





Notations	Example: Opinion poll
 If θ denotes the quantity by which the constituent pmfs/pdfs of the model differ from each other, then we can write each pmf/pdf as f(x θ). The quantity θ is the <i>parameter</i> of this model. The set Θ of all possible values of θ is called the parameter space of the model. 	 A researcher wants to know what percentage of students in a certain university are in favor of a recent government policy. For a large university, soliciting every student's opinion is impossible. The researcher may want to draw a random list of n = 500 students and quiz them on their opinion regarding the policy. A random list gives the best chance of guarding against systematic biases in obtaining a representative sample of students. The data here is the number X of students in the sample who are in favor.
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A model for TC counts

A useful model for TC counts

- First focus on describing any one X_t.
- ▶ Since X_t is a count, we can describe it by a Poisson pmf:

$$f_t(x_t) = \frac{e^{-\mu_t} \mu_t^{x_t}}{x_t!} I(x_t \in \{0, 1, ...\})$$

where μ_t represents the expected count for year t.

• To describe $X = (X_1, \dots, X_n)$, treat X_t 's as independent:

$$f(x|\mu_1,\cdots,\mu_n)=f_1(x_1|\mu_1)\times\cdots\times f_n(x_n|\mu_n)$$

gives the joint pmf of X at $x = (x_1, \dots, x_n)$.

• A model for X is $\{f(x|\mu_1,\cdots,\mu_n): 0 < \mu_1,\cdots,\mu_n < \infty\}$.

- The above model includes many pmfs that do not embed the researcher's question in any meaningful way.
- We must restrict to pmfs f(x|µ1,...,µn) for which the evolution of µt over time t represents a theory about the trend.
- One possible restriction is to include $f(x|\mu_1, \dots, \mu_n)$ with

$$\log \mu_t = \alpha + \beta(t-1), \quad t = 1, \cdots, n$$

for some α and β .

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Imprecise trend theories

Protein diet and bodyweight gain in infants

- Unlike the opinion poll example, the TC count theories are less precise.
- One could use many other distributions, instead of a Poisson pmf, to describe each X_t.
- The evolution of µ_t over time t could also be described in many different ways.
- One might need to expand the model or compare it against other possible models to account for this imprecision in the theoretical formulation.

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- ► To determine whether high protein diets offer higher gains in body weight in infant mammals, data were collected on 19 female rats, n = 12 of which were given a certain high protein diet, while the other m = 7 received a regular diet.
- For each rat, weight gain between 28th and 84th days after birth were recorded.
- ▶ Data consists of measurements X_1, \dots, X_n from the high-protein group and Y_1, \dots, Y_m from the low-protein group.

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