There $\underline{\underline{is}}$ class tomorrow!!!

Gov't shutdown opens some opportunities...

Basic probability:

Prob. of H when flipping coin: $\frac{1}{2}$ ← outcome of interest, just H; 2 ← possible outcomes H or T

prob. of a 6 when rolling 6-sided die: $\frac{1}{6}$ ← # outcomes of interest; 6 ← # of outcomes.

prob of getting even # when rolling 6-sided die: $\frac{3}{6}$ ← # of outcomes of interest {2, 4, 6}; 6 ← # of outcomes.

$= \frac{1}{2}$

EQUALLY LIKELY OUTCOMES

↑ VERY IMPORTANT FEATURE.

Roll 2 dice: # of outcomes: 36

(1,1), (1,2), (1,3)

(2,1) ....

(3,1) ...

$\text{Prob}(5 \text{ and } 3) = \frac{2}{36}$ ← (5,3) and (3,5); 36 ← total. $= \frac{1}{18}$

$\text{Prob}(\text{sum to } 7) = \frac{6}{36}$ ← {(1,6), (2,5), (3,4), (4,3), (5,2) ~~and~~, (6,1)}.

$= \frac{1}{6}$

What's the prob. of ~~getting~~ ~~exactly~~ having 4 ~~children~~ boys (given you have 4 children).

outcomes: $2 \cdot 2 \cdot 2 \cdot 2 = 16$ possible ordered lists of boy/girl.

1st child boy/girl, 2nd, 3rd, 4th

EQUALLY LIKELY OUTCOMES:

only one has no girls.

BBBB . . . :
BBBG
BBGB   GGGB
⋮   . . .   GGGG

Note: there are 5 NOT-EQUALLY LIKELY OUTCOMES 0, 1, 2, 3, 4 boys BAD CHOICE b/c it's not equally likely

Ans $\frac{1}{16}$

What's Prob. of having exactly one boy?

$$\frac{C(4,1) \to 4}{2^4 \to 16} = \frac{1}{4}.$$

$4 \leftarrow$ {GGGB, GGBG, GBGG, BGGG}

So, <u>counting</u> is very important!

Using Venn diagrams....

Let S denote the "sample space." These are all the possible outcomes, which we'll assume to be equally likely.

When you roll 2 dice, S = {(1,1), (1,2), (1,3), ..., (2,1), (3,1), ...}

flip 3 coins, S = {HHH, HTT, THH, ...}

<u>Event</u> E is a <u>subset</u> of S. We're interested in the prob. of the event E occurring.

Ex Roll 2 dice. $S = \{(1,1), (1,2) \dots \}$

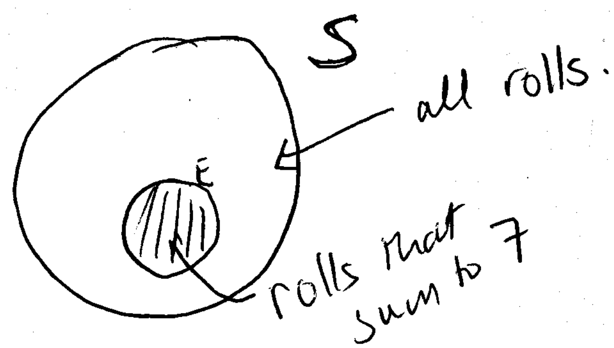
$E = \{(1,6), (2,5), (3,4), (4,3), (5,2), (6,1)\}$

The "event" is 2 dice that sum to 7.

It's expressed as a <u>subset</u> of the sample space.

$$P(\text{sum to } 7) = \frac{n(E)}{n(S)} = \frac{6}{36} = \frac{1}{6}$$

probability



$S = \{\text{outcomes of sex for 4 babies}\} = \{BBBB, BBBG, \dots\}$

$E = \{\text{exactly 2 are boys}\} = \{BBGG, BGGB, GGBB, BGBG, GBGB, GBBG\}$

$n(S) = 16$ $\qquad P(\text{exactly 2 boys}) = \dfrac{n(E)}{n(S)} = \dfrac{6}{16}$

<u>Note</u> $n(E) = C(4,2)$

Sometimes we can multiply probabilities:

Prob. of getting the outcome $(5,5,5)$ when rolling 3 dice is:

$\dfrac{1}{6^3}$ ← one outcome $(5,5,5)$

← # of possible triples when rolling the 3 dice in a row.

or $\boxed{\dfrac{1}{6}} \cdot \dfrac{1}{6} \cdot \dfrac{1}{6}$

prob of getting 5 on 1st roll; prob. of 5 on 2nd roll; prob. of 5 on 3rd roll.

You can multiply like this only when the events are independent.

Probability must be between 0 and 1. $0 \le p \le 1$

If you have a finite # of outcomes $s_1, s_2, \ldots, s_N$ with respective probabilities $p_1, \ldots, p_N$ then $\boxed{p_1 + p_2 + \cdots + p_N = 1}$

NOT ASSUMING outcomes are equally likely.

Ex A woman has a child. The prob. of dying in childbirth in the U.S. is approx $1/10{,}000$.

Outcomes s_1 = she dies $p_1 = \frac{1}{10{,}000}$

s_2 = she lives $p_2 = \frac{9{,}999}{10{,}000}$

Notice $p_1 + p_2 = 1$.