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A NOTE ON APPROXIMATION BY BERNSTEIN POLYNOMIALS

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Let f be continuous on $[0, 1]$ and $0 \leqq \alpha < \beta \leqq 1$ and let $B_n f$ be the Bernstein polynomial of f of degree n, defined by

$$B_n f(x) = \sum_{\nu=0}^{n} f\left(\frac{\nu}{n}\right)\binom{n}{\nu} x^\nu (1 - x)^{n-\nu}.$$

In view of a result of E. V. Voronovskaya, which states that the boundedness of f on $[0, 1]$ and the existence of f'' at a point $x \in [0, 1]$ implies that

$$B_n f(x) - f(x) = \frac{x(1 - x)}{2n} f''(x) + o\left(\frac{1}{n}\right) \qquad (n \to \infty),$$

it has been conjectured [1, p. 22] that the relation

$$B_n f(x) - f(x) = o\left(\frac{1}{n}\right)$$

cannot be true for all $x \in [\alpha, \beta]$ unless f is a linear function on $[\alpha, \beta]$. The following theorem related to this conjecture was proved by K. de Leeuw [2]:

If f is continuous on $[0, 1]$ and

$$B_n f(x) - f(x) = O\left(\frac{1}{n}\right)$$