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Integral representations for multivariate logarithmic polynomials

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# INTEGRAL REPRESENTATIONS FOR MULTIVARIATE LOGARITHMIC POLYNOMIALS

FENG QI

*To Professor Sen-Lin Xu, my doctoral advisor, at USTC*

ABSTRACT. In the paper, by induction and recursively, the author proves that the generating function of multivariate logarithmic polynomials and its reciprocal are a Bernstein function and a completely monotonic function respectively, establishes a Lévy-Khintchine representation for the generating function of multivariate logarithmic polynomials, deduces an integral representation for multivariate logarithmic polynomials, presents an integral representation for the reciprocal of the generating function of multivariate logarithmic polynomials, computes real and imaginary parts for the generating function of multivariate logarithmic polynomials, derives two integral formulas, and denies the uniform convergence of a known integral representation for Bernstein functions.

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## 1. PRELIMINARIES AND MOTIVATIONS

In this section, we recall some preliminaries and state motivations of this paper.

**1.1. Completely monotonic function and the Bernstein function.** Recall from [9, Chapter XIII], [13, Chapter 1], and [14, Chapter IV] that an infinitely differentiable function  $f$  is said to be completely monotonic on an interval  $I$  if it satisfies  $(-1)^k f^{(k)}(x) \geq 0$  on  $I$  for all  $k \geq 0$ . Theorem 12b in [14] reads that a

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*Key words and phrases.* multivariate logarithmic polynomial; generating function; completely monotonic function; Bernstein function; integral representation; Lévy-Khintchine representation; real part; imaginary part; uniform convergence; recurrence relation; mathematical induction.

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