**Identities Involving Some Restricted Partitions**

A ***partition*** of a positive number *n* is a representation of this number as a sum of natural numbers, called parts or summands. The partition function *p(n)* is sometimes called the unrestricted partition of *n*. Besides the partition function *p*(*n*), we also consider partitions formed from numbers from some restricted set. For example, let *q*(*n*) denotes the number of partitions of the number *n* where all parts are distinct. The partitions of the number 7 into distinct parts are 7, 6+1, 5+2, 4+3, and 4+2+1. Thus, *q*(7) = 5. Other examples of restricted partitions are the following

* *p(m, n)= the number of partitions of n in which no part is larger than m*
* *=* *the number of partitions of n in which at most m parts appear*
* *d(m, n) = the number of partitions of n into m distinct parts*
* *D(m, n) = the number of partitions of n into distinct parts in which no part is greater than m*
* *= the number of partitions of n whose least part is m*
* *o(n)=the number of partitions of in which all parts are odd*
* *e(n)= the number of partitions of n in which all parts are even*
* *p(S, n) = the number of partitions of n using summands in S.*

In [1], Chandrupatla Hassen and Osler have shown that there is a recurrence relation of the restricted partition *p(m, n)= the number of partitions of n in which no part is larger than m* The paper concludes with remarks regarding the other partitions listed above.

The main purpose of this project is to study these partition functions. In particular the students will be lead to discover some identities such as

 and .

Finally, one has the deep results of so the called Roger-Ramanujan Identities and the Ramanujan Congruences. We believe Andrews' book [2] has an excellent treatment of these topics that should be accessible to most readers with modest background in mathematics.

**References**

[1] Chandrupatla , T. R, Hassen,A., Osler, T, *A Table of the Partition Function*, The Mathematical Spectrum, 34 (2001/2002), pp. 55 - 57.

[2] Andrews, George E, *Number Theory,* Dover Publications, New York, 1971, pp. 149-200.