Proof

$$\binom{n}{r} = \binom{n-1}{r-1} + \binom{n-1}{r}$$

$$\binom{n}{r} = \left(\frac{(n-1)!}{(r-1)!(n-1-(r-1))!}\right) + \left(\frac{(n-1)!}{r!((n-1)-r)!}\right)$$

$$\binom{n}{r} = \left(\frac{(n-1)!}{(r-1)!(n-r)!}\right) + \left(\frac{(n-1)!}{r!((n-r)-1)!}\right)$$

$$\binom{n}{r} = \left(\frac{(n-1)!}{(r-1)!(n-r)!}\right) + \left(\frac{(n-1)!}{r(r-1)!((n-r)-1)!}\right)$$

$$\binom{n}{r} = \left(\frac{(n-1)!}{(r-1)!(n-r)(n-r-1)!}\right) + \left(\frac{(n-1)!}{r(r-1)!((n-r)-1)!}\right)$$

$$\binom{n}{r} = \left(\frac{r(n-1)!}{r(r-1)!(n-r)(n-r-1)!}\right) + \left(\frac{(n-1)!(n-r)}{r(r-1)!((n-r)-1)!(n-r)}\right)$$

$$\binom{n}{r} = \frac{r(r-1)! + (n-1)!(n-r)}{r(r-1)!(n-r)(n-r-1)!}$$

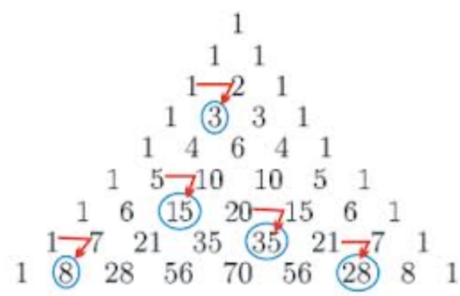
$$\binom{n}{r} = \frac{(n-1)![r+(n-r)]}{r(r-1)!(n-r)(n-r-1)!}$$

$$\binom{n}{r} = \frac{(n-1)!n}{r(r-1)!(n-r)(n-r-1)!}$$

$$\binom{n}{r} = \frac{n(n-1)!}{r(r-1)!(n-r)(n-r-1)!}$$

$$\binom{n}{r} = \frac{n!}{r!(n-r)!}$$

$$\binom{n}{r} = \binom{n}{r}$$



Given

By definition, $\binom{n}{r} = \frac{n!}{r!(n-r)!}$

By definition, $u! = u(u-1)!$

for example 5! = 5 (4!)

Prove

$$\binom{n}{r} = \binom{n-1}{r-1} + \binom{n-1}{r}$$