Dean Doty's "minimal sufficiency" argument was presented as an enthymeme. For those who are unfamiliar with logic, his reasoning is offered in detail hereinafter.

4.1 Minimal Sufficiency

A given problem can admit many sufficient statistics.

4.1.1 Example

Consider the Normal location model $X_i \sim N(\theta, 1)$. The data itself, $(X_1, \ldots, X_n)$ is sufficient. Also, a re-ordering $(X_{(1)}, \ldots, X_{(n)})$ is sufficient. We will show that the mean $\overline{X} = \frac{1}{n}\sum_{i=1}^{n} X_i$ is minimally sufficient.

4.1.2 Definition

A statistic T is "Minimally sufficient" if T is sufficient and for all other sufficient statistics U there exists some function f such that $T = f(U), a.s.\mathbb{P}_\theta, \forall\theta \in \Theta$

We want simpler criteria to recognize minimal sufficiency.

Theorem 4.1. *(a) Let $\mathcal{P} = \{\mathbb{P}_\theta | \theta_0, \ldots, \theta_k\}$ be a regular family with finitely many members. Then $T(X) = \left(\frac{p(x;\theta_1)}{p(x;\theta_0)}, \ldots, \frac{p(x;\theta_k)}{p(x;\theta_0)}\right)$ is minimal sufficient.*

(b) Given nested families $\tilde{\mathcal{P}} \subseteq \mathcal{P}$ such that $(\tilde{\mathcal{P}} a.e.)$ implies $(\mathcal{P} a.e.)$, if T is minimal sufficient for $\tilde{\mathcal{P}}$ and sufficient for $\mathcal{P}$ then T is minimal sufficient for $\mathcal{P}$.

Therefore, Lindley and DePree's "grievance does not meet ***T***, the minimal sufficiency for initiating a faculty grievance."

We have borrowed from Wainwright's Theoretical Statistics Lecture 4—September 7, 2006. See,. http://www.stat.berkeley.edu/~gvrocha/STAT210A/scribing/lectures/stat210a_lecture_04.pdf