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A Cohen-Macaulay complex is said to be balanced of type \( a = (a_1, a_2, ..., a_s) \) if its vertices can be colored using \( s \) colors so that every maximal face gets exactly \( a_i \) vertices of the \( i \)th color. For \( b = (b_1, b_2, ..., b_s) \), \( 0 \leq b \leq a \), let \( f_b \) denote the number of faces having \( b_i \) vertices of the \( i \)th color. Our main result gives a characterization of the \( f \)-vectors \( f = (f_b)_{0 \leq b \leq a'} \) or equivalently the \( h \)-vectors, which can arise in this way from balanced Cohen-Macaulay complexes. As part of the proof we establish a generalization of Macaulay’s compression theorem to colored multicomplexes. Finally, a combinatorial shifting technique for multicomplexes is used to give a new simple proof of the original Macaulay theorem and another closely related result.

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