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Between Compactness and Completeness

Gerald A. Beer

California State University, Los Angeles
5151 State University Dr., Los Angeles, CA 90032 USA

gbeer@cslanet.calstatela.edu

Call a sequence in a metric space quasi-Cauchy if for each positive ε there exists a cofinal (rather than residual) set of indices whose corresponding terms are ε-close.

We give a number of characterizations of metric spaces for which each quasi-Cauchy sequence has a cluster point. For example, a space has such a metric if and only if each continuous function defined on it is uniformly locally bounded. A metrizable space admits such a metric if and only if its set of points having a compact neighborhood has compact complement.

Such metric spaces sit between the complete spaces and the UC spaces, whose characteristic properties we review in some detail.