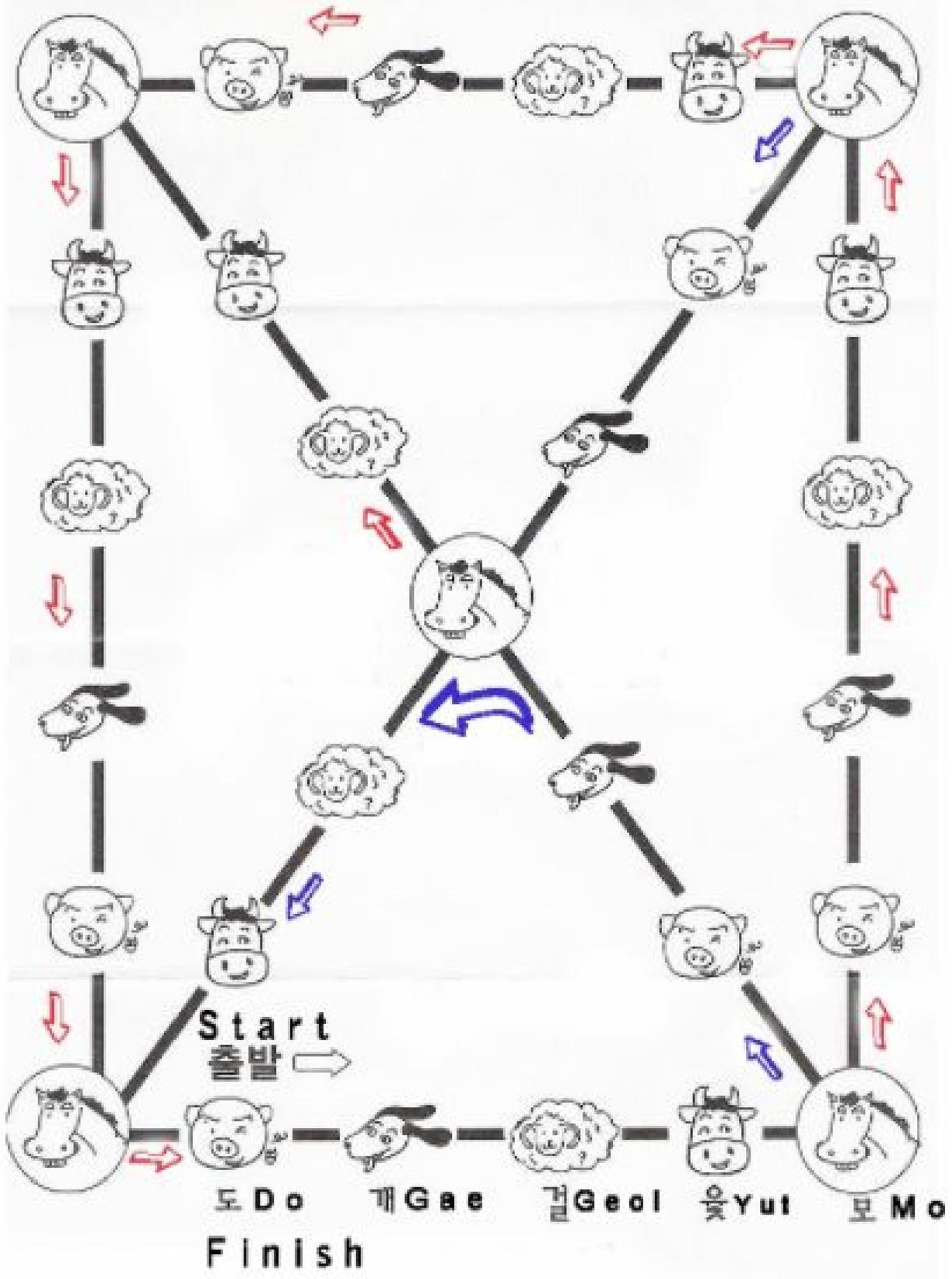


Yut or Yoot, Korean Traditional Games

Yoot, is a traditional board game played in Korea, especially during Korean New Year.



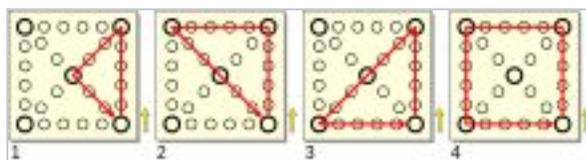
Yut (윷) has been a popular game in Korea for thousands of years—try it yourself and see why!

Each turn, players throw the yut sticks once to determine how many spaces one of their markers can move. To win, be the first to get all four of your markers around the board and back home.

- If a marker lands on a corner, ^(a horse picture) the player can take a shortcut through the middle of the board. (see blue arrow)
- Players who throw a mo or yut get a second turn.
- If two (or more!) markers belonging to one player land on the same space, they may move together for the rest of the game.
- If your marker lands on a space occupied by another player's marker, the other player's marker is sent home and must begin again, and you get another turn.
- If your yut stick got a "do" with a back labelled sign in the stick (후퇴) , it means you must move one step back.



Each team then casts the sticks in turn, then moves a mal according to the score achieved. One turn usually consists of only one cast. However, a player achieving a *yut* or *mo* earns an extra cast for the turn; if he/she casts a *yut* or *mo* at the second cast, he/she earns an extra cast again, so there is no limit to the number of times a player can cast again before the end of a turn, provided he or she keeps casting *yuts* or *mos*. The respective scores can be played separately if wished, each given to another mal (or group of mals, see below), but a score earned from one cast cannot be split into two moves—for example, a *geol* (advance three steps) cannot be split into a *do* (one step) and a *gae* (two steps).



The four possible courses of the game of Yut

As long as there are mals outside the board, a team can either put a new mal onto the board according to the scores it got, or move a mal already on the board. The mals travel around the board and can move forward only. However, when landing on one of the big stations (in the corner and the

centre), the team can choose to take the shorter way should they wish to. There are four possible courses, the default course being longest one with no abbreviation (No. 4).

If a mal lands on a station occupied by the opponent's team, the opponent's mal is removed from the course and returned to the starting position, and the current player is allowed to cast again.

If a mal lands on a station occupied by the own team, these mals can form a group and travel together from that point on. However, this bears a risk: If an opponent lands their mal on a station occupied by a group of mals of the opponent, all mals in the group are removed from the course.

For example, if one casts two *yuts* and one *do* at his/her first turn in the game, possible moves would include (see *The Stations* below for the station names):

- Put a mal on the board at the *yut* station (uses the first *yut* score); advance to *mo* (uses the *do* score), then to *sok-yut* (uses the second *yut*).
- Put a mal on the board at the *yut* station (uses first *yut* score); put another mal on the board at the same *yut* station (uses the second *yut* score), causing the two mals to move together from then on; advance them to *mo* (uses the *do*).
- Put a mal on the board at the *yut* station (uses the first *yut*); advance to *duet-geol* (uses the second *yut*), then to *duet-yut* (uses the *do*).

The game is won by the team who brings all their mals home first, that is complete the course with all their mals. A course is completed if a mal passes the station where the game is started (*cham-meoki*). Landing on *cham-meoki* is no finish, but any score going "beyond" this station completes a home run. *Yut* is often played for three or more wins.

How they land	1 flat side up; 3 curved/marked sides up	2 flat sides up; 2 curved/marked sides up	3 flat sides up; 1 curved/marked side up	4 flat sides up; no curved /marked sides up	No flat sides up; 4 curved/marked sides up
How many moves	1 move	2 moves	3 moves	4 moves	5 moves
Korean term	도 (do)	개(gae)	걸(Gul)	윷(Yut)	모(Mor)
Animal	Pig	Dog	Sheep	Cow	Horse
The statistics	$4 \cdot \frac{1}{16} = \frac{4}{16}$	$6 \cdot \frac{1}{16} = \frac{6}{16}$	$4 \cdot \frac{1}{16} = \frac{4}{16}$	$\frac{1}{2}^4 = \frac{1}{16}$	$\frac{1}{2}^4 = \frac{1}{16}$

It seems like the statistically likeliest moves to make would be 2 moves. This can be seen below in the table that outlines the most likely results from throwing sticks in the air:

Flat side (F); Curved/marked side (C)

5 Moves	4 Moves	3 Moves	2 Moves	1 Move
CCCC	FFFF	CFFF	CCFF	FCCC
		FCFF	CFCF	CFCC
		FFCF	CFFC	CCFC
		FFFC	FCCF	CCCF
			FCFC	
			FFCC	

1) Consider the experiment of flipping of 4 coins.

Each coin flip has 2 possible outcomes, so the flipping of 4 coins has $2 \times 2 \times 2 \times 2 = 16$ possible outcomes. We can enumerate all possible outcomes as follows, where H indicates a head, and T a tail:

HHHH THHH
 HHHT THHT
 HHTH THTH
 HHTT THTT
 HTHH TTHH
 HTHT TTHT
 HTTH TTTH
 HTTT TTTT

If we assume that each individual coin is equally likely to come up heads or tails, then each of the above 16 outcomes to 4 flips is equally likely. Each occurs a fraction one out of 16 times, or each has a probability of $1/16$.

Alternatively, we could argue that the 1st coin has probability $1/2$ to come up heads or tails, the 2nd coin has probability $1/2$ to come up heads or tails, and so on for the 3rd and 4th coins, so that the probability for any one particular sequence of heads and tails is just $(1/2) \times (1/2) \times (1/2) \times (1/2) = (1/16)$.

Now lets ask: what is the probability that in 4 flips, one gets N heads, where $N=0, 1, 2, 3, \text{ or } 4$. We can get this just by counting the number of outcomes above which have the desired number of heads, and dividing by the total number of possible outcomes, 16.

<u>N</u>	<u># outcomes with N heads</u>	<u>probability to get N heads</u>
0	1	$1/16 = 0.0625$
1	4	$4/16 = 1/4 = 0.25$
2	6	$6/16 = 3/8 = 0.375$
3	4	$4/16 = 1/4 = 0.25$
4	1	$1/16 = 0.0625$