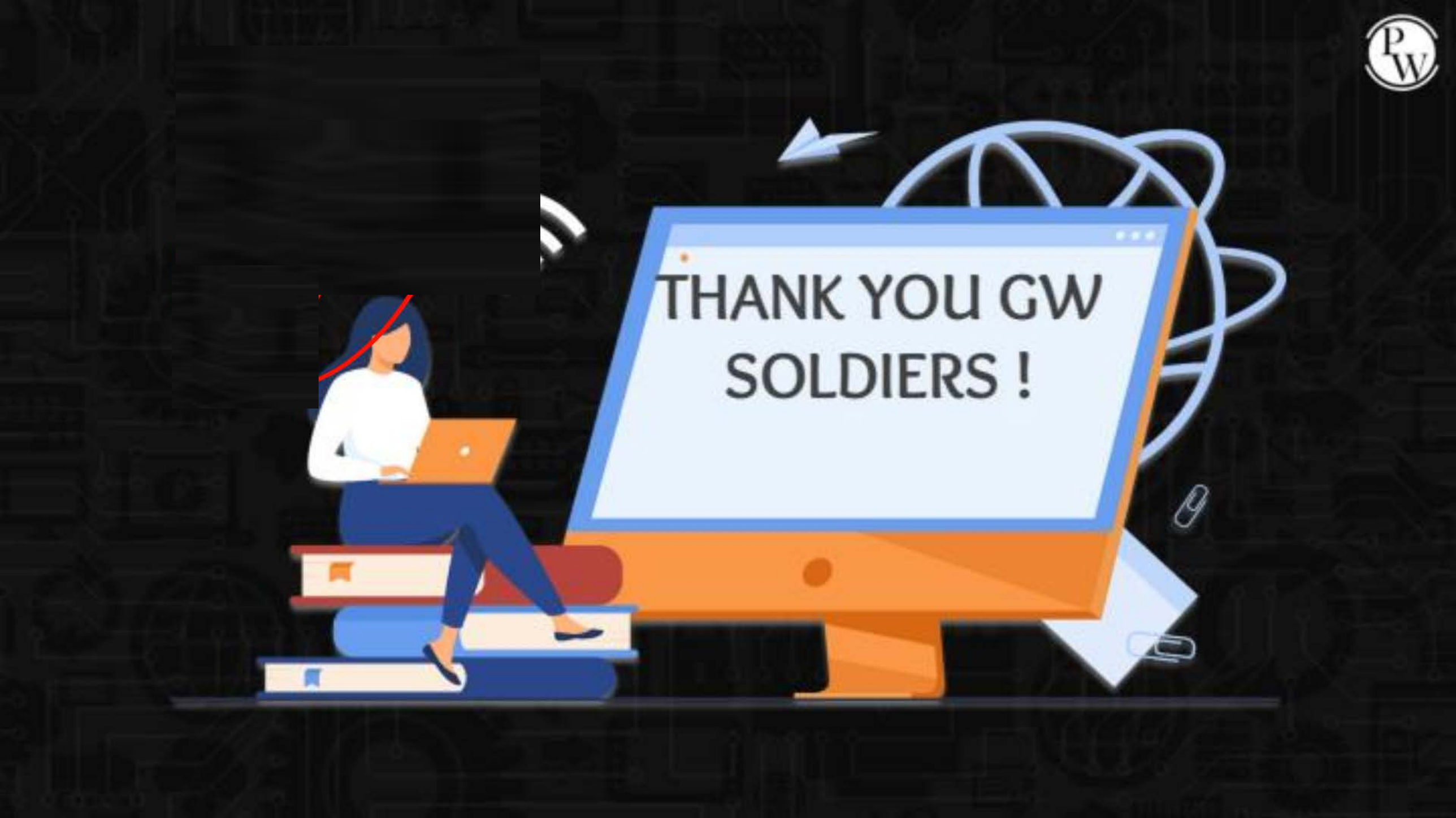
$f_1(n) > f_2(n)$

$f_1(n) \mid f_2(n)$

$n^{2^n} = n^{n^2}$

$2^n \log n = n^2 \log n$

$2^n \Rightarrow n^2$


THANK YOU GW
SOLDIERS !