



Part 1

Lecture 1a GAMES AND CONCEPTS



Who we are...

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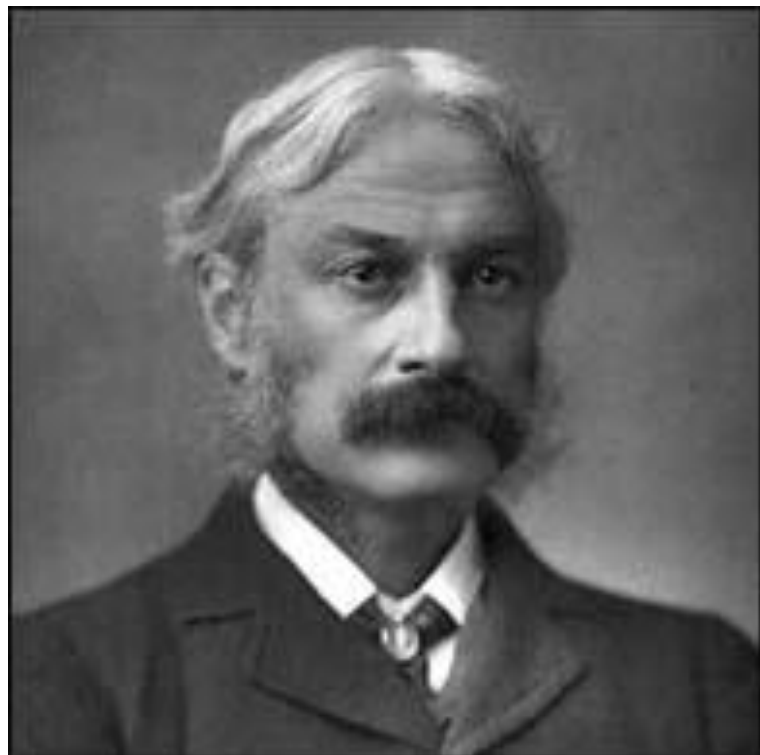


“There are three kinds of lies: lies, damned lies and statistics”



Benjamin Disraeli 1804 – 1880
Prime Minister of England 1874 – 1880





“He uses statistics as a drunken man uses lamp posts

- for support rather than for illumination”

Andrew Lang

Poet 1844 – 1912



Florence Nightingale 1820 - 1910



THE PERRY COLLECTION
FLORENCE NIGHTINGALE

"Statistics ... the most important science in the whole world: for upon it depends the practical application of every other science and of every art; the one science essential to all political and social administration, all education, all organization based on experience, for it only gives results of our experience."



WE BEGIN WITH THE FAIR COIN TOSSING GAME

- 1) Flip a coin 4 times
- 2) do this a billion times
- 3) what proportion of the billion games has 2 heads and 2 tails ?

Correct answer is equal to or closest to:

0.1

0.2

0.3

0.4

0.5



DISTRIBUTION OF GUESSES

(Personal sample of Prof Corey)

Proportion	N	%
0.1	93	8.58
0.2	203	18.73
0.3	138	12.73
0.4	126	11.62
0.5	<u>524</u>	<u>48.34</u>
Totals	1084	100.00



16 POSSIBLE RESULTS OF FLIPPING A COIN 4 TIMES

				TTHH		
				THTH		
		TTTH		THHT		THHH
		TTHT		HTHT		HTHH
		THTT		HTTH		HHTH
	<u>TTTT</u>	<u>HTTT</u>	<u>HHTT</u>	<u>HHHT</u>		<u>HHHH</u>
# Heads	0	1	2	3		4
Probability	1/16	4/16	6/16	4/16		1/16
	0.0625	0.250	0.375	0.250		0.0625



KNOW YOUR SUMS

2 COMICS

The Sunday Sun, October 23, 199.

**THE
BORN
RENOU**



7/1/10-23

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- The little girl did not know that there was more than one way of getting a sum of two numbers that is equal to 9
- Many students did not know the number of ways of getting two heads and two tails in four tosses of a fair coin



Before introducing an important application of this coin flipping result we introduce the General Statistical Model.

Suppose we want to compare patients on two different drugs, diets or exercise programs. Call these exposures.



We have n patients in each group. How did they get assigned into groups?

- ❑ One way is to select the data from a database in what is called an observational study.
- ❑ In the other way subjects did not choose the exposure but were randomly allocated to the two groups by the scientist in what is called a randomized trial.



THE BINOMIAL PROBABILITY MODEL FOR COIN FLIPPING

$$P[B_n = h] = {}_n C_h \times P^h \times Q^{n-h} = \frac{n!}{h! \times (n-h)!} \times P^h \times (1-P)^{n-h}$$

$$P[B_4 = 2] = \frac{4!}{2! \times (4-2)!} \times 0.5^2 \times 0.5^2 = 6 \times (0.5)^4 = \frac{6}{16} = 0.375$$

$$4! = 4 \times 3 \times 2 \times 1$$

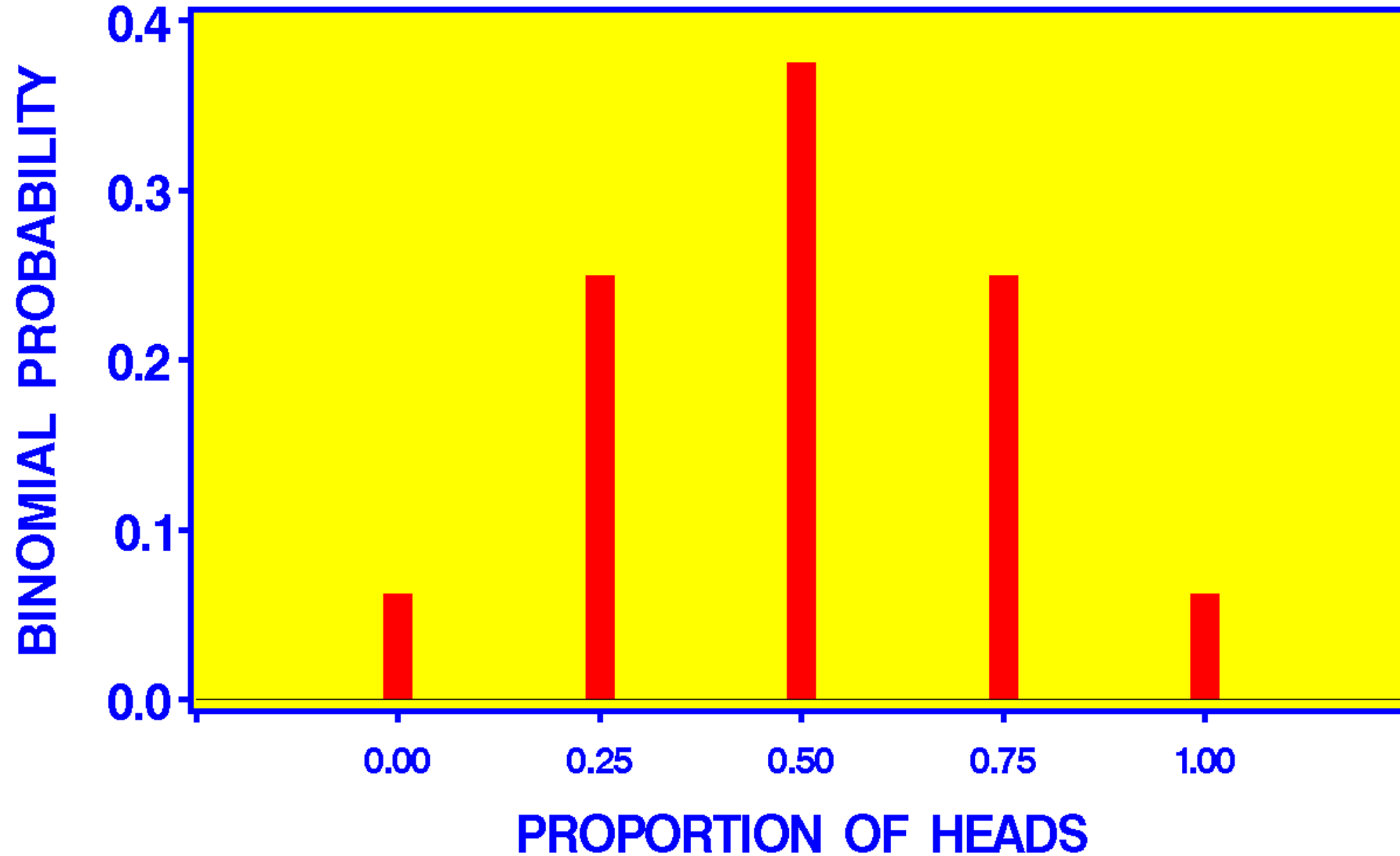
$$2! = 2 \times 1$$

Describing the Binomial probability distribution is a simple way to introduce the concept of a random variable (B_n).

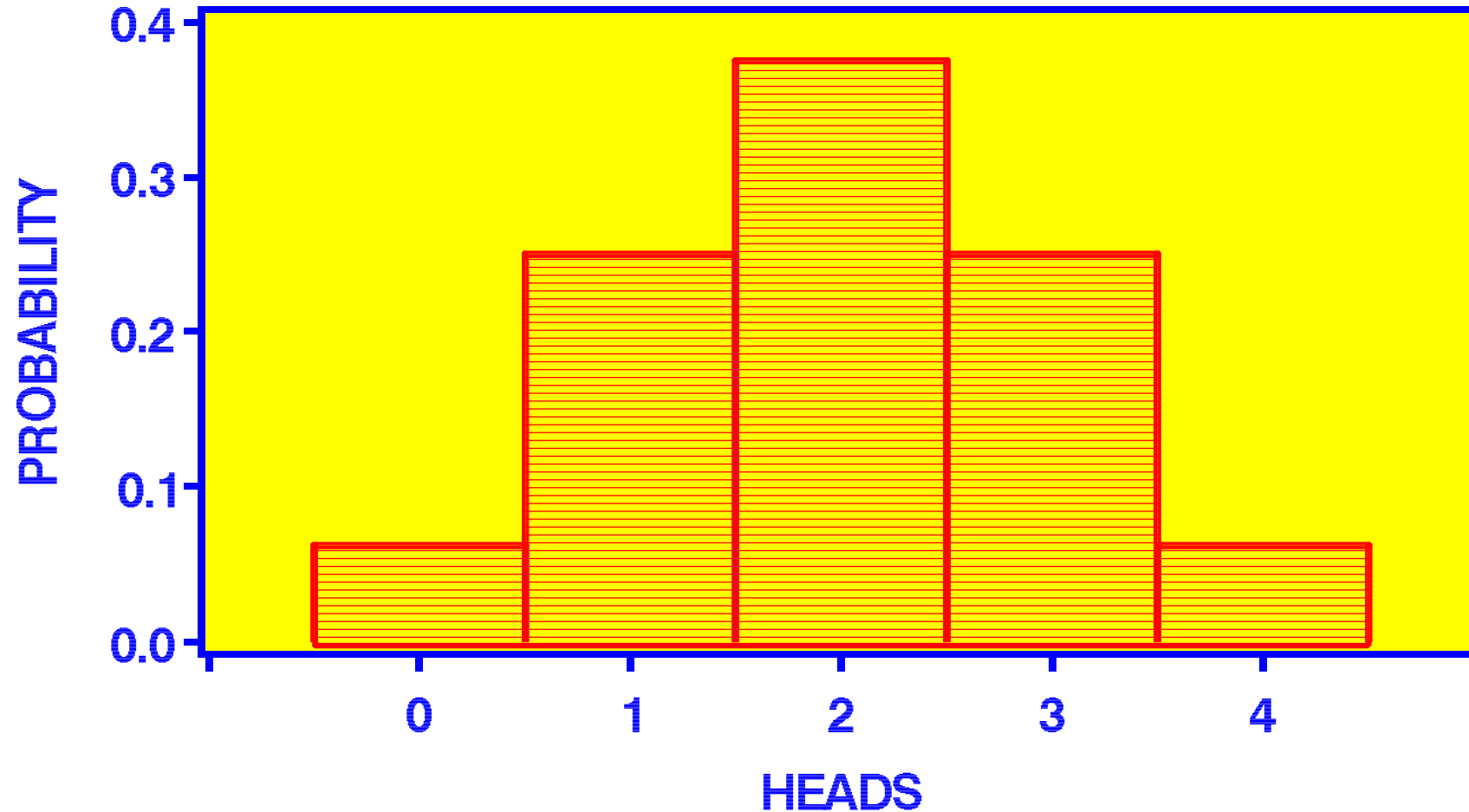
If the trial was not a flip of a coin but a homozygous offspring (aa) of heterozygous parents (Aa) then $p = 0.25$



BINOMIAL PROBABILITY DISTRIBUTION $N=4$ $P = 0.5$

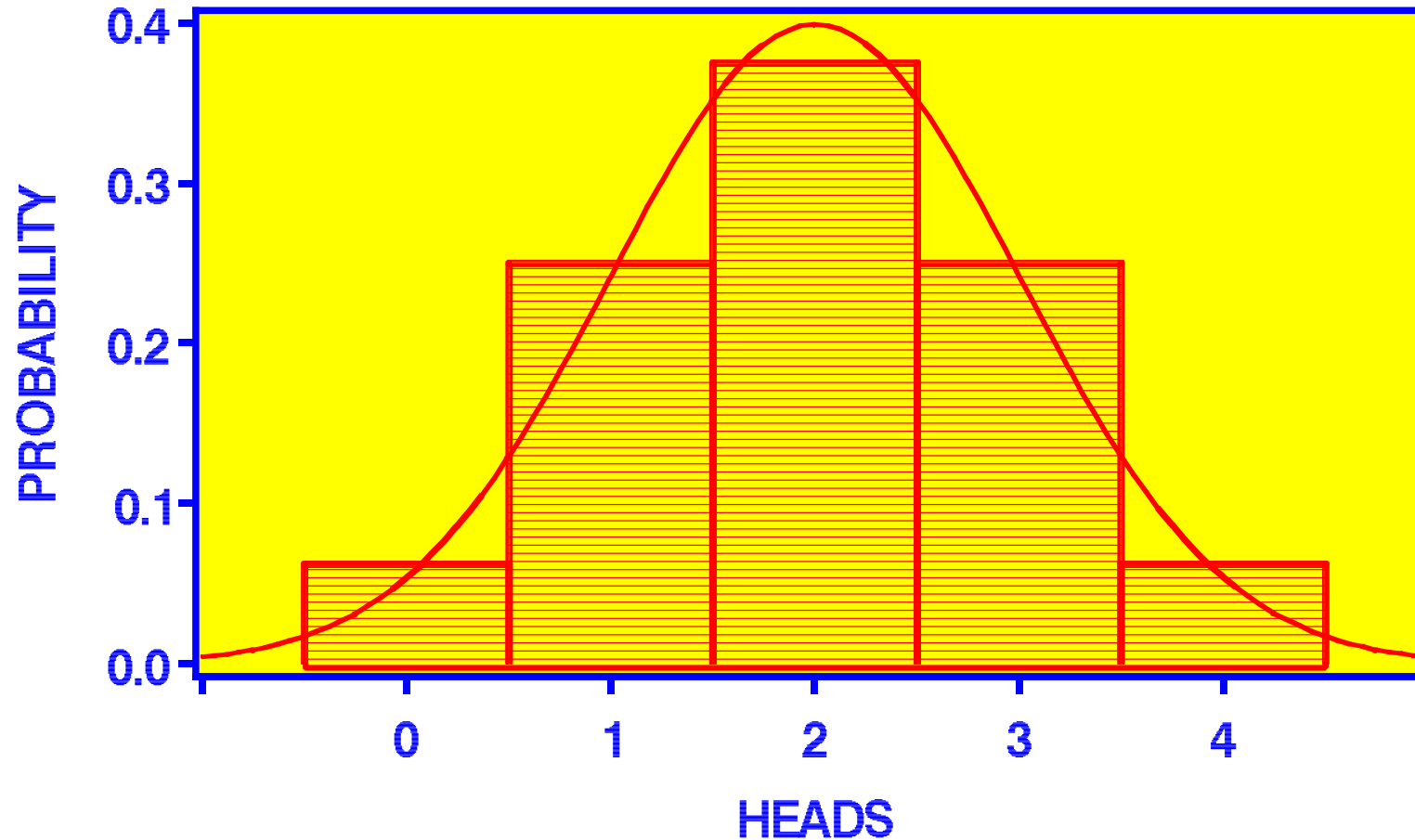


BINOMIAL PROBABILITY HISTOGRAM



Important Result:: Probabilities are **AREAS** under a histogram.

GAUSSIAN CURVE ON BINOMIAL HISTOGRAM



Important Result: Total area under the histogram and under a Gaussian or Normal probability curve is 1.0

