Ox Blocks probabilities

Maths Jam Conference IV

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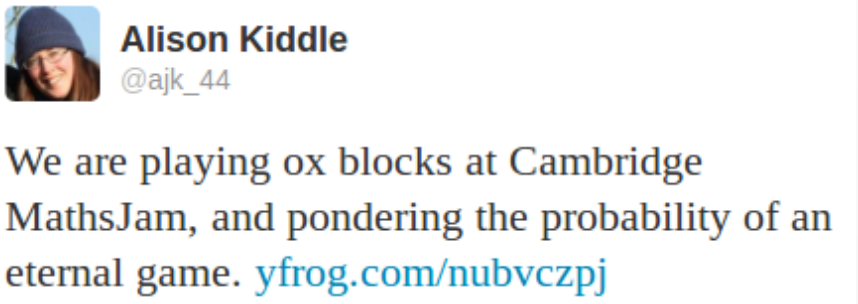
Ox Blocks

- Ox Blocks promises "Noughts and Crosses with a novel twist".
- Heard about from a #MathsJam tweet from Alison Kiddle.



Alison Kiddle
@ajk_44

We are playing ox blocks at Cambridge MathsJam, and pondering the probability of an eternal game. yfrog.com/nubvczpj

Gameplay

- One player plays as '**O**'(noughts) and the other as '**X**'(crosses).
- Each turn, a player rolls a cube, or block, which has
  - two faces marked '**O**';
  - two faces marked '**X**';
  - and, two blanks.
- Rolling a '**O**' or a '**X**', the player must place the block on the board.
- Rolling a blank, the player must remove a block from the board.
- Play continues with the usual rule of three in a row winning the game.

Question

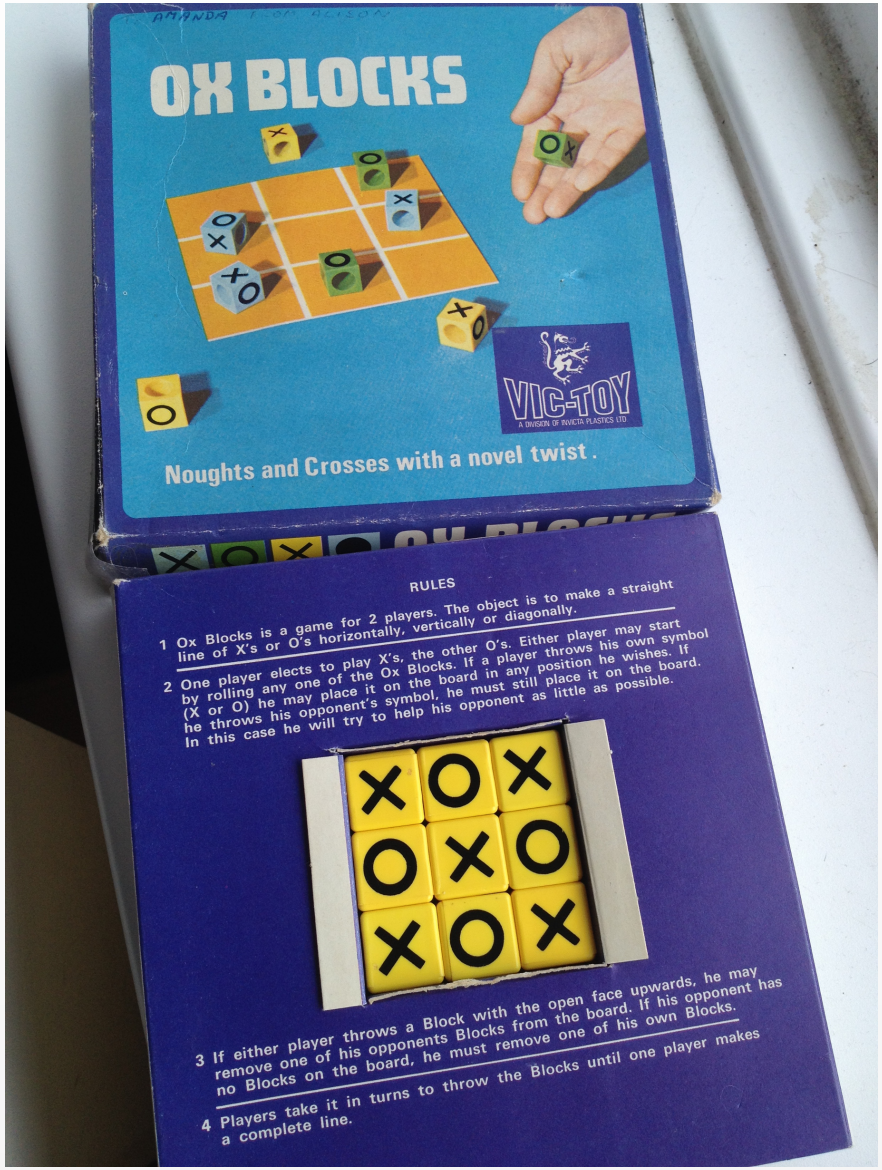
- Can Ox Blocks be played with pencil, paper and a normal die?

Question

- The blanks are not just blank faces, but are hollow – does this change the probabilities?
- Specifically, does the hollow make it less likely to roll a blank, thus reducing the odds of a game going on forever?

Ox Blocks

- Thankfully, Ox Blocks is readily available via a popular auction site;
- I was able to pick up a 1970 copy for £3.80 including delivery.



Probability of removing a block

In an attempt to settle this, I rolled one block 501 times. The results were as follows:

- ‘O’s: 161;
- ‘X’s: 159;
- blanks: 181.

Seems fairly even?

- 161 ‘O’s; 159 ‘X’s; 181 blanks.
- Since I am interested in whether the block comes up blank or not, I can use a two-tailed binomial test with a null hypothesis that the block is a fair die.

Ask R

```
> binom.test(181,501,1/3,alternative="two.sided
   ")
```

- This tests whether 181 blanks from 501 rolls is consistent with the probability of a blank being $\frac{1}{3}$.

Ask R

```
> binom.test(181,501,1/3,alternative="two.sided
   ")

Exact binomial test

data:  181 and 501
number of successes = 181, number of trials =
   501, p-value = 0.1848
alternative hypothesis: true probability of
   success is not equal to 0.3333333
95 percent confidence interval:
 0.3191425 0.4050602
sample estimates:
probability of success
             0.3612774
```

Seems fairly even?

- As the p-value is a giant 0.1848, we don't have evidence from my block rolling to reject the null hypothesis that blanks come up one third of the time.
- So, according to my experiment, there's no reason not to play home grown Ox Blocks with pencil, paper and a normal die.
- Of course, this doesn't quite tell me that the blocks *do* roll evenly,
- and, if they do, it doesn't explain why the uneven shape doesn't affect the roll;
  - wave arms, talk about centre of mass, symmetry.

My recommendation:
Play Ox Blocks with a standard die

- Draw a 3×3 noughts and crosses grid;
- one player chooses '✕'s, the other '○'s;
- players take turns to roll a standard die:
  - if roll a 1 or a 6, draw their own symbol;
  - if roll a 2 or a 5, erase one symbol from the board;
  - if roll a 3 or a 4, draw their opponent's symbol;
- usual noughts and crosses winning conditions apply.

More information, discussion

- Ox Blocks probabilities at aperiodical.com
- bit.ly/oxblocks