

Q.1 Set. (A)

Marks: 5

Arrange the following 10 functions (on  $n$ ) in ascending order of their growth rates:

$5n(\log(n))^5$ ,  $4\log(\log(n))$ ,  $44^{n+4}n^3$ ,  $6n^{13}+5$ ,  $71\log(n^2)+9$ ,  
 $3n^3+8n+6$ ,  $2n^{\log(3)/\log(n)}$ ,  $512^{\log(8n)}$ ,  $(\pi n)^{4.5}$ ,  $1729n^{n/2}\log(n)$

Q.1 Set. (B)

Marks: 5

Arrange the following 10 functions (on  $n$ ) in ascending order of their growth rates:

$6n(\log(n))^4$ ,  $9\log(\log(n))$ ,  $33^{n-3}n^2$ ,  $8n^{11}+3$ ,  $8\log(n^3)+55$ ,  
 $3n^5+7n+4$ ,  $3\pi n^{\log(4)/\log(n)}$ ,  $64^{\log(4n)}$ ,  $(3n)^{6.25}$ ,  $202n^{n/3}\log(n)$

Q.1 Set. (C)

Marks: 5

Arrange the following 10 functions (on  $n$ ) in ascending order of their growth rates:

$3n(\log(n))^5$ ,  $\pi\log(\log(n))$ ,  $77^{n-7}n^6$ ,  $6n^{17}+4$ ,  $7\log(n^5)+91$ ,  
 $9n^7+5n+1$ ,  $4n^{\log(5)/\log(n)}$ ,  $128^{\log(2n)}$ ,  $(2n)^{7.75}$ ,  $505n^{n/4}\log(n)$

$$\begin{aligned}(512)^{\log_2(8n)} &= (2^9)^{\log_2(8n)} \\ &= (2)^{(9 \cdot \log_2(8n))} \\ &= (2)^{\log_2((8n)^9)} \\ &= (8n)^9\end{aligned}$$

$$\begin{aligned}2 \cdot n^{\log(3)/\log(n)} &= 2 \cdot n^{\log_n(3)} \\ &= 2.3 \\ &= O(1)\end{aligned}$$

Constant -	$2 \cdot n^{\log(3)/\log(n)}$
Polylogarithmic -	$4 \cdot \log(\log(n))$ , $71\log(n^2)+9 = 71.2\log(n)+9$
Polynomial -	$5n(\log(n))^5$ , $3n^3+8n+6$ , $(\pi \cdot n)^{4.5}$ , $(512)^{\log_2(8n)} = (8n)^9$ , $6n^{13}+5$
Exponential -	$44^{(n+4)} \cdot n^3$ , $1729n^{(n/2)} \cdot \log(n)$

$$n^{(0.1)} \gg (\log(n))^{10001}$$

$$(\log(n))^5 \ll n^2$$

$$\log(256) = 8, \log(\log(256)) = \log(8) = 3$$

$$O(c^n) \ll O(n!) \ll O(n^n)$$