

Problem 2 (due Monday, September 25)

2024 points are chosen in space so that among any 18 of these points there are two which are no farther apart than 1. Prove that there exists a ball of radius 1 which contains at least 120 of the 2024 points.

The problem was solved by Sasha Aksenchuk, Prof. Vladislav Kargin, Ashton Keith (Purdue U.), and Mithun Padinhare Veettil. All received solutions as well as our original solution follow essentially the same idea, though the exposition varies from solution to solution. Both Slava Kargin and Ashton Keith reformulate the problem using graph theory and then prove a corresponding graph theory result. Ashton formulates a more general result with 18 replaced by n and 2024 replaced by M and 120 replaced by $M/(n-1)$ and then proceeds by induction on n . He also observes that the 2024 in the problem is optimal (i.e. the problem is no longer true for 2023 points). For a detailed solution see the following link Solution.

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