Proof – Total Nodes of a Perfect Binary Tree

- Sum of finite Geometric Progression
  - $Sn = a + ar + ar^2 + ar^3 + ar^4 + ... + ar^{n-1} = a\left[\frac{(r^n-1)}{r-1}\right]$ -----------Eq. (1)
- Series we have in perfect binary trees
  - $Total\ nodes = 2^0 + 2^1 + 2^2 + 2^3 + 2^4 ..... + 2^h$
  - $Total\ nodes = 1.2^0 + 1.2^1 + 1.2^2 + 1.2^3 + 1.2^4 ..... + 1.2^h$
  - a = 1, r = 2 and
  - n-1 = h OR n=h+1

  Putting above values in in the formula of Eq.(1)
  - $Total\ nodes = a\left[\frac{(r^n-1)}{r-1}\right]$
  - $Total\ nodes = 1\ .\ \left[\frac{(2^{h+1}-1)}{2-1}\right]$
  - $Total\ nodes = 2^{h+1}-1$