

# Notes on "Statistics for Mathematicians" by Victor M. Panaretos

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## 1 About this note

## 2 Jargons

## 3 Chapter 1: Regular Probability Models

### Definition 1.1: Regular Parametric Probability Models

- $X$  :  $\mathbb{R}$ -valued random variable
- $F_\theta$  : distribution function of  $X$
- $\theta$  : a parameter in  $\Theta \subseteq \mathbb{R}^p$  (parameter space)

The probability model  $\{F_\theta : \theta \in \Theta\}$  will be calld regular if one of the two following conditions holds:

1.  $\forall \theta \in \Theta$ , the distribution  $F_\theta$  is continuous with density  $f(x; \theta)$
  2.  $\forall \theta \in \Theta$ , the distribution  $F_\theta$  is discrete with probability mass function  $f(x; \theta)$  such that  $\sum_{x \in \mathbb{Z}} f(x; \theta) = 1$  for all  $\theta \in \Theta$ .
- The model  $F_\theta$  cannot switch between continuous and discrete depending on the value of  $\theta$ .
  - $\mathcal{X} := \{x \in \mathbb{R} : f(x; \theta) > 0\}$  is called the sample space of  $X$ .

### 3.1 Discrete Regular Models