On the $\mathcal{D}$-equivalence Class of Complete Bipartite Graphs

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Let G be a simple graph of order n. We mean by *dominating set*, a set $S \subseteq V(G)$ such that every vertex of G is either in S or adjacent to a vertex in S. The *domination polynomial* of G is the polynomial $\sum_{i=1}^{n} d(G,i)x^i$, where $d(G,i)$ is the number of dominating sets of G of size i. Two graphs G and H are said to be $\mathcal{D}$-*equivalent*, written $G \sim H$, if $D(G,x) = D(H,x)$. The $\mathcal{D}$-*equivalence class* of G is $[G] = \{ H \mid H \sim G \}$. Recently, the determination of $\mathcal{D}$-equivalence class of a given graph, has been of interest. In this talk, we show that for $n \geq 3$, $[K_{n,n}]$ has size two. We conjecture that the complete bipartite graph $K_{m,n}$ for $n - m \geq 2$, is uniquely determined by its domination polynomial. Moreover, we show that the conjecture is true for the following cases:

(i) $n > max \{ m+2, \binom{m}{2} \}$;
(ii) $m \leq 4$.