$$X \sim \text{Binomial}\left(5, \frac{1}{3}\right),\ Y \sim \text{Binomial}\left(10, \frac{2}{3}\right) \implies$$

$$\text{Prob} = \mathcal{P}(X = Y) = \sum_{i=0}^{5} \mathcal{P}(X = i, Y = i) = \sum_{i=0}^{5} \mathcal{P}(X = i) \times \mathcal{P}(Y = i) =$$

$$\sum_{k=0}^{5} \binom{10}{k} \binom{5}{k} \left(\frac{2}{3}\right)^{k} \left(\frac{1}{3}\right)^{10-k} \left(\frac{1}{3}\right)^{k} \left(\frac{2}{3}\right)^{5-k} =$$

$$\left(\frac{2}{3}\right)^{5} \left(\frac{1}{3}\right)^{10} \sum_{k=0}^{5} \binom{10}{k} \times \binom{5}{5-k}$$

based on this formula **Link**

$$\text{Prob} = \binom{15}{5} \left(\frac{2}{3}\right)^{5} \left(\frac{1}{3}\right)^{10}$$

Prove it by python:

In [ ]:
```
from sympy import summation, symbols, binomial, Rational

i = symbols("i")
summation(binomial(10, i) * binomial(5, 5-i) * (Rational(2, 3)**i) * (Rational(1, 3)**(10-i)) *
(Rational(1,3)**i) * (Rational(2, 3)**(5-i)), (i, 0, 5))
```

Out[ ]:
$$\frac{32032}{4782969}$$

In [ ]:
```
(Rational(2, 3)**5) * (Rational(1, 3)**10) * binomial(15, 5)
```

Out[ ]:
$$\frac{32032}{4782969}$$