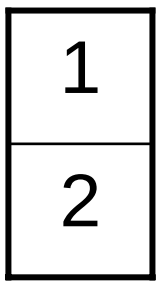
Young Tableau: A Simple Introduction

- Use boxes for SU(n) objects: 

- To combine two or more objects, follow these rules.

  (1) When we connect boxes horizontally, the number never decrease.

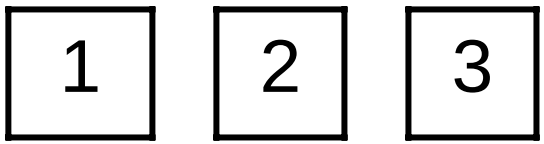
  (2)When we connect boxes vertically, the number always decrease.



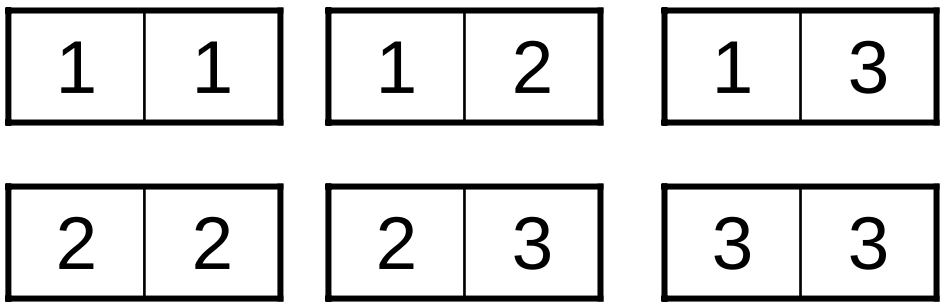
- Horizontal boxes are symmetric. Vertical boxes are anti-symmetric.

Young Tableau for SU(3)

- Single object : dimensionality 3

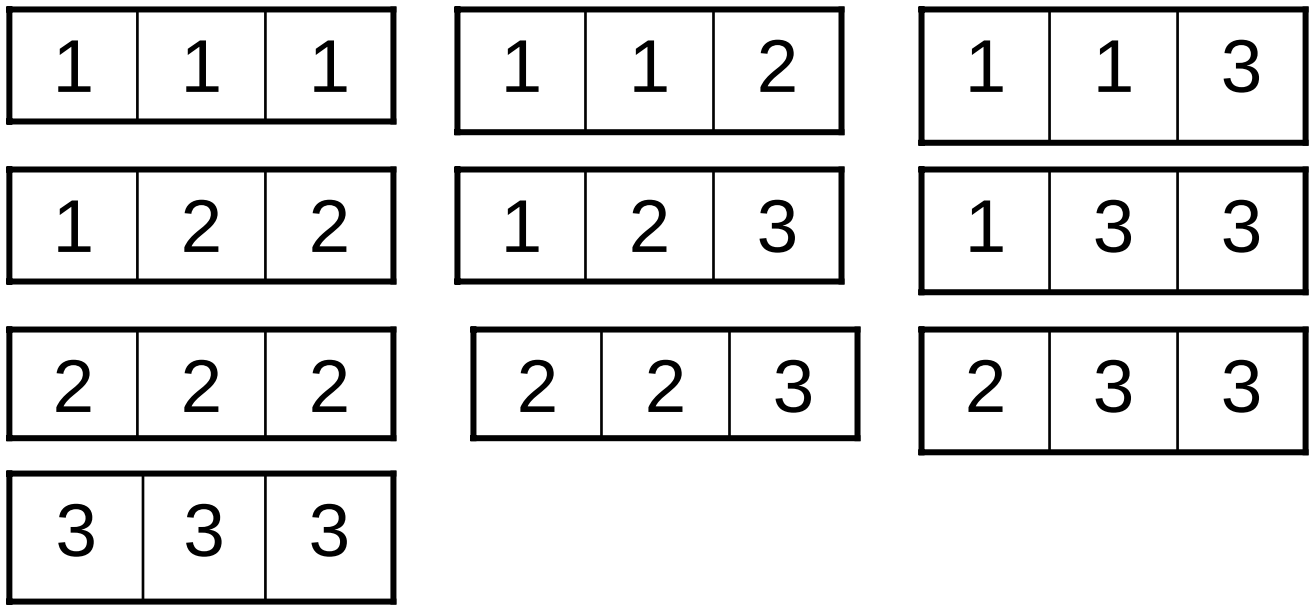


- Symmetric two objects: dimensionality 6



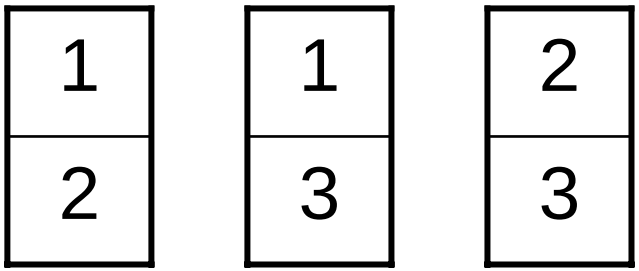
Young Tableau for SU(3)

- Symmetric three objects : dimensionality 10

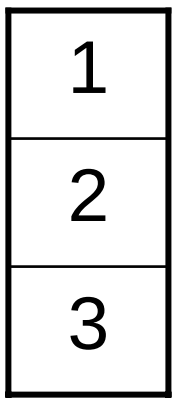


Young Tableau for SU(3)

- Anti-symmetric two object : dimensionality 3*

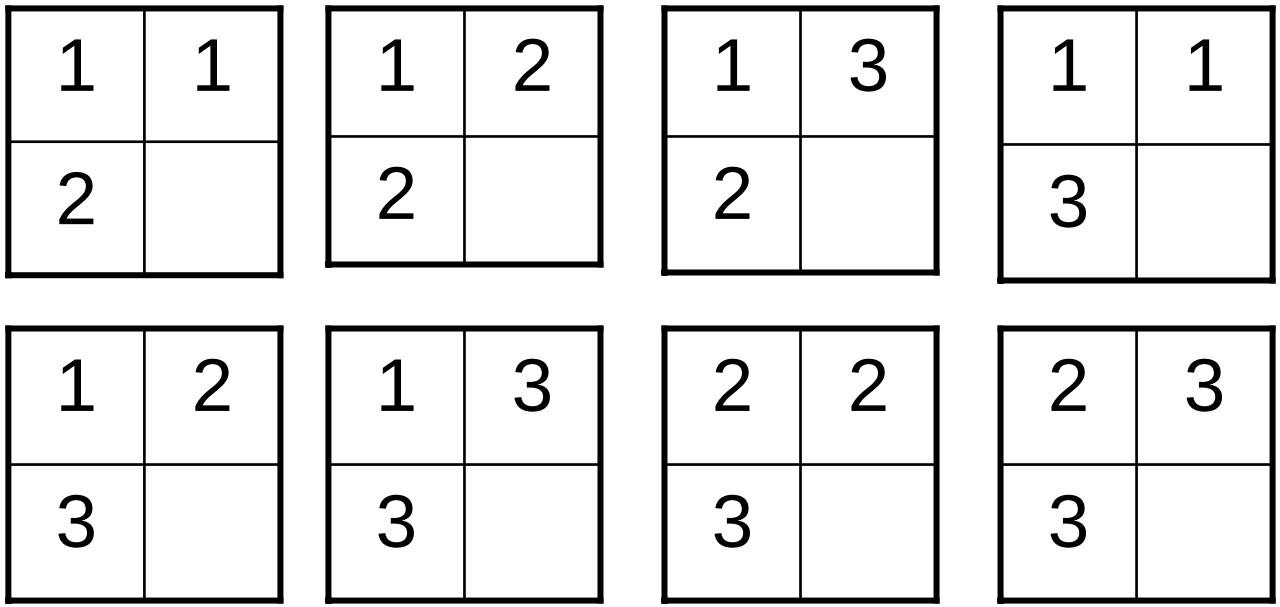


- Anti-symmetric three objects: dimensionality 1 (singlet)



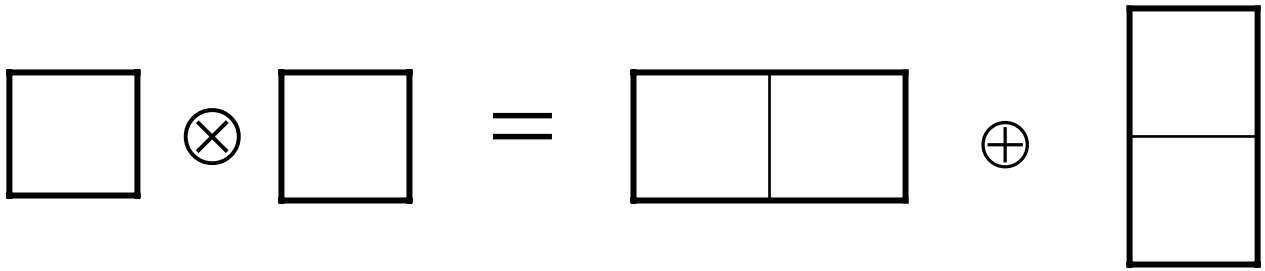
Young Tableau for SU(3)

- Mixed symmetry three objects : dimensionality 8 (octet)



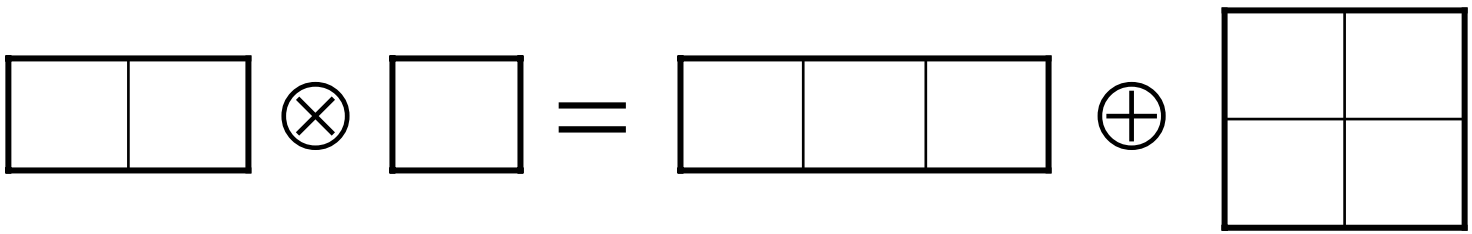
Young Tableau for SU(3)

$$3 \otimes 3 = 6 \oplus 3^*$$

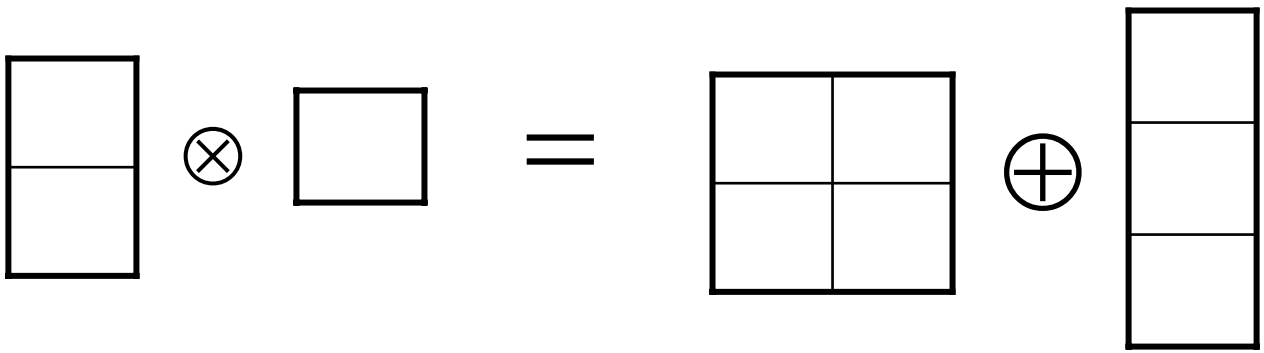


Young Tableau for SU(3)

$$6 \otimes 3 = 10 \oplus 8$$

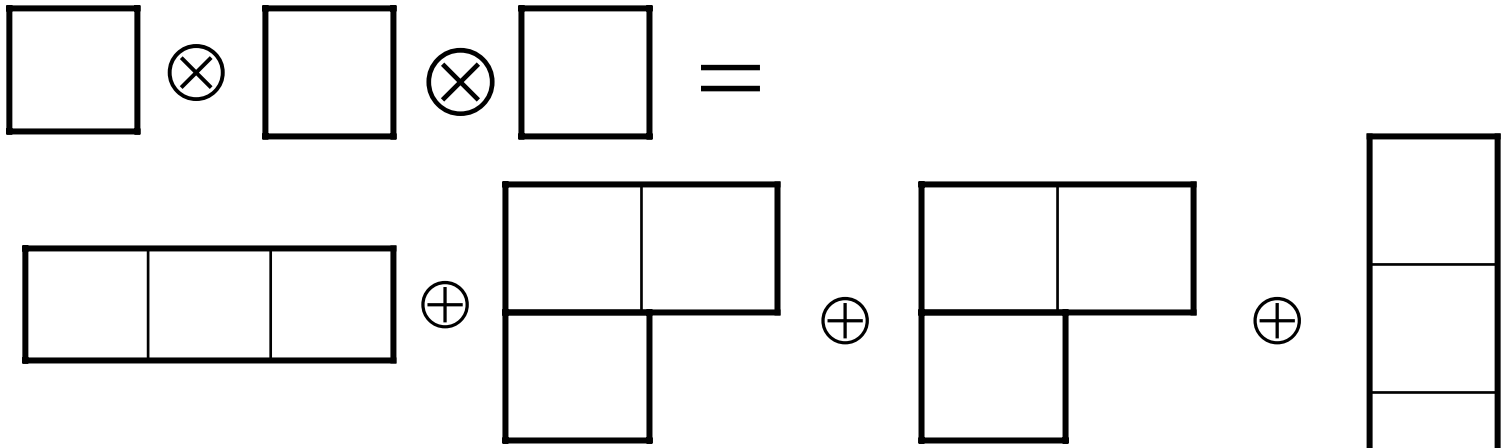


$$3^* \otimes 3 = 8 \oplus 1$$

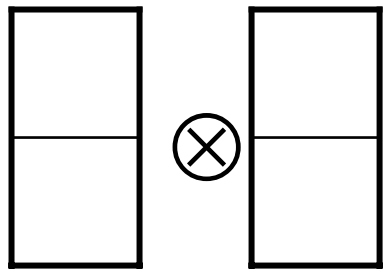


$$(3 \otimes 3) \otimes 3 = (6 \oplus 3^*) \otimes 3 = (6 \otimes 3) \oplus (3^* \otimes 3) = 10 \oplus 8 \oplus 8 \oplus 1$$

Extension and Limitation



Cannot apply to complicated cases like:



References:

1. K. Huang, QUSRKS, LEPTONS & GAUGE FIELDS, 2nd ed., World Scientific, 1992
2. H. Georgi, LIE ALGEBRAS IN PARTICLE PHYSICS, ABP, 1999