

# Summary of Lecture 1

Some of this did not get said today but should have:

- Models: family of densities, cdfs or distributions indexed by  $\theta \in \Theta$ .
- Parametric:  $\Theta \subset \mathbb{R}^k$  for some  $k$ .
- Non-parametric  $\Theta$  infinite dimensional
- Semiparametric  $\theta = (\phi, \psi)$  with  $\phi$  finite dimensional and  $\psi$  infinite dimensional.
- $X$  has density  $f$  means

$$P(X \in A) = \int_A f(x) dx$$

- If  $X, Y$  has density  $f(x, y)$  we call it *joint* density and
  - ▶  $X$  has density (called *marginal* density)

$$f_X(x) = \int f(x, y) dy.$$

- ▶ Conditional = joint / marginal. Conditional density of  $Y$  given  $X$  is

$$f_{Y|X}(y|x) = \frac{f(x, y)}{f_X(x)}$$



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- If  $X$  has density  $f$  and  $Y = g(X)$  then

$$E(Y) = E(g(X)) = \int g(x)f(x) dx.$$

- If  $X, Y$  has joint density  $f(x, y)$  then

$$E(h(Y)|X = x) = \int h(y)f_{Y|X}(y|x) dy.$$

and

$$E(h(Y)|X) = \int h(y)f_{Y|X}(y|X) dy.$$

- Second is first formula evaluated at random point – at  $X$ .

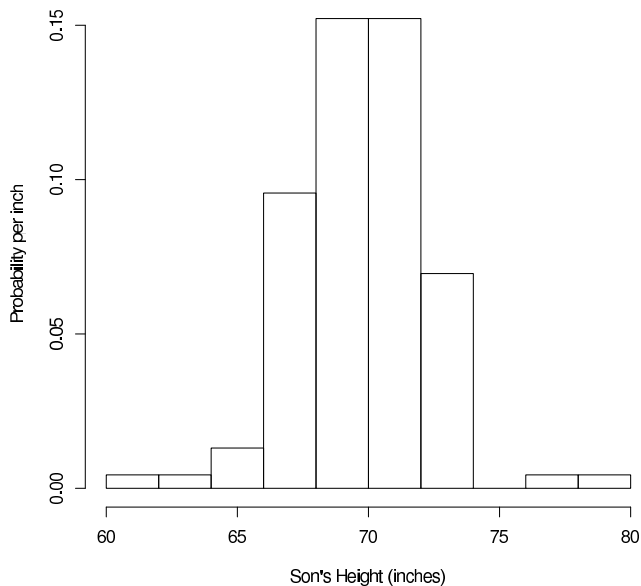


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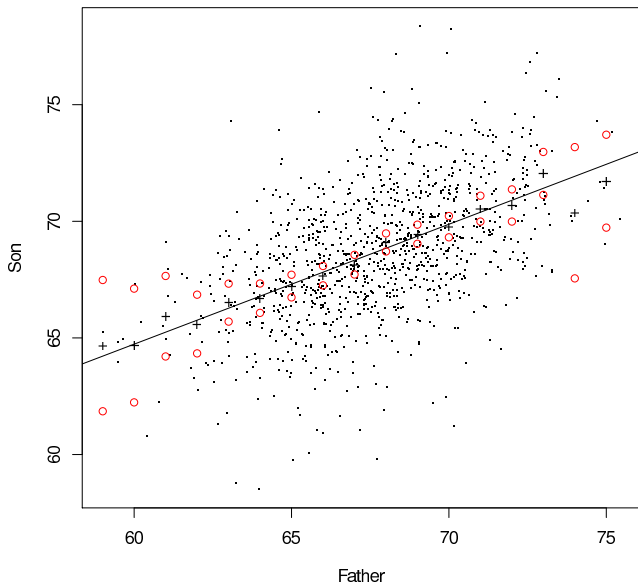
[Link to some R code.](#)



# Conditional distribution of son's heights



# Regression of Son on Father



## Course coverage in text

- Chapter 6, sections 1, 2.
- Review of Chapter 1.4, 1.5, 1.6; 2.1 to 2.9; 3.1, 3.2, 3.5.



## Other things I said

- Units are very important; the graph above should have axis labels which say that the units are inches.
- I talked about Eugenics. I encourage you to look at the [Table of contents of Annals of Eugenics, 1\(1\)](#).

