$\sum a_n \quad ; \quad a_n = \frac{n}{2^n} \quad ; \; n \text{ is odd}$

$\qquad\qquad\qquad\quad \frac{1}{2^n} \quad ; \; n \text{ is even}$

Case-I when n is even then

$\sum a_n = \sum \frac{1}{2^n} \quad ; \; a_n = \frac{1}{2^n}$

$\lim_{n\to\infty} \frac{a_{n+1}}{a_n} = \lim_{n\to\infty} \frac{1/2^{n+1}}{1/2^n} = \lim_{n\to\infty} \frac{1}{2^n \cdot 2} \times 2^n = \frac{1}{2}$

$\lim_{n\to\infty} \frac{a_{n+1}}{a_n} = \frac{1}{2} < 1$

$\Rightarrow \sum a_n = \sum \frac{1}{2^n}$ is convergent series when n is even

Case-II when n is odd

$\sum a_n = \sum \frac{n}{2^n} \quad ;$ by ratio test

$\lim_{n\to\infty} \frac{a_{n+1}}{a_n} = \lim_{n\to\infty} \frac{(n+1)}{2^{n+1}} \times \frac{2^n}{n} = \lim_{n\to\infty} \frac{\cancel{n}(1+1/n)}{\cancel{2^n} \cdot 2} \times \frac{\cancel{2^n}}{\cancel{n}}$

$= \frac{(1+0)}{2}$

$= \frac{1}{2} < 1$

$\Rightarrow \sum a_n = \sum \frac{n}{2^n}$ is also convergent

$\because$ sum of two convergent series is also a convergent series

hence $\sum a_n$ is also convergent

$\sum a_n \quad ; \quad a_n = \frac{1}{\log n} \quad ; \; n \geq 2$

$\because \quad n > \log n \quad ; \; \forall \, n > 2$

$\Rightarrow \quad \frac{1}{n} < \frac{1}{\log n}$