Suppose that $v_1, v_2, \ldots, v_d$ are unit vectors in $\mathbb{R}^d$. Prove that there exists a unit vector u such that

$$|u \cdot v_i| \leq \frac{1}{\sqrt{d}}$$

for $i = 1, 2, \ldots, d$.

(Here $\cdot$ denotes the usual scalar product on $\mathbb{R}^d$.)