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~~1 + ... n + n + n-2 + n-4 ... 1~~ 1+

$= n + n/2 + n/3 + n/4 \dots \dots n/n$

$= n\left(1 + 1/2 + 1/3 + 1/4 \dots \dots + \frac{1}{n}\right)$

$= n\left(\underbrace{\qquad\qquad}_{\log n}\right) = \underline{n\log n}$

~~Q10~~

Q11:-

```
void fun (int n)
{ int j=1, i=0;
  while (i<n)
  { i=i+j;
    j++; } }
```

i=0 i=1 3 7

0 1 3 7 12 ...

~~n~~ ~~i~~

last term would be

$\frac{k(k+1)}{2} = n$

1

1+2

1+2+4

1+2+4+5

$k^2 = n$

$\boxed{k = \sqrt{n}}$

Time complexity :- $O(\sqrt{n})$ Ans

~~Q12:~~

~~1) n log n~~

Q14:- $T(n) = T(n/4) + T(n/2) + cn^2$

~~as T(n/2)~~

Assuming $T(n/2) > T(n/4)$

$T(n) = T(n/2) + cn^2$

Applying master's theorem,

$a = 1 \quad b = 2$

$f(n) = cn^2 \mid n^{\log_1 2}$

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As, $cn^2 > n^{\log 2}$
So, $T(n) = \Theta(f(n))$
$T(n) = n^2$ Ans

$= O(n^2)$

Q15:-

$n + n/2 + n/3 + n/4 + \dots$
$n(1 + 1/2 + 1/3 + 1/4 + \dots)$
$= n(\log n) = n\log n$ Ans

Q16:-

$n = i^k$
$\log n = k \log i$
$\boxed{k = \log_i n}$

$O(\log n)$ Ans

Q18:-

a) $100 < \log\log n < \log n < \log(n!) < \text{root } n < n < n\log n$
$< n^2 < 2^n < 2^{2n} = 4^n < n!$

b) ~~$\sqrt{\log(n)} <$~~ $1 < \log(\log(n)) < \sqrt{\log(n)} < \log(n)$
$< \log 2n < 2\log n < n < 2n < 4n < n\log n <$
$< \log(n!) <$
$< n^2 < 2(2^n) < n!$

c) $96 < \log_8 n < \log_2 n < \log(n!) < 5n <$
$n\log_8 n < 6n\log_2 n < 8n^2 < 7n^3 <$
$8^{2n} < n!$