Novel Formulas for Coefficients in Expansion of $\left(1 + 2x + 3x^2 + 4x^3 + 5x^4 + 6x^5\right)^n$

1) First Formula

$$T(n,k) = \sum_{i=0}^{k} \sum_{j=2i}^{k} \sum_{q=3i}^{k} \sum_{r=4i}^{k} \frac{2^{k+q-2r}\ 3^{j+r-2q}\ 4^{i+q-2j}\ 5^{j-2i}\ 6^{i}\ n!}{(n-k+r)!\ (k+q-2r)!\ (j+r-2q)!\ (i+q-2j)!\ (j-2i)!\ i!}$$

$$for\ k\ =\ 0..5n,\ where\ n\ is\ nonnegative\ integer\ and$$

$$\frac{2^{k+q-2r}\ 3^{j+r-2q}\ 4^{i+q-2j}\ 5^{j-2i}\ 6^{i}\ n!}{(n-k+r)!\ (k+q-2r)!\ (j+r-2q)!\ (i+q-2j)!\ (j-2i)!\ i!} = 0$$

$$for\ (n-k+r) < 0\ or\ (k+q-2r) < 0\ or\ \ (j+r-2q) < 0\ or\ (i+q-2j) < 0\ or\ \ (j-2i) < 0$$

2) Second Formula

$$T_{n,k} = T_{n-1,k} + 2\,T_{n-1,k-1} + 3\,T_{n-1,k-2} + 4\,T_{n-1,k-3} + 5\,T_{n-1,k-4} + 6\,T_{n-1,k-5}$$

$$for\ k\ =\ 0..5n,$$

$$T_{0,0} = 1\ and\ T_{n,k} = 0\ for\ n\ or\ k\ <\ 0.$$

REFERENCE:
Shara Lalo and Zagros Lalo, Polynomial Expansion Theorems and Number Triangles, Zana Publishing, 2018, ISBN: 978-1-9995914-0-3