

## CONDITIONAL DISTRIBUTIONS

## Why

We want to speak of the pairwise conditional distributions of a particular joint distribution.<sup>1</sup>

## **Definition**

Suppose  $A_1, \ldots, A_n$  is a listof finite setsand  $p: \prod_{i=1}^n A_i \to [0,1]$  is a distribution on the (finite) product  $\prod_{i=1}^n A_i$ .

For  $i \neq j \in \{1, ..., n\}$ , the conditional distribution of i on j is the function  $p_{i|j}: A_i \times A_j \to \mathbf{R}$  defined so that that  $p_{i|j}(\cdot, b)$  is the conditional distribution induced by conditioning on  $\{a \in \prod_{i=1}^n A_i \mid a_j = b\}$ .

For 
$$i, j = 1, ..., n$$
 and  $i \neq j$ ,  $p_i$ ,  $p_{ij}$  and  $p_{i|j}$  satisfy

$$p_{i|j}(b,c)p_{j}(c) = p_{ij}(b,c) \quad \text{for all } b \in A_{i}, c \in A_{j}$$

<sup>&</sup>lt;sup>1</sup>Future editions will rework this sheet.

