Læreruddannelsen i Århus

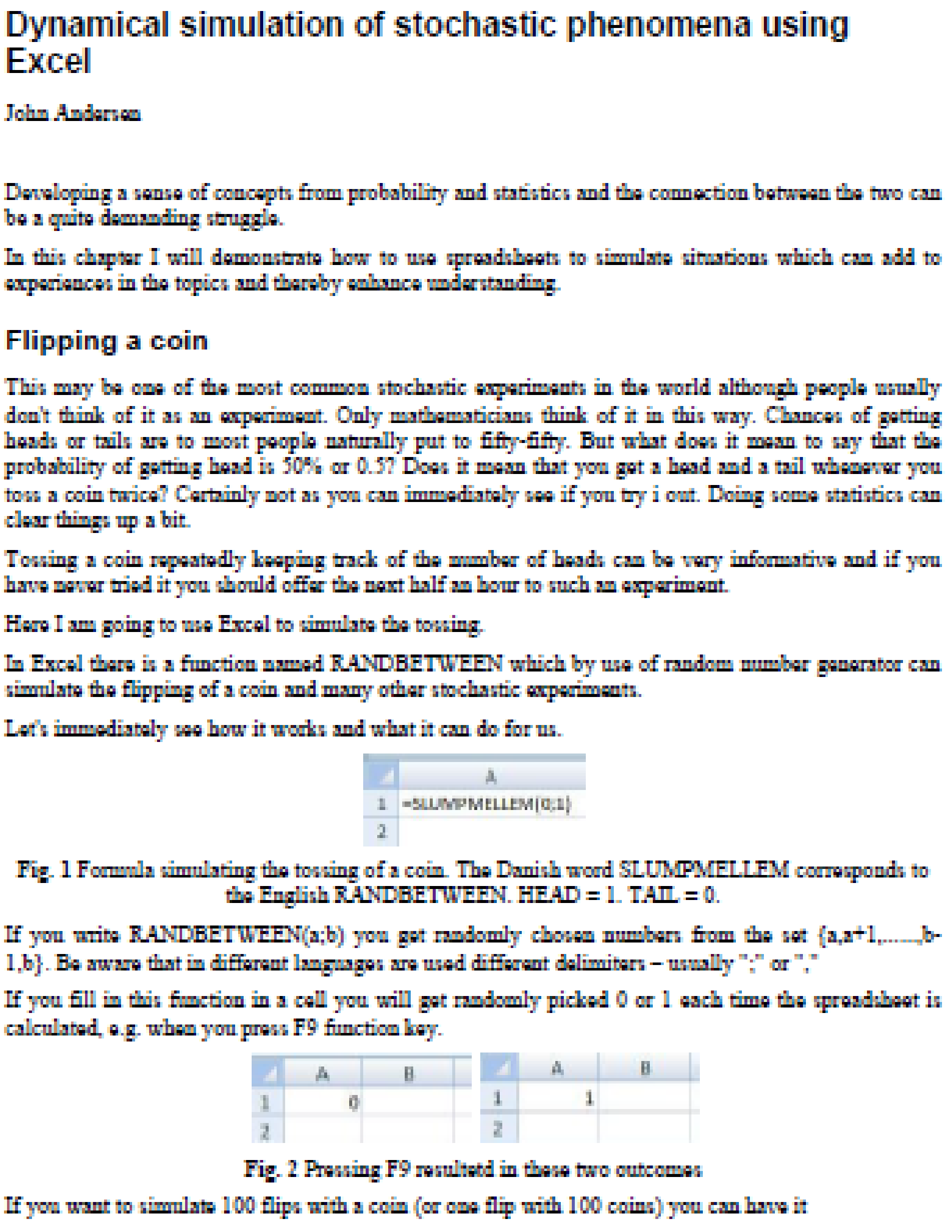
Nordic Geogebra Network
Copenhagen 21 September 2013

Screen cast in Dynamat

- Focus of the project is the use of ICT dynamically for investigation of different mathematical topics.
- An important project outcome: E – Learning courses.
- Danish contribution is learning material some both in writing and by the use of screen casts.

Screen casts/E-moduls

- Dynamic simulation of stochastic phenomena using Excel. (In Danish)
- Simulation of Chi-square distribution (In English)
- Arithmetic mean and the Normal distribution (In English)



Dynamical simulation of stochastic phenomena using Excel

John Andersen

Developing a sense of concepts from probability and statistics and the connection between the two can be a quite demanding struggle.

In this chapter I will demonstrate how to use spreadsheets to simulate situations which can add to experiences in the topics and thereby enhance understanding.

Flipping a coin

This may be one of the most common stochastic experiments in the world although people usually don't think of it as an experiment. Only mathematicians think of it in this way. Chances of getting heads or tails are to most people naturally put to fifty-fifty. But what does it mean to say that the probability of getting head is 50% or 0.5? Does it mean that you get a head and a tail whenever you toss a coin twice? Certainly not as you can immediately see if you try i out. Doing some statistics can clear things up a bit.

Tossing a coin repeatedly keeping track of the number of heads can be very informative and if you have never tried it you should offer the next half an hour to such an experiment.

Here I am going to use Excel to simulate the tossing.

In Excel there is a function named RANDBETWEEN which by use of random number generator can simulate the flipping of a coin and many other stochastic experiments.

Let's immediately see how it works and what it can do for us.

	A
1	=SLUMPMELLEM(0;1)
2	

Fig. 1 Formula simulating the tossing of a coin. The Danish word SLUMPMELLEM corresponds to the English RANDBETWEEN. HEAD = 1. TAIL = 0.

If you write RANDBETWEEN(a;b) you get randomly chosen numbers from the set {a,a+1,......,b-1,b}. Be aware that in different languages are used different delimiters – usually ";" or ","

If you fill in this function in a cell you will get randomly picked 0 or 1 each time the spreadsheet is calculated, e.g. when you press F9 function key.

	A	B
1	0	
2		

	A	B
1	1	
2		

Fig. 2 Pressing F9 resultetd in these two outcomes

If you want to simulate 100 flips with a coin (or one flip with 100 coins) you can have it

- **Simulering af kast med 5 terninger**

De to foregående lektioner har handlet om møntkast. Her viser jeg et lidt mere kompliceret eksempel. Det bygger imidlertid på de samme principper. Funktionerne SLUMPMELLEM og TÆL.HVIS Kopiering af formler til mange celler ved at trække med musen Kopiering af formler til rigtig mange celler ved at bruge F5 og CTRL+D En eller anden form for grafik til at anskueliggøre pointerne Gentagne beregninger ved tryk på F9

- **Grafisk illustration af statistikken over antal seksere med 5 terninger: Søjlediagram/Pindediagram**

Her tilføjes et diagram så vi får et visuelt udtryk for de tabellagte frekvenser KLIK HER (Varighed 4:18 min)

- **De store tals lov - frekvensstabilitet**

Her øges antallet af kast i simuleringerne. Vi ser hvorledes frekvenserne bliver mere og mere stabile desto flere kast statistikken er baseret på. KLIK HER (Varighed 6:57)

- **Alternativ grafik: Frekvenserne som funktion af antallet af kast - formlerne til grafikken**

Uagtet at jeg siger noget andet i slutningen af den foregående video så handler den her video om, Hvorledes man også kan illustrere frekvensstabiliteten med grafer, som i eksemplet med møntkast. I denne video forklarer jeg hvilke formler der er brugt. KLIK HER (Varighed 5:15 min)

- **Øvelser**

Øvelse 1: Udarbejd et regneark med søjle/pinde-grafik der viser frekvenser for de forskellige antal af 1-ere ved kast med 3 4-sidede terninger (terninger formet som regulære tetraedre).

Øvelse 2: Udarbejd et regneark med grafik der viser frekvenser som funktioner af antal kast for de forskellige antal af 1-ere ved kast med tre 4-sidede terninger (terninger formet som regulære tetraedre).

Simulation of Chi-square distribution

- Aims of the work:
  - Showing some of the possibilities in Excel:
    - Technical: Tricks and functionalities
    - Thematic: Simulations beyond the usual
  - Providing a deeper understanding of Chi-square distribution and of statistical tests.
  - Changing attitudes towards experimentation in mathematics

Your turn

- First lets see the first half of in first video, in order to understand the problem:
- Then open the folder, you have:
  - The second video
  - A half done spread sheet – equivalent to the work of the first video
- Do the work in the spread sheet according to the 2nd video:
- If there is time: do some ordinary statistics on the sums of squares.

Discussion/comments

- Aims: Do this fulfil the aims on slide 6
  - Comment on the attitude –aim: It is to be understood as an introduction/maintenance of the values of a mathematical (sub)community
- Prerequisites/ target group?
- Structure: a narrative but not historically correct

??

- Isn’t a teacher SC just another web 1,0 learning material?
  - You can see it only the teachers way – but now with motion
  - You can also pause a book!
  - Isn’t it only passing on information?

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THANK YOU