Math 124 Lecture #8

From last time. Some Results

Toss	#UP	P(UP)
1	1	1
2	2	1
3	2	0.66
4	2	0.5
5	3	0.6
10	5	0.5
20	13	0.65
30	20	0.66
40	26	0.65
50	31	0.62
100	61	0.61
200	117	0.585
400	238	0.595
500	299	0.598
1000	617	0.617

Questions

- Repeatibility?
  Is every toss the same?
  - Initial state up/down
  - Surface?
  - height?
  - toss or drop?
- Independence?
  Does the outcome of any trial affect the outcome of any other trial.

We say that two trials are <u>independent</u> if the outcome of one trial does not influence the outcome of any other.

In practice we cannot carry out completely repeatable simulations of every situation because we need a long sequence of independent trials which may be impossible either physically or otherwise. But it is important to know that probability describes only long range behaviour. Ie in the back of your mind think of the hypothetical situation (since you can't do the experiment)

<u>Describing Probability Situations using Mathematical models</u>

<u>Some terminology</u>

<u>Sample Space</u> set of all possible outcomes of an experiment. Denoted by S

eg 1 Coin toss $S = \{H, T\}$

H: heads, T: tails

2 coin tosses

$S = \{HH, HT, TH, TT\}$

roll a standard 6 sided dice

$S = \{1, 2, 3, 4, 5, 6\}$

Survey on agreement with the presidents war policies.

$S = \{Yes, No, Undecided\}$

Toss coins until get first Heads

Event $\{H, TH, TTH, TTTH, \ldots\ldots\}$

An <u>event</u> is an outcome or a set of outcomes of a random phenomenom. Events are subsets of the sample space.

eg 1 coin toss

Event A is "get a heads"

$A = \{H\}$

2 coin tosses

Event B is "two of same side"

$B = \{HH, TT\}$

roll dice

Event C is "Prime number showing"

$C = \{2, 3, 5\}$

Surveys

Event D is "does not agree with president"

$D = \{No, Undecided\}$

Toss coins until first heads

Let A be "heads within first 3 tosses"

$A = \{H, TH, TTH\}$

~~Probability rules~~

P(A) is read as the "probability of the event A"

Probability rules

Rule 1 For any event A, $0 \leq P(A \leq 1)$

Rule 2 If S is the sample space

in a probability model then $P(S) = 1$

Rule 3

The complement of any event A is the event that A does not occur, denoted A^c.

The probability rule is $P(A^c) = 1 - P(A)$

eg two coin tosses. Let

A = "Two heads" = $\{HH\}$

A^c = "not two heads" = $\{TT, HT, TH\}$

If $P(A) = 0.25$

then $P(A^c) = 1 - P(A)$

$= 1 - 0.25 = 0.75$

Rule 4

Two events A and B are <u>disjoint</u> if they have no outcomes in common and so cannot occur simultaneously.

If A and B are disjoint then

$P(A \text{ or } B) = P(A) + P(B)$

eg roll a dice

A = "get a 1" = {1}

B = "get even number" = {2, 4, 6}

A and B are disjoint

Suppose $P(A) = \frac{1}{6}$ $P(B) = \frac{1}{2}$

$P(A \text{ or } B) = P(A) + P(B)$

$= \frac{1}{6} + \frac{1}{2} = \frac{2}{3}$

A = "get a prime" = {2, 3, 5}

B = "get an even" = {2, 4, 6}

A and B are not disjoint since 2 is both even and prime.