PHYC 467: Methods of Theoretical Physics II

Spring 2013

Homework Assignment #7

(Due April 16, 2013)

1- The symmetric group S_5 has $5! = 120$ elements, and hence 120 permutations of $(1, 2, 3, 4, 5)$ can be formed. Use the Young diagrams to find the irreducible representations of S_5 and determine their dimensionality. How do the 120 vectors formed by permutations of $(1, 2, 3, 4, 5)$ are decomposed into these irreducible representations?

2- Construct the $SU(3)$ multiplets built up from four particles and determine their dimensionality by using the Young diagrams. Are any of these representations real? Use this answer to argue that no bound states consisting of four quarks can exist in the nature.

3- By using the related Young diagrams, show that the (p, q) representation of $SU(3)$ has dimension $d = (p + 1)(q + 1)(p + q + 2)/2$.