Hook length property of d-complete posets via q-integrals

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Abstract: In this work, we prove the hook length property of the d-complete posets using the q-integral technique developed by Kim and Stanton. For a non-negative integer n, the generating function for the number of partitions of n with no more than k parts, $p_k(n)$, is given by

$$\sum_{n=0}^{\infty} p_k(n)q^n = \prod_{i=1}^{k} \frac{1}{1-q^i}.$$

Considering a partition of n with no more than k parts as an order-reversing map from a k-element chain to the set of non-negative integers such that the sum of images equals to n, Stanley extended this concept of partition and defined *P-partitions* of n. Then Stanley proved that the P-partition generating function for shapes has the hook length property. Proctor and Peterson figured out that the d-complete posets satisfy the hook length property, and Proctor showed that any connected d-complete poset P can be uniquely decomposed into a slant sum of one element posets and irreducible components. Furthermore, he classified 15 disjoint classes of irreducible components and showed that these 15 disjoint classes exhaust the set of all irreducible components. We show that the P-partition generating function for each irreducible d-complete poset can be written as a q-integral and prove the hook length property of them by computing the q-integrals explicitly. This is a joint work with Jang Soo Kim.