1110-05-32 **Tri Lai*** (`tmlai@ima.umn.edu`), 207 Church Street SE, 306 Lind Hall, Minneapolis, MN 55455.
Enumeration of lozenge tilings of a hexagon with holes on boundary.

MacMahon's classical theorem on plane partitions fitting in a given box is equivalent to fact that the number of lozenge tilings of a centrally symmetric hexagon of side-lengths a, b, c, a, b, c (in cyclic order) on the triangular lattice is equal to

$$\frac{H(a)H(b)H(c)H(a+b+c)}{H(a+b)H(b+c)H(c+a)},$$

where the hyperfactorial function $H(n)$ is defined by $H(n) := 0!1! \ldots (n-1)!$.

We generalize MacMahon's theorem by giving an exact enumeration for the lozenge tilings of a hexagon with three holes on boundary. The result also solves (and generalizes) an open problem posed by James Propp (*New Perspectives in Geometric Combinatorics*, Cambridge University Press, 1999). In addition, we investigate a q-analog of the result and its connection to q-enumeration of plane partitions that fit in a connected union of several boxes. (Received February 12, 2015)