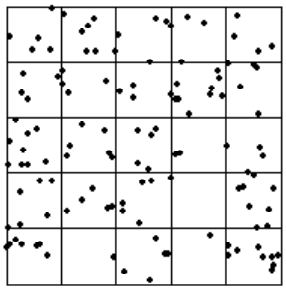
Hands on

the plains of Gheisra
slides 2–7

which are by chance ...
and which are unusual?

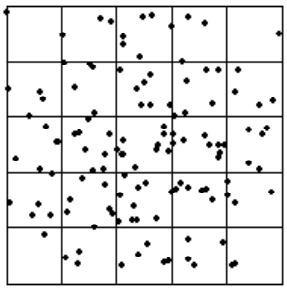
tick the one you think is really random

day 1



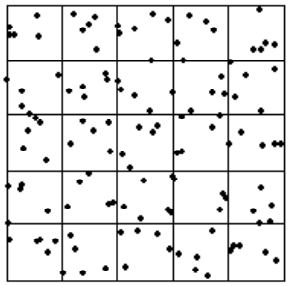
☐

day 2



☐

day 3



☐

why did you choose the one you did?

Hands on

two horse races
slide 8 & 9

 before you do anything read the instructions

 what do you think will happen?

 start to toss your 20 coins

 place them in two rows:
one for heads, the other for tails

 when one row gets to 10 stop

 write down your scores (e.g. heads 10, tails 8)

 if you have time repeat the exercise

Hands on

averages
slide 18

- toss 10 coins (A)
- write down the number of heads and tails below
- do the same with the remaining 10 coins (B)
- add the two totals to get a 20 coin count (C)
- toss them all to get a second 20 coin count (D)

	heads	tails	
A. 10 coins			
B. 10 coins			
C. 20 coins			(add A&B)
D. 20 coins			

- gather into groups of between 5 and 10

Hands on (ctd.)

averages
slide 18 (ctd.)

how many in your group? n = ☐

work out the sum and average for your group

	A (10)		**B** (10)		**C** (20)		**D** (20)	
	H	T	H	T	H	T	H	T
total								
average (total / n)								

we'll work out the average for the whole tutorial

	A		**B**		**C**		**D**	
everyone								

Hands on

variation
slide 43

☞ as a group look again at your data A–D
just look at the number of heads

☞ estimate the variation in each – how far the individual counts you recorded differ from the average or ideal (5 heads for A / B, 10 for C / D).

∑± if you like calculate the standard deviation or alternatively just eyeball the numbers

✍ write down your groups' figures and then we'll work out the figures for the entire tutorial

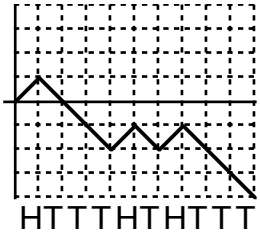
	A	B	C	D
group average				
group variation				
overall average				
overall variation				

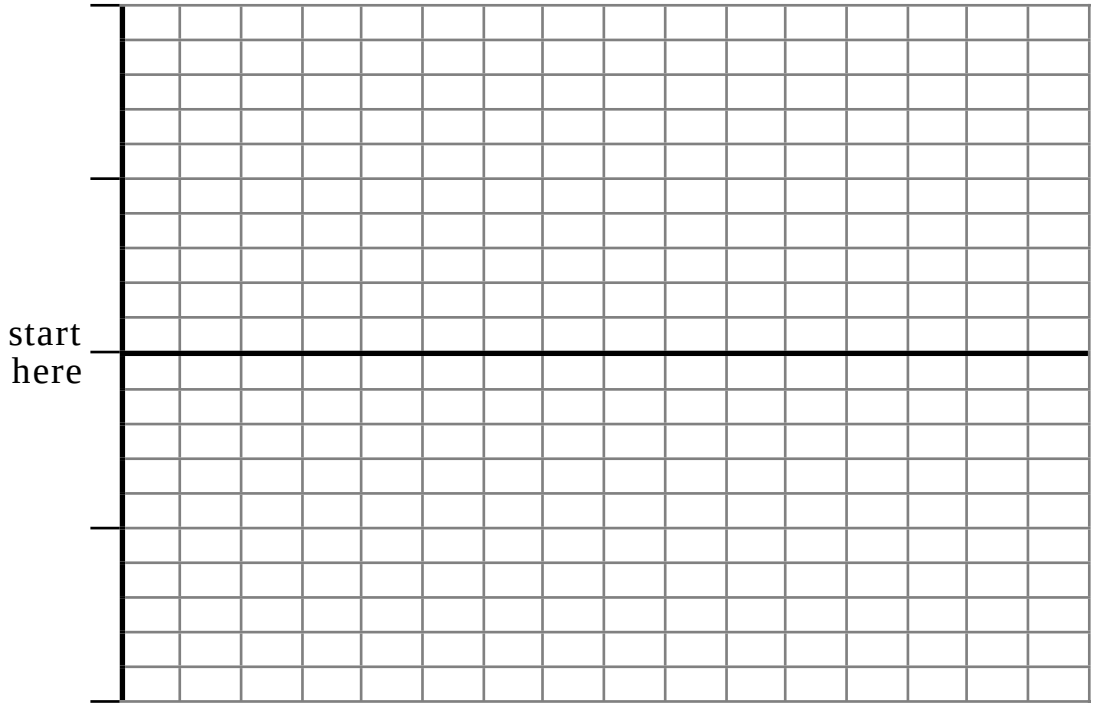
N.B. the overall variation figure for the whole tutorial means the variation of your group averages

Hands on

drunkard's walk
slide 47

- take a single coin and toss it repeatedly
- draw a line moving upwards for each head and downwards for each tail





- compare your walk with others

Hands on

significance test
slide 63

? are the coins fair?

perhaps they all give more heads than tails?
let's see ... we'll use your data A-D again

ⓘ because all the coin tosses are independent we can use the *binomial distribution*
if the count of heads is too large we could conclude that the coins are not fair.

? how big?

for data A & B use the binomial table with n=10
for C & D use the binomial table with n=20

ⓘ I've done it (!) and the values are:

n=10	#heads > 7	significant @ 5%
	#heads > 8	significant @ 1%
n=20	#heads > 13	significant @ 5%
	#heads > 14	significant @ 1%

✍ compare with your data and write down the result (n/s, 1%, 5%) – do you think the coins are fair?

	A	B	C	D
significant?				
# in tutorial at 5%				
# in tutorial at 1%				

Hands on

confidence interval
slide 74

☞ now we are going to work out a confidence interval for the probability of a head based on your data

! this is actually a bit awkward for the *binomial distribution*, so we'll use big enough numbers that we can approximate things using the *Normal distribution*

☞ add up your individual head counts for C & D

this gives the total of 40 tosses total C&D = ☐

☞ divide this by 40 to give an estimate of the probability of a head

$$\frac{\text{total heads}}{40} = \square$$

ⓘ I've worked out the relevant formula for the confidence interval call your number above X, then the confidence interval is:

$$\left[\frac{X}{1.1}, \frac{X+0.1}{1.1} \right]$$

☞ work this out for your value of X

confidence interval = [,]

? does your interval include the 'fair' value of 0.5?

N.B. its more common to see confidence intervals of the form:

[X – somat , X + somat]

the funny X / 1.1 bit is because unfair coins have slightly higher *variance* than fair ones

Hands on

workshop session
slide 112

? what happens now depends on you ...

keep your own notes!