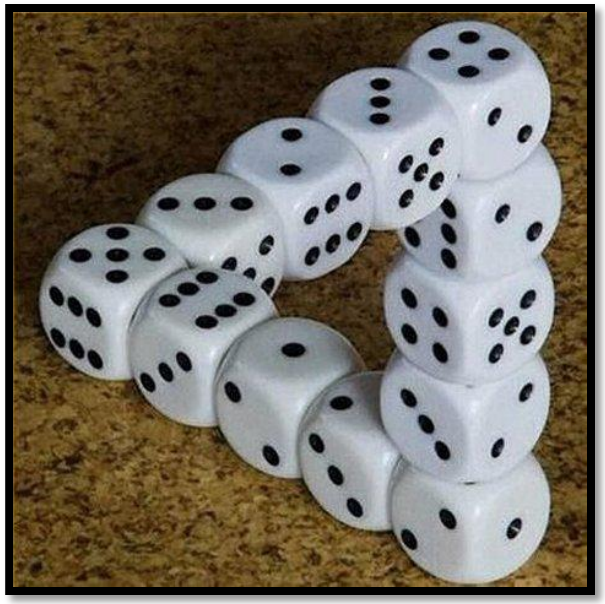
GAT 110: Game History

Course Instructor:
Richard Thames Rowan
Email: rrowan@digipen.edu
Cell: 206-898-2955

Dice Games

The Role of Dice



Origins of Dice

- Dice evolved independently in many ancient cultures.
  - Dice were in all probability (pun intended) a fortune telling device, as the outcome of a roll was believed to be controlled by the gods.
- Dice are ancient in origin:
  - Oldest known dice are over 5000 years old discovered in **Shahr-e Sūkhté** (literally BURNT CITY) that appeared around 3200 BCE and disappeared around 2100 BCE (after burning down the 4th time).

Origins of Dice

- Dice are ancient in origin:
  - Tetrahedral (four-sided) dice were discovered along with the Royal Game of Ur (c. 3000 BCE origin)

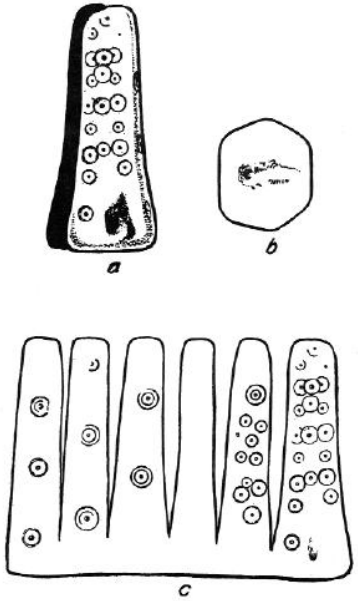
Origins of Dice

- Dice are ancient in origin:
  - Dice found in Egyptian tombs dating from 2000 BCE.

Origins of Dice

- Dice are ancient in origin:
  - Dice have been found in Native American prehistoric burial mounds, including fossilized knucklebones of a llama.

Arapaho Stick Dice



Incan “pichqa”

Dice Forms

- Dice have taken many forms, including:
  - Cubical dice
  - Sticks with a flat side and a rounded side.
  - Tetrahedral dice
  - Myriad of other platonic solids and other non-standard shapes.

Dice Nomenclature

- When describing dice, we use the NdF descriptor method to describe a combination die roll for dice with normal distribution (numbered 1-N with a single digit on each face of the die).

- N = Number of dice of this type.
- F = Number of faces on the die.

- Example: 2d6 = 2 six-sided dice

- You can also use “d6” as shorthand for “six-sided die with normal distribution”.
- Use of this nomenclature implies that it is a platonic solid with normal distribution, so if it isn’t you should use “non-standard d6” and clarify how it is non-standard (e.g. “with a distribution of 1, 1, 1, 2, 2, 3”).

Dice Forms

- Cubical dice as we know them today were originally made from the talus of hoofed animals, commonly called knucklebones. By Roman times:
  - Dicing (a game of chance) was more commonly played by boys.
  - Knucklebones (a game of dexterity that jacks evolved from) was primarily played by women and children.

Greece c.330 BCE

Probability

A Brief Introduction to Probabilities

Possibilities

- A six-sided, standard die has 6 possible rolls:
  - 1, 2, 3, 4, 5, or 6
- The odds of rolling a given number on a single die is one in six (one possibility out of six possible outcomes):
  - This is written as 1/6
- This is pretty obvious, right?

Possibilities

- What are the odds of rolling a value of 2 on TWO six-sided, standard dice?

Possibilities

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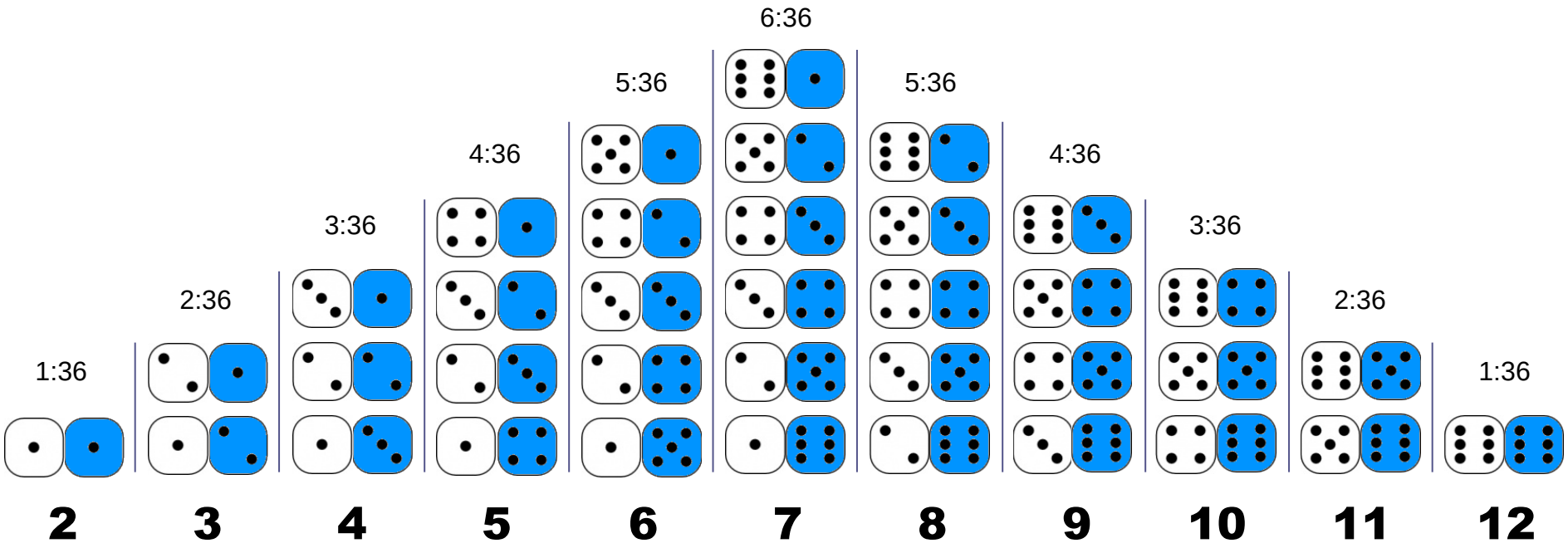
  - ONE in THIRTY-SIX

Possibilities

- What are the odds of rolling a value of 2 on TWO six-sided, standard dice?
  - ONE in THIRTY-SIX
- Wait… what?

Possibilities

- Let's look at a chart of all the possible combinations of 2 six-sided dice:



Independence of Events

- Two events are independent if they do NOT affect one another. Example: Rolling a 1 and then rolling a 4 with d6.

- Two events are dependent if they DO affect each other (for example: drawing an Ace, and then drawing another Ace from a standard playing card without replacement of the first Ace).

Multiplication Rule (AND)

- Example: What are the odds of rolling a 1 on a d6 AND immediately rolling a 1 on a d6 again?

- To determine the total number of possible choices, you multiply the choices together, or put in more mathematical terms…

- If a choice consists of k steps, of which the first can be made in n_1 ways, the second in n_2 ways, …, and the kth in n_k ways, then the whole can be made in $n_1 \cdot n_2 \cdot \ldots \cdot n_k$ ways.

Addition Rule (OR)

- To determine the total number of possible choices, you ADD the choices together.

- Example: What are the odds of drawing an Ace OR a Spade from a standard deck of playing cards on a single draw?

Addition Rule (OR)

- To determine the total number of possible choices, you ADD the choices together.

- Example: What are the odds of drawing an Ace OR a Diamond from a standard deck of playing cards on a single draw?

=

Addition Rule (OR)

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- Example: What are the odds of drawing an Ace OR a Diamond from a standard deck of playing cards on a single draw?

$$A = \frac{4}{52}$$

Addition Rule (OR)

- To determine the total number of possible choices, you ADD the choices together.

- Example: What are the odds of drawing an Ace OR a Diamond from a standard deck of playing cards on a single draw?

$= \frac{4}{52}$ OR  =

Addition Rule (OR)

- To determine the total number of possible choices, you ADD the choices together.

- Example: What are the odds of drawing an Ace OR a Diamond from a standard deck of playing cards on a single draw?

 $= \frac{4}{52}$ OR  $= \frac{13}{52}$

Addition Rule (OR)

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- Example: What are the odds of drawing an Ace OR a Diamond from a standard deck of playing cards on a single draw?

Addition Rule (OR)

- To determine the total number of possible choices, you ADD the choices together.

- Example: What are the odds of drawing an Ace OR a Diamond from a standard deck of playing cards on a single draw?

$$= \frac{4}{52} + \frac{16}{52}$$

$$= \cancel{\frac{13}{52}} \quad \frac{12}{52}$$

Permutations

- In general, if r objects are selected from a set of n objects, any particular arrangement of these objects is called a PERMUTATION.
  - This is especially useful when considering the probability of drawing r cards from a deck of 52 cards in a particular order.

- Using the previous multiplication rule, the total number of permutations of r objects selected from a set of n objects is $n(n\text{-}1)(n\text{-}2)\cdot\ldots\cdot(n\text{-}r\text{+}1)$.

- Products of consecutive integers can be simplified through factorial notation in which $3!=3\cdot2\cdot1$. ($0!=1$ by definition.)
- Any product of consecutive numbers can be written as a quotient of two factorials.
  - For example, if $n=52$ and $r=3$, then $52\cdot51\cdot50=\frac{52\cdot51\cdot50\cdot49!}{49!}=\frac{52!}{49!}$
  - Or in general form: $\frac{n!}{(n\text{-}r)!}$

Combinations

- What if we don't care about the order in which we get the permutations?
  - We don't care if we get (1,6) or (6,1) on a die roll of 2d6 as the result is still 7.
  - We don't care which Ace we drew if we are trying to determine the odds of drawing 4 Aces from a deck of cards on the first 4 draws.
- If we don't want the order, then we're looking for the number of COMBINATIONS that give us a particular result.
- A combination is the same as a subset, and when we ask for the number of combinations of r objects chosen from a set of n objects, we are asking "How many different subsets of r objects can be chosen from a set of n objects?"
  - Note that r objects can be arranged among themselves in $r!$ permutations, which count as only *one* combination. That means that each of the target permutations appear in the total number of permutations $r!$ times.
- This means to get the number of combinations, you can divide by $r!$ or more generically:

$$\frac{n!}{(n-r)!\cdot r!}$$

Law of Large Numbers

- If the number of times a situation is repeated becomes larger and larger, the proportion of successes will tend to come closer and closer to the actual probability of success.
  - Consider rolling the pair of dice – if you roll 36 times, you are not guaranteed to get double 1's, even though the probability is 1:36.
  - However if you roll the dice 36,000 times, then very close to 1,000 of those rolls will be double 1's.

Crown & Anchor

Banker's Advantage

Crown & Anchor History

- Crown & Anchor is a dice gambling game of English origin dating back to the early 18th Century.
- Popular in the British Royal Navy and fishing communities.
- Still played in Bermuda and the Channel Isles.
- Closely related to the modern casino game of Chuck-a-luck and has the same banker's advantage.

Rules Overview

- Three special dice are used marked with a crown, an anchor, a heart, a spade, a diamond, and a club.
- The players sit around a board or cloth marked with the same symbols.
- Players place their bets on the devices of their choice and the banker throws 3 dice from a cup.
- Banker pays even money on singles, two to one on pairs, and three to one on triples, and losses come to the bank.

Probabilities of Crown & Anchor

- Let's calculate the probabilities of the player winning on a single bet (say on the crown).
- First, let's determine the odds of losing:
  - Since there are 3 dice thrown, there is a 5/6 chance that the first die will not have a crown, the same on the second, and the same on the third, or 125/216 odds. That means that odds are they will lose 57.87% of the time!
- The odds of winning even money are as follows:
  - This is the product of missing on 2 dice and hitting on the third: $3 \cdot (5/6) \cdot (5/6) \cdot (1/6)$ or 75/216, or 34.72%.
- The odds of doubling your bet are as follows:
  - This is the product of hitting on 2 dice and missing on the third: $3 \cdot (5/6) \cdot (1/6) \cdot (1/6)$ or 15/216, or 6.94%.
- The odds of tripling your bet are as follows:
  - To hit on all 3 dice, the odds are $(1/6) \cdot (1/6) \cdot (1/6)$ or 1/216, or 0.46%.
- On average, a player will lose 7.87% of their stake each time.

Farkle

Press Your Luck Dice Game

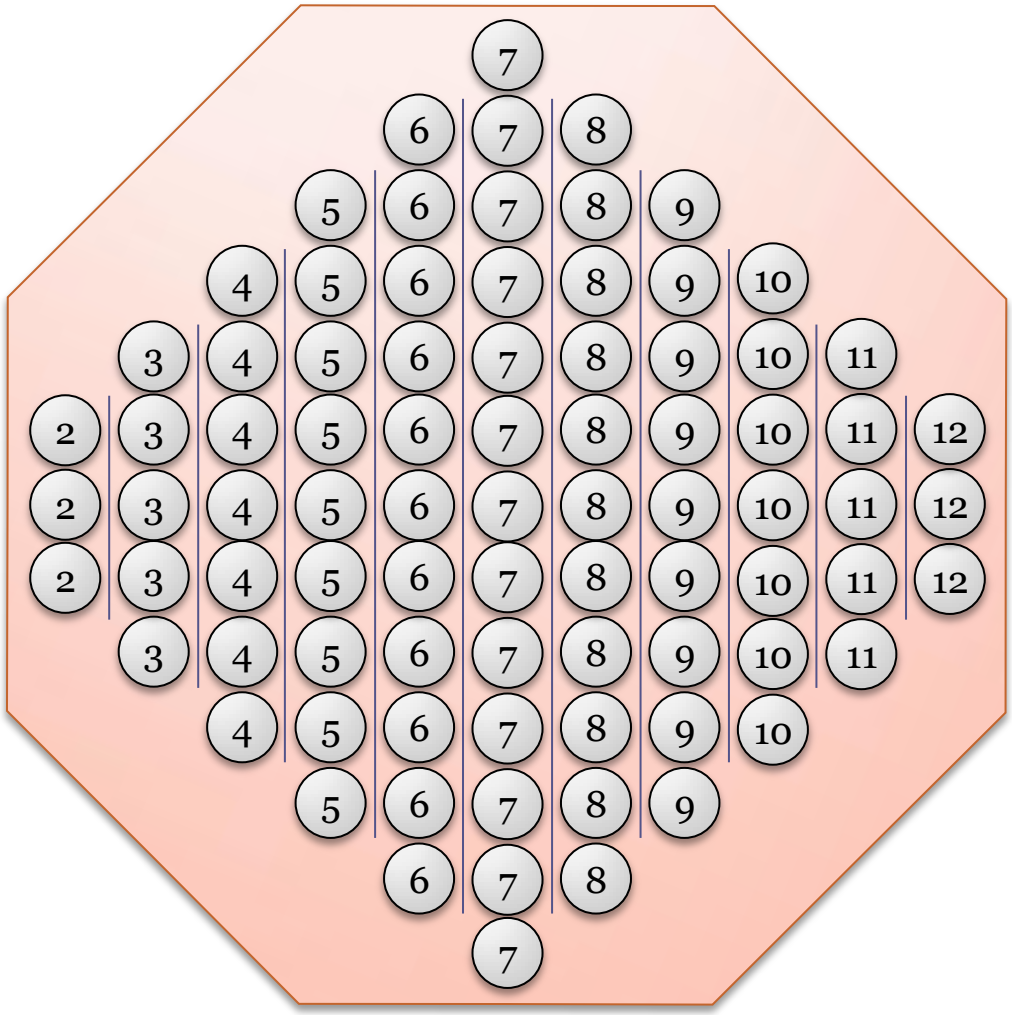
Farkle History

- Despite many claims that this dates back to Shakespearean times or was played by a “Lord Farkle” in 14th Century Iceland, there is no evidence of the game prior to the 20th Century.
- Some claim it derives from a French game called Dix Mille (Ten Thousand), but I have found no documentary evidence of this.
- What we do know is that Parker Brothers published Game of Five Thousand in 1963 and released an updated game called Risk ‘n’ Roll 2000 in 1999.
- There was an explosion of popularity for this game in the early 1980’s with half a dozen published versions between 1980-1983.
- Cosmic Wimpout is one of the better known variants of the game.

Rules Overview

- Goal: Be the first to reach 5,000 (or 10,000) points.
- Components: 5d6, notepad
- Mechanics: Set collection, point accumulation, wagering (press your luck)
- Rules:
  - One player starts, then play progresses clockwise.
  - On your turn, throw all 5 dice. You must then set aside at least one scoring combination:
    - Triplet of 1s counts 1,000 points.
    - Triplet of 2s through 6s count as 100 times the pip count of a single die (200-600 points total)
    - Single 1 counts 100 points.
    - Single 5 counts 50 points.
  - You may re-throw remaining dice as often as you wish, but you must keep at least one scoring combination after each throw (set aside dice may not be re-thrown).
  - If you succeed in setting aside all the dice, total the points and you may roll all the dice and continue adding to your score.
  - Your turn ends:
    - If you voluntarily stop and “bank” your points.
    - If you fail to make a scoring combination on a throw and lose your turn and your progress.
  - First player to reach 5,000 banked points wins.

Can't Stop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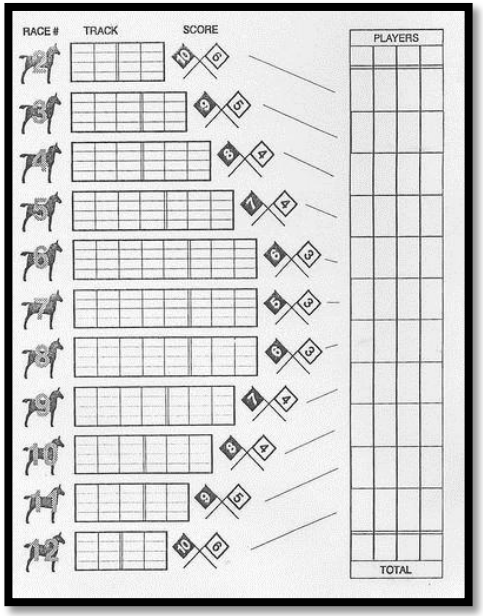
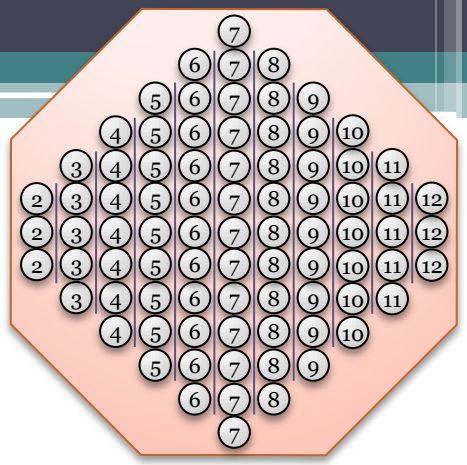
Can’t Stop History



- The predecessor to this games was called *The Great Races*, and was published by Sid Sackson in *The 6-Pack of Paper & Pencil Games*, 1974. It was later reprinted in Games magazine in the Jan/Feb 1978 edition.
- *Can’t Stop* was designed by Sid Sackson and published by Parker Brothers in 1980.
- The game was reprinted by Face 2 Face games in 2007.



Rules Overview

- Goal: Be the first to complete 3 number columns.
- Components: 4d6, 11 markers in each player color, 3 active column markers (ACM), and a game board with three each of 2 and 12, five of 3 and 11, seven of 4 and 10, nine of 5 and 9, eleven of 6 and 8, and thirteen of 7.
- Mechanics: Point Allocation, Wagering
- Rules:
  - On a player's turn, they roll 4d6 and form the dice into two pairs.
  - They then add an ACM to one spot above their player marker (or the first spot if they don't have a player marker on the board) for the column corresponding to the sum of a pair, OR they advance an existing ACM. The same ACM may be moved twice.
  - After each roll, the player may replace the ACMs with their player marker in that column, or add a player marker if they don't have one, and end their turn, OR they can press their luck and roll the dice again.
  - If a player is not able to add or advance at least one ACM on their turn, they lose all progress they have made this turn.
  - Once a player marker reaches the top of the column, all other player markers on that column are removed and that column may not be used for the rest of the game.
  - The winner is the first player to advance their player marker to the top of at least 3 columns.

Shut the Box

Shut the Box History

- Shut the Box is a popular pub game that dates back to the 19th Century in Normandy, France or the Channel Islands before making its way to England in 1958 from the Channel Islands.

- There is some speculation that the game could be as old as from the 12th Century as well.

Rules Overview

- Goal: Score the fewest points at the end of the round.
- Components: 2d6, score box with numbers 1-9 that can be marked as “scored”, notepad
- Mechanics: Set Collection, Point Allocation
- Rules:
  - A player rolls 2d6 and can mark off 1 box equal to the sum of the dice or 2 boxes that add up to the sum of the dice.
  - Each box can only be used once.
  - After marking off the box(es), the player rolls again.
  - When the 7, 8, and 9 are marked off, the player can elect to continue with only 1 die and can split that number between 2 boxes.
  - When the player can not completely mark off boxes for a roll, their turn is over.
  - Unused boxes are summed and become the player’s score for the round.
  - The player with the lowest score after all players have had a turn wins the round.

Liar's Dice

Bluffing Dice Game

Liar's Dice History

- *Liar's Dice* originated in South America as the game *Cachito* (later known as Dudo, Cacho, Pico, or Perudo) during the early Spanish colonization and was brought to Europe by Francisco Pizarro in the 16th Century.
- Liar's Dice has become a whole sub-group of games within the Dice Family as there are many variations.
- In 1993, *Bluff*, a Liar's Dice variant by Richard Borg won the Spiel des Jahres (Game of the Year) award in Germany.

Rules Overview

- Goal: Be the only player that is not eliminated from play.
- Components: 5d6, dice cup, 3 life tokens per player
- Mechanics: Bluffing
- Rules:
  - A player secretly rolls 5d6 and declares a score which may be accepted or challenged by the player to his left.
  - If it is challenged and the score is at least as high as the declaration, the challenger loses a life token; otherwise, the declarer loses a life.
  - If it is accepted, the dice are secretly passed to the accepting player who may re-roll any number of dice (must declare how many) and then declare a score that is higher than the previous declaration.
  - Last player with remaining lives wins.

Yacht/Yahtzee

Set Collection Dice Game

UPPER SECTION	HOW TO SCORE	GAME #1
Aces = 1	Count and Add Only Aces	
Twos = 2	Count and Add Only Twos	
Threes = 3	Count and Add Only Threes	
Fours = 4	Count and Add Only Fours	
Fives = 5	Count and Add Only Fives	
Sixes = 6	Count and Add Only Sixes	
TOTAL SCORE	→	
BONUS If total score is 63 or over	SCORE 35	
TOTAL Of Upper Section	→	

LOWER SECTION		
3 of a kind	Add Total Of All Dice	
4 of a kind	Add Total Of All Dice	
Full House	SCORE 25	
Sm. Straight Sequence of 4	SCORE 30	
Lg. Straight Sequence of 5	SCORE 40	
YAHTZEE 5 of a kind	SCORE 50	
Chance	Score Total Of All 5 Dice	
YAHTZEE BONUS	✓ FOR EACH BONUS	✓ ✓ ✓
	SCORE 100 PER ✓	
TOTAL Of Lower Section	→	
TOTAL Of Upper Section	→	
GRAND TOTAL	→	

Yahtzee History

- Yahtzee was invented(?) by a Canadian couple in 1954 (names unknown) and published by E.S. Lowe in 1956.
- E.S. Lowe was acquired by Milton Bradley in 1973, and was subsequently acquired by Hasbro in 1984.

Next Lecture

Race Games

- Spiral Race Games
- Table Group
- Cross & Circle Games
- Peg Scoring Games