Title: LOTTERY GAME THAT ALTERNATES BETWEEN GAME INDICA AND RAFFLE PRIZES

Abstract: A drawing in the inventive lottery game comprises one or two stages. In the first stage, a wheel is spun. If the wheel indicates a slot occupied by game indica, then a group of players win simultaneously, in which case, the drawing is over. Otherwise, the wheel indicates a prize, in which case, a raffle drawing for a winner of this prize is deferred to a second stage. There are single-wheel and more sophisticated multi-wheel embodiments, a multi-wheel embodiment having at least one advantage in that it requires no minimum level of sales.
Description

BACKGROUND OF THE INVENTION

Field of the Invention

The invention relates in general to wagering game methods. More particularly, the invention relates to a lottery game that is hosted by a central computing system, wherein entries are memorialized on tickets issued at electronic terminals and drawings are held at specific times.

Description of the Related Art

A lottery is a wagering game sponsored by an organization, such as a government. In particular, an “online” lottery game (as opposed to an instant game) is a wagering game for which a player purchases an entry that is memorialized on a paper ticket that is dispensed at an electronic terminal. The transaction is recorded by a central computing system.

An online game is consummated by a “drawing,” a process by which winning indicia are determined. The drawing may be a physical process, such as releasing numbered balls into a transparent chamber, wherein the balls are mixed by jets of air. The winning balls may be selected by allowing one or more balls to pass to a display area such as a clear tube. Alternatively, the winning indicia may be determined by a computer process driven by a random number generator. In recent years, electronic drawings have become more popular as they are less expensive. Once the drawing has been conducted, prizes are awarded based on comparisons between a player’s and the winning indicia.

The most well known lottery games are “matrix” games, a matrix being a range of numbers, e.g., 1 to 50. An entry comprises a subset of the matrix chosen by or assigned to a player. The lottery organization conducts a drawing to produce the winning numbers.
Prizes are awarded based on matches between the entry and the winning numbers. A variation on this idea is the multi-matrix game. For example, an entry may comprise subsets of two matrices of numbers. Prizes are awarded based on the matches between an entry’s subsets and the respective winning subsets. Such are the popular multi-state Powerball® and Mega Millions® lottery games for which the top prize is typically in the tens or hundreds of millions of dollars.

Another common type of online game is the “numbers game.” Such are the well-known “Pick 3” and Pick 4” games, wherein an entry comprises a sequence of digits. The lottery randomly selects a sequence of digits. Depending on the bet type, the player is awarded a prize based on whether the digits comprising his number match the digits in the winning number in exact or in any order. (There are variations.) The prizes for numbers games are several magnitudes lower than that of jackpot-driven matrix games. The prizes may be fixed, i.e., a straight bet (i.e., matching 3 digits in exact order) may pay out 500 to 1, or the prizes may be pari-mutuel. If the prizes are fixed, the day-to-day cost to the lottery may be erratic (e.g., a popular number such as 777 costs the lottery a huge payout). But a numbers game will correct itself over time based on the laws of probability. Numbers games have their roots in illegal street games and tend to be more popular in geographic areas that have such a history.

Another type of online lottery game is the raffle. Traditionally, raffles are events that raise funds (e.g., for charities, governments, etc.) and long predate online computer technology. Tickets with unique identifiers are purchased by players. Identifiers are randomly selected from the pool of those purchased and prizes are awarded. Online raffles simply expand on their old-fashioned counterparts by allowing broader participation and larger prizes, made possible by computer technology. Nonetheless, online raffles require more management than other online games. Unlike a numbers game, a conventional raffle will not “correct” itself over time. If sales don’t support guaranteed prizes, the lottery will lose money. For this reason, raffles are usually “special events,” rather than regularly scheduled games, to allow the lottery to devote the necessary attention. However, raffles show promise in providing a viable way for
lotteries to raise price points, as raffles typically have higher price points than other online games.

Another, somewhat separate, category of online lottery games is that of monitor games. A monitor game comprises a network of television-like monitors deployed across a jurisdiction, usually in age-restricted environments such as bars. As with other online games, players purchase tickets. Drawings are held at specific intervals and the results are displayed on monitors, which are the same for each monitor across a jurisdiction. Drawings are fast-paced, conducted at regular intervals, up to hundreds of times per day. The most well-known monitor game is that of Keno. Keno is a matrix game where 20 numbers are drawn from 1 to 80. Players are allowed to decide the number of numbers to select as well as the actual numbers. There are different prize tables based on the number of selected numbers. There are other less common monitor games besides Keno, e.g., animated, simulated horse races with bet types similar to those at racetracks.

As online lotteries run their course, it has become an increasing challenge to grow or sustain revenues. For the player, the online gaming experience has remained much the same for decades. Although, production values for paper tickets have improved, as thermal printers are overtaking dot-matrix printers in the industry. (Thermal printers produce higher quality images.) Nonetheless, at this time, color printers are apparently cost-prohibitive or otherwise impractical (slow).

Two approaches to address this challenge of increasing online lottery revenue are to expand online game content and increase price points. It is to these goals of expanding game content and increasing price points that the inventive game is largely directed: As the inventive game provides new twists on the old-fashioned raffle, it should inject new life into the online repertoire. Also, as players have exhibited a willingness to pay higher prices for raffle games, they may be more receptive to higher price points for the inventive game.

Another goal of the inventive game is technical. Raffles have already proven reliable revenue generators for lotteries. However, they are comparatively labor-intensive as they
require more planning and coordination. It is the goal of the inventive game to provide a more systematic, automated raffle game while retaining the old-fashioned charm of a raffle. As an example of the low-maintenance, automated nature of the inventive game, it will be disclosed how this invention can be embodied as a fast-paced monitor game, like Keno.

SUMMARY OF THE INVENTION

In a single-wheel embodiment, a player selects a letter from the alphabet. The lottery extends this selection to a unique raffle identifier, which is memorialized on a paper ticket. The first stage of the game is the spinning of the “raffle wheel,” which comprises slots occupied by letters of the alphabet interspersed with prizes. If the outcome is a letter, a group of players is simultaneously awarded prizes, i.e., entries for which players selected the winning letter each receive a prize. Otherwise, the outcome of the first stage of the drawing is a prize, from which follows a second stage to the drawing: an individual raffle drawing for the winner of this prize. An embellishment on this idea is that a slot on the raffle wheel may indicate a plurality of prizes (rather than a single prize), in which case, the second stage would comprise a corresponding plurality of raffle drawings for individual winners.

A multi-wheel embodiment adds a step to the single-wheel embodiment: the raffle wheel used in the drawing is selected from a system of wheels. This allows the inventive game to be embodied in such a way that there is no minimum sales requirement. In particular, the invention can be fully automated as a fast-paced monitor game, like Keno.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a play slip for the inventive game.

FIG. 2 is a ticket for the inventive game for which the raffle identifier has been generated at the terminal without input from the central computing system.
FIG. 3 is an example of a ticket for the inventive game for which each raffle identifier has been dynamically generated with communication between the terminal and the central computing system.

FIG. 4 is a physical gaming wheel.

FIG. 5 illustrates the two possible scenarios for a drawing, the wheel indicates a: (1) letter, or, (2) raffle prize, in which case, there is a subsequent raffle drawing for a winner of this prize.

FIG. 6 is a method for dynamically assigning raffle identifiers using the letter “B” as an example.

FIG. 7 is a specific example of the method for assigning raffle identifiers described in FIG. 6.

FIG. 8 is a method for assigning letter-match prizes after the drawing has taken place.

FIG. 9 is a wheel used for the drawing in the inventive game that has a slot for a special symbol, a palmetto tree. If the palmetto tree is hit, there are individual drawings for each of a set of prizes. These prizes may vary each cycle.

FIG. 10 is a ticket wherein the potential letter-match prize is assigned prior to the drawing and printed beside the raffle identifier.

FIG. 11 is a wheel for a multi-jurisdictional embodiment of the inventive game, with high fixed cash prizes, and a special symbol, the Statue of Liberty, for a set of special prizes.

FIG. 12 is a ticket for a multi-jurisdictional embodiment of the inventive game that includes advance purchases for 2 games.
FIG. 13 is a method for conducting a raffle drawing for a multi-jurisdictional embodiment.

FIG. 14 is a system of wheels used in a monitor game embodiment.

FIG. 15 is an exemplary ticket for a monitor game embodiment.

FIG. 16 is an exemplary deluxe ticket for a monitor game embodiment. For the higher price of $5, the letter-match prize is $100, twenty times the price point, vs. $20, ten times the price point, for a $2 purchase.

FIG. 17 describes the parameters for a monitor game embodiment including a system for assigning probabilities to the four wheels in FIG. 14 based on the number of entries.

FIG. 18 illustrates mathematically that wherein the number of entries is below a certain threshold, the average total progressive jackpot contributions per winning jackpot is $500,000.

FIG. 19 illustrates retrieving the probabilities assigned to the raffle wheels and jackpot contribution in a database based on the number of entries. This figure further illustrates selecting one of the four wheels using a random number generator.

FIG. 20 illustrates the scenario for a monitor game wherein the outcome of the spinning of the wheel is a letter.

FIG. 21 illustrates the scenario for a monitor game wherein the outcome of the spinning of the wheel is a raffle prize.

FIG. 22 illustrates a system for assigning probabilities to the wheels in a monitor game embodiment, such that if the number of entries is above a certain threshold, then the four wheels are weighted equally.
FIG. 23 summarizes the inventive game.

DETAILED DESCRIPTION OF THE INVENTION

Overview

In the inventive wagering game, a player selects game indicia, such as a letter from the alphabet, that is extended to a unique raffle identifier by the lottery. Figure 1 is an example of a play slip 100 for the inventive game. The play slip includes the name of the game, e.g., “The Raffle Wheel” 101, indicia from which to select, in this case, the letters of the alphabet 102, and instructions as to how many indicia to select, e.g., “Pick 1 or Q P” 103. The player has marked a single letter “B” 104 in the first panel. The player could have alternatively marked QP for a “quick-pick” 105. (The lottery may prefer to not include the quick-pick option for individual panels to avoid being held responsible for offensive words. Instead, quick-picks could be provided upon a verbal request to the sales agent and would consist of a contiguous segment of the alphabet, e.g., ABCDE, BCDEF, etc., none of which form offensive words.) The player may cancel his selection for a particular panel by marking VOID 106.

The price is indicated under the panels 107, $5 per board, or, $20 for 5 boards. The play slip may include a multi-draw section for advance draws 108. The player may select to play 2, 3, 4, 5, 10, or 20 draws in advance and would be charged accordingly (number of draws x the price per draw). If the player changes his mind and decides only to play for the current drawing, then she would mark VOID in the multi-draw section. The player submits her play slip to the sales agent who has it scanned by a lottery terminal, which issues a ticket memorializing her selected indicia concatenated with supplemental indicia to produce a unique raffle identifier. As the player has selected one panel, she pays the sales agent $5 to complete the transaction.
Figure 2 is an example of the ticket 200 corresponding to the play slip in Figure 1. Some exemplary features of a ticket include the price, $5.00 201, the name of the game, “The Raffle Wheel” 202, graphics 203 (e.g., a Ferris wheel motif), the date 204, the draw number 205, a promotional message 206, the entry 207 comprising the selected letter concatenated with 10 digits separated into groups by three dashes, and a bar code 208 containing various authentication information.

Figure 4 illustrates a physical gaming wheel used in the drawing of the inventive game 400. (An animated wheel may be substituted.) Such a wheel includes a sturdy base 401 onto which is mounted a pole 402. The actual wheel 403 is made of lightweight durable material, such as plywood, mounted at its hub 404 onto a turntable, or, some other rotating apparatus, that is itself mounted onto the pole. Protruding around the circumference are pins 405. As the wheel spins, these pins clap against the wheel indicator (or “clapper”) 406, that is clamped on the pole.

The face of the wheel is made by silk-screening or some other durable printing process. It includes 36 equally spaced slots: 26 for the letters of the alphabet 407, 4 for prizes of $5,000 408, 2 for prizes of $10,000 409, 2 for prizes of $25,000 410, 1 for a prize of $50,000 411, and 1 for a progressive jackpot 412. Throughout, a wheel (physical or animated) used in the inventive game is referred to as a “raffle wheel.”

Figure 5 illustrates the two possible scenarios for the inventive game. Suppose the player has purchased the ticket 200 in Figure 2, with the raffle identifier B-07-038-50073 207. In scenario 1 500, after the wheel has stopped spinning, the wheel indicator 501 points to a letter, in this example, “B.” As the player’s entry starts with a “B,” he wins a prize, typically of a “chatter” magnitude. (In lottery vernacular, a chatter prize ranges from about $20 to $500, enough to stir conversation but not enough to be life-changing.) In scenario 2 502, after the wheel has stopped spinning, the wheel indicator 503 points to a prize, in this example, $10,000. There follows a second stage to the drawing 504, wherein a raffle identifier is drawn. The actual raffle drawing would be a computer process. But it would be communicated by a friendly animation such as a raffle ticket being pulled from
a hat. In this example, the raffle identifier B-07-038-50073 has been drawn. As this is the player’s raffle identifier on ticket 200, he wins $10,000.

An overview having been provided for the inventive game, we discuss in more detail some of its components. In particular, the assignment of the raffle identifier, and, the awarding of “letter-match” prizes.

Raffle Identifiers

Raffle games differ from other online games in that the indicia for each entry are unique. Generally speaking, extending a player-selected letter to a unique identifier can be accomplished by concatenating enough information. In fact, it can be done at the level of the terminal, with no input from the central computing system. Consider the ticket 200 in Figure 2. Suppose there are no more than 10,000 lottery terminals in this particular jurisdiction and each terminal is assigned a number greater than 0 and no more than 10,000. For each drawing, each terminal keeps 26 counters (each starting at 1 with a maximum value of 50,000), keeping track of the number of raffle identifiers produced at that terminal for each letter, e.g., a “B counter.” Also, each drawing is assigned a draw number that increments by 1 each drawing. An example for assigning a unique raffle identifier to an entry where the player has selected “B”:

Concatenate

(i) “B” (1 character),
(ii) the draw number modulo 20 + floor([(B counter – 1) / 10,000] x 20 (2 characters), *
(iii) the terminal number - 1 (4 characters),
(iv) the B counter -1 modulo 10,000 (4 characters).

* floor of a value is the greatest integer less than or equal to that value.
Suppose the draw number is 387, the terminal number is 386 and the B counter at the terminal is 74. By the above procedure, concatenate “B,” 07, 0385, and 0073, for B-07-038-50073 (separated by dashes for readability). Those skilled in the art of Mathematics can show that this method yields up to 50,000 unique raffle identifiers, per letter, per terminal, per 20 advance drawings, which, for all intents and purposes, provides an inexhaustible supply of raffle identifiers.

The above-described method for extending a letter to a unique raffle identifier is serviceable. However, it is more aesthetic for the raffle identifier to be shorter. Other methods, which require some interaction between the terminal and the central computing system, generate shorter raffle identifiers while still providing a huge supply and allowing for advance draws. Such a method is disclosed in Figure 6, which, for brevity, is specific to the letter “B.”

The first step in this method is to assign to each terminal a unique number greater than 0 601, most straightforwardly starting at 1 to the total number of terminals. (This numbering may differ from drawing to drawing.) Next, select parameters m and n 602. The choice of m and n should be based on the fact that there will be 3 + m + n characters per raffle identifier (excluding dashes) and a guarantee of 5 x 10^m+n - 2 x maximum terminal number x 10^n raffle identifiers being available per letter. At the central computer, a counter for B, central_B_cnt, is initialized to 2 x maximum terminal number 603. At each terminal, a counter, local_B_cnt, is initialized to 0, a 1st number, B_N1, is initialized to the terminal number – 1, and a 2nd number, B_N2, is initialized to the maximum terminal number + terminal number – 1 604.

After these initializations, the system is ready to generate raffle identifiers. Is there another player 605? She selects “B” 606. The letter is extended to a unique raffle identifier by the following concatenation 607:

(i) “B” (1 character),
(ii) floor(B_N1 /10^m) x 20 + draw # modulo 20 (2 characters),
(iii) \( B \_N1 \mod 10^n \) (m characters),
(iv) \( \text{local}_B \_cnt \mod 10^n \) (n characters).

After extending B to a raffle identifier, test whether or not the \( \text{local}_B \_cnt \) ends in \( 10^n - 1 \) 608 (e.g., 9, 99, 999, etc). If so, replace \( B \_N1 \) with \( B \_N2 \) 609, and delete \( B \_N2 \). (This leaves \( B \_N2 \) momentarily unassigned.) Otherwise, directly proceed to increment \( \text{local}_B \_cnt \) 610 and send this new entry to the central computer 611. Does the entry end in \( 10^n - 1 \)? 612. If so, then send \( \text{central}_B \_cnt \) to the terminal, assign \( B \_N2 \) the value of \( \text{central}_B \_cnt \) and increment \( \text{central}_B \_cnt \) 613. Continue this loop until sales are closed or raffle identifiers are exhausted for “B”.

Figure 7 is an example of the above-described method for assigning raffle identifiers. The general parameters are initialized 700: The draw number is 478, the maximum terminal number is 4859, m is assigned to be 4 and n to 2. For the exemplary terminal # 2315, \( \text{local}_B \_cnt \) is initialized to 0, \( B \_N1 \) to 2315 – 1 = 2314, and \( B \_N2 \) to 4859 + 2315 – 1 = 7173. The \( \text{central}_B \_cnt \) is initialized to 2 x 4859 = 9718.

We inspect the system later on 701 after many raffle identifiers have been generated. The \( \text{central}_B \_cnt \) count is 26,895. At terminal 2315, \( \text{local}_B \_cnt \) =199, \( B \_N1 \) = 19,283 and the \( B \_N2 \) = 20,849. The player selects letter “B” 702, which is concatenated with 38, 9283, and 99 to produce B-389-28399 703 (separated by dashes for readability). Since \( \text{local}_B \_cnt \) ends in 99, \( B \_N1 \) = 19,283 is replaced with \( B \_N2 \) = 20,849, \( \text{local}_B \_cnt \) is incremented to 200 and the entry, B-389-28399, is sent to the central computer 704. Since the entry ends in 99, current \( \text{central}_B \_cnt \) = 26895, is sent to the terminal and \( \text{central}_B \_cnt \) is incremented (to 26,896) 705. \( B \_N2 \) is assigned to be 26895 706.

The ticket 300 in Figure 3 illustrates the above-described dynamic method. The first entry 302 is that generated in Figure 7. Notice that this identifier uses only 9 characters (excluding dashes), whereas the raffle identifier in Figure 2 uses 11 characters (excluding dashes).
Letter-Match Prizes

If the raffle wheel lands on a letter that matches the one in the player’s raffle identifier, she is awarded what will hereon be referred to as a “letter-match” prize. We discuss various options for the lottery.

The letter-match prize may be fixed. For example, suppose the wheel 400 is that in Figure 4, which has 36 slots. The price is $5 per play. The lottery could award a fixed letter-match prize of $20, which returns $20/36/$5 = 11\frac{1}{3}\% to the player in the form of letter-match prizes. Or, the lottery could award a fixed letter-match prize of $50, which returns $50/36/$5 = 27\frac{7}{9}\%. A fixed letter-match prize of $100 returns $100/36/$5 = 55\frac{5}{9}\%.

However, letter-match prizes need not be fixed. For example, upon issuance each entry could be randomly assigned a potential letter-match prize subject to a distribution such as: $500: 1\%, $200: 5\%, $100: 10\%, $50: 84\%. Moreover, these potential letter-match prize could be (but are not required to be) printed beside the raffle identifier as illustrated on the ticket 1000 in Figure 10 1002. The player receives this prize if and only if her letter matches one indicated by the raffle wheel. In terms of return to the player this would be equivalent to returning a fixed letter-match prize of $500x1\% + $200x5\% + $100x10\% + $50x84\% = $67$, which comprises a percentage return of $67/36/$5 = 37\frac{7}{9}\%.
The above methods for awarding letter-match prizes have the disadvantage of exposing the lottery to short term volatility. As with popular numbers in Pick 3 and Pick 4, popular letters would temporarily cost the lottery a large pay out. The lottery could mitigate such volatility by assigning letter-match prizes after the drawing. In fact, the lottery could avoid volatility with the letter-match prizes altogether by awarding prizes on a strictly pari-mutuel basis. However, this may not be appealing to players. As a compromise between paying out on a fixed or a pari-mutuel basis, prizes could be composed of two parts: a fixed component and a component based on sales. Figure 8 illustrates such a method:

If the raffle wheel indicates a letter 801, the number of winning entries, M, is computed 802. Each letter-match prize is initially assigned $50 803. Therefore, the fixed component of the letter-match prize comprises a return of $50/36/$5 = 27\% . An “upgrade fund” is determined, comprising 17% of the sales, and any funds rolling from prior drawings 804. (Where the roll comes from will be discussed shortly.) The “upgrade fund” is divided by $1700, and truncated down to the nearest integer, N 805. ($1700 comprises a complete set of upgrades, i.e., $450 + 5x$150 + 10x$50.) 16N of the letter-match prizes are each to be upgraded from $50 to a higher prize 806: N to $500 (adding $450 to $50), 5N to $200 (adding $150 to $50), and 10N to $100 (adding $50 to $50). If M ≥ 16N 807, then there are enough letter-match prizes to accommodate these upgrades and the lottery proceeds to upgrade 16N $50 prizes to higher prizes 808 and the excess of the upgrade fund, upgrade fund – $1700N, rolls to the next drawing 809. On the other hand, if it is the case that M < 16N 807, then there are more upgrades than there are letter-match winners. If this is the case, then all letter-match winners receive an upgrade 810, starting with the highest upgrades (“to $500” upgrades, i.e. adding $450) and continuing in non-decreasing order. The 16N – M upgrades that are left over are pooled and roll to the next drawing 811. Also, the excess of the upgrade fund, upgrade fund – $1700N, rolls to the next drawing 809.
The above-described method returns $27\frac{7}{9}\% + 17\% = 44\frac{7}{9}\%$ to the player in letter-match prizes. This method exposes the lottery to some short term volatility, as each letter-match prize will always be at least $50. However, the lottery is not exposed to as much volatility as if the whole $44\frac{7}{9}\%$ were returned to the player in the form of fixed prizes. But this method may be more palatable to players than a purely pari-mutuel payout as each player has a guarantee of receiving a good prize (at least $50) regardless of the number of winners.

There are various considerations in deciding how to award letter-match prizes. First, sales must be large enough to cover both the letter-match and the other prizes on the raffle wheel. Consider an embodiment with a progressive jackpot, as indicated by the slot 412 on the wheel 400 in Figure 4. Suppose the jackpot starts at $500,000 and the lottery would like the jackpot to increment a minimum of $50,000 each drawing. Also, the price per play is $5 and the lottery wishes to pay out a total of 70%. Furthermore, suppose the letter-match prize is a fixed $50, which comprises a percentage return of $27\frac{7}{9}\%$. The cash prizes on the raffle wheel plus the initial starting jackpot plus the jackpot increment will cost the lottery an average of $(4x$5,000 + 2x$10,000 + 2x$25,000 + $50,000 + $450,000) / 36 + $50,000 = $66,388\frac{8}{9}$ per drawing. (The $450,000 figure used in the computation is the initial starting jackpot of $500,000 minus a jackpot increment of $50,000.) This means that $70\% - 27\frac{7}{9}\% = 42\frac{2}{9}\%$ of sales per drawing must be at least $66,388\frac{1}{3}$, which means sales must be at least about $160,000 per drawing. If the lottery makes a judgment that the average sales will comfortably meet this threshold, it may proceed with launching the game. Otherwise, the lottery must make some modifications, such as lowering the letter-match prize, the initial starting jackpot, or the minimum jackpot increment.

As we’ve described the basic components of the inventive game, we present some hypothetical examples.

Single-Wheel Embodiments
Example 1: This embodiment may be appropriate for a jurisdiction with an over-18 population of about 4,000,000, like South Carolina. It is a biweekly game, the price for which is $5 per entry and employs the raffle wheel 400 in Figure 4 that has 36 slots, one of which is a progressive jackpot. The lottery would like the return to the player to be 60%. The letter-match prize is a fixed $50, for which the return to the player is $50/36/$5 = 27 7/9%.

The progressive jackpot starts at $250,000 and the lottery plans to increment it a minimum of $50,000 each drawing. Thus, the prizes for the raffle wheel will cost the lottery an average of $(4 \times 5,000 + 2 \times 10,000 + 2 \times 25,000 + 50,000 + 200,000)/36 + 50,000 = 59,444 4/9$ per drawing. (The $200,000 figure in this computation is the starting jackpot minus a $50,000 increment.) In addition to the regular $50,000 increments, the lottery will contribute (60% - 27 7/9%) \times Sales \times 59,444 4/9 to the jackpot each drawing. This means that sales per drawing must be such that (60% - 27 7/9%) \times Sales \geq 59,444 4/9, i.e., sales must be at least about $185,000 each drawing. Based on marketing research and the performance of previous games, the lottery has assessed that sales will comfortably meet this threshold. Figure 2 illustrates a ticket 200 for this embodiment. Sample Drawing: The raffle wheel is spun and indicates $25,000. There follows a raffle drawing for which the raffle identifier is B-07-038-50073. The ticket 200 in Figure 2 wins $25,000.

Example 2: Suppose the embodiment in Example 1 has been deployed for a couple of years and sales have plateaued at about $300,000 per drawing. Also, the vast majority of purchases are either $5 for 1 play or $10 for 2 plays, on which the lottery makes profits of 40% \times 5 = 2 and 40% \times 10 = 4, respectively. (40% is 100% minus the 60% return to the player.) The lottery plans to offer 5 plays for $20, i.e., 5-plays-for-the-price-of-4 to increase profits, with the payout to the $20 player being $5/4 \times 60\% = 75\%$. The profit to the lottery for a $20 purchase will be 25% \times 20 = $5. Therefore, despite paying out a higher percentage return to the $20 player, if the lottery can transition a significant number of $5 and $10 players to $20 5-for-the-price-of-4 players, then the lottery will increase profits. The percentage of sales contributed to the jackpot should be
\[(60\% - 27^{7/9}\%) \times (\text{sales at full price} + \frac{5}{4} \text{sales for $20 purchases}) - \$59,444^{4/9}] / \text{(total sales)}.\]

Thus, the $5 player is indifferent to whether or not the $20 player receives a discount, as the jackpot and her chances of winning it are the same as if the $20 players had paid full price. The ticket 300 in Figure 3 illustrates 5-for-the-price-of-4 with a price of $20 301 and 5 plays. Sample Drawing: The wheel spins and indicates “B.” As the player has selected that 3 entries on his ticket start with “B,” the player wins $3 \times \$50 = \$150.

Example 3: This embodiment employs the raffle wheel 900 in Figure 9. This wheel is similar to the wheel 400 in Figure 4, except that in place of the slot for a jackpot there is a special symbol, a palmetto tree 901, South Carolina’s state tree. There is a special prize fund that finances these prizes. Every time the palmetto symbol is hit, $250,000 is automatically donated to the fund. The price is $5 with a $20 5-for-the-price-of-4 option. The payout for the $5 purchase is 64% and the payout for a $20 purchase is 80%. The potential letter-match prize randomly varies from play to play, subject to the distribution: $500: 1\%, $200: 5\%, $100: 10\%, $50: 84\%, which averages $67, and thus pays out $67/36/5 = 37^{2/9}\%$. Aside from the letter-match prizes, the raffle wheel pays out an average per draw of \(4 \times 5,000 + 2 \times 10,000 + 2 \times 25,000 + 50,000 + 250,000\)/36 = $10,833^{1/3}$. (Notice that unlike a progressive jackpot, there are no minimum increments to the fund each drawing.) In addition to the $250,000 that is automatically donated to the prize fund when the palmetto symbol is hit, the following percentage of sales is donated to the prize fund:

\[\left((64\% - 37^{2/9}\%) \times (\text{sales at full price} + \frac{5}{4} \text{sales for $20 purchases}) - \$10,833^{1/3}\right) / \text{(total sales)}.\]

Those skilled at the art of Mathematics can verify that sales-per-draw of 8,100 plays, however distributed between full price and $20 purchases, is enough to cover the letter-match prizes and the other prizes on the raffle wheel. The lottery has assessed that sales will comfortably meet this threshold. A sample ticket 1000 for this embodiment is in Figure 10. The ticket includes a promotional message advertising the “palmetto prize”
1001 (50 prizes of $5,000 each). The potential letter-match prizes are printed beside the
raffle identifiers 1002. Sample drawing: The raffle wheel is spun and indicates a palmetto
tree. Fifty raffle identifiers are drawn and published on the lottery website. One of the
numbers is 1-070-00589. As this is the fourth entry 1003 on the ticket, the player wins
$5,000.

Example 4: This is a multi-jurisdictional version embodiment of the inventive game,
"Raffle America." The wheel 1100 employed is that in Figure 11. There is a slot with a
special symbol, the Statue of Liberty 1101. If the Statue of Liberty is hit, then there will
be raffle drawings for a plurality of prizes. The cash prizes on the wheel are scaled up
dramatically from previous examples, which is possible because of a very large sales
base.

Aside from the higher magnitude of prizes, a major difference between a multi-
jurisdictional embodiment and previous embodiments is that there may be different
lottery vendors for the different jurisdictions. Therefore, different jurisdictions need to be
able to operate autonomously, i.e., to produce unique raffle identifiers without having to
coordinate with each other. This can be accomplished by assigning each jurisdiction one
(or two) unique two-digit code(s) that is positioned immediately after the letter in each
raffle identifier. This will guarantee that a raffle identifier from one jurisdiction is
different from that of another jurisdiction. The ticket 1200 in Figure 12 illustrates this
embodiment. The player has purchased 5-plays-for-the-price-of-4 for 2 drawings 1202,
which costs 2 x $20 = $40.00 1201. This particular jurisdiction is assigned a code of 12.
All 5 plays have the two digits "12" positioned after the letter 1203. This ensures that
raffle identifiers from this jurisdiction will be different from those from other
jurisdictions, regardless of lottery vendor for that jurisdiction.
After sales are closed and before the drawing, all of the entries from all of the jurisdictions are sent to a “Raffle America” operations center which will conduct the potential raffle drawing. Alternatively, it is easy to devise a mathematically equivalent method of conducting a raffle drawing without requiring that all of the entries from each jurisdiction be sent in. Such a method is described in Figure 13:

Each jurisdiction sends in the number of entries purchased in that jurisdiction and a random sample of such entries 1301. (The size of the sample should be at least as big as the maximum possible number of raffle prizes to be awarded.) Is another raffle prize to be awarded 1302? Each jurisdiction is assigned a probability equal to the proportion of entries from that jurisdiction out of all of the entries 1303. A jurisdiction is randomly selected subject to this probability distribution 1304. An entry is randomly chosen from the selected jurisdiction 1305 and the chosen entry is eliminated from the random sample 1306. The number of entries from that jurisdiction is decremented by 1 1307. (This will appropriately adjust the probability assigned the jurisdiction if there is another raffle winner to be drawn.)

Multi-Wheel Embodiments

The described single-wheel embodiments require a minimum level of sales, which is typical of lottery games. By use of a system of wheels, rather than one wheel, the inventive game can be embodied in such a way that allows for large fixed prizes, as well as a progressive jackpot, but requires no minimum number of entries. In particular, the inventive game can be embodied as a fully automated, low-maintenance, fast-paced monitor game, like Keno. As in the single-wheel embodiments, the slots on each wheel are equally probable.

Example 5: This monitor-game embodiment employs a system of four wheels illustrated in Figure 14:

Wheel 1 1401 has 26 slots: 1 for each letter of the alphabet.
Wheel 2 1402 has 36 slots: 26 for the letters of the alphabet, 4 for $250, 4 for $500, 
1 for $5,000 and 1 for $10,000,
Wheel 3 1403 has 36 slots: 26 for the letters of the alphabet, 4 for $500, 2 for $5000, 
2 for $10,000, 1 for $25,000, and 1 for $50,000,
Wheel 4 1404 has 36 slots: 26 for the letters of the alphabet, 4 for $5,000, 2 for $10,000, 
2 for $25,000, 1 for $50,000, and 1 for a progressive jackpot, for 
which the initial starting jackpot is $500,000 1405.

Observe that Wheel 1 is fundamentally different from the other wheels in that there are 
only 26 slots, one for each letter of the alphabet and no slots for raffle prizes. Also 
observe that Wheel 4 is the premium wheel in that it comprises the highest raffle prizes as 
well as the jackpot. Each wheel has a colorful design and a fanciful name.

After sales are closed, each of the four wheels is assigned a probability based on the 
number of entries. One wheel is randomly selected subject to this probability distribution 
via a random number generator. At this point, the game proceeds as would a single-wheel 
embodiment.

Figure 17 summarizes the parameters for this monitor-game embodiment. The price per entry is $2 1701, n denotes the number of entries 1702, and the letter-match prize is $20 
1703. Each Si, 2 ≤ i ≤ 4, is defined to be the average value of the cash prizes (and the 
initial jackpot in the case of Wheel 4) per drawing for Wheels 2 through 4: S_2 1704 is the 
sum of the cash prizes for Wheel 2 divided by 36 = $500. S_3 1705 is the sum of the cash 
prizes for Wheel 3 divided by 36 = $2,972\frac{2}{9}. S_4 1706 is the sum of cash prizes plus the 
initial starting jackpot ($500,000) for Wheel 4 divided by 36 = $17,777\frac{7}{9}. W_i , 1 ≤ i ≤ 4, 
1707 are the returns for the 4 individual wheels (ignoring progressive contributions to the 
jackpot in the case of Wheel 4). For example, the return for Wheel 1, W_1 1707, (which 
has no slots for raffle prizes) is $20/26/$2 = 386\frac{6}{13}\% . The return for Wheel 2, W_2 1707, is 
(S_2/n)/$2 + $20/36/$2 = (S_2/n)/$2 + 27\frac{7}{9}\%. Similarly, the returns for Wheels 3 and 4, W_3 
and W_4, are (S_3/n)/$2 + 27\frac{7}{9}\% and (S_4/n)/$2 + 27\frac{7}{9}\% (excluding progressive 
contributions to the jackpot).
For \( n \), \( 0 < n < 37,500 \), \( \alpha(n) \) 1708 is defined to be such that

\[
72n[\sum_{i=1}^{4}(70\% - W_i)(W_\psi/W_i)^{\alpha(n)}] = 500,000.
\]

We prove that there is such a \( \alpha(n) \), for each \( n \), \( 0 < n < 37,500 \).

4

Proof: For each \( n \), \( 0 < n < 37,500 \), define \( f_n(\alpha) = 72n[\sum_{i=1}^{4}(70\% - W_i)(W_\psi/W_i)^{\alpha}] \).

Those skilled in the art of Mathematics can show that for every \( n \), \( 0 < n < 37,500 \),

\( f_n(-50) < 500,000 < f_n(2) \). Furthermore, those skilled in the art of Mathematics know that

\( f_n(\alpha) \) is everywhere continuous. Therefore, by the Intermediate Value Theorem of

Mathematics, there is a value \( \alpha(n) \) such that \( f_n(\alpha(n)) \) is 500,000 for every \( n \), \( 0 < n < 37,500 \). End of Proof.

The actual value of \( \alpha(n) \) can be very accurately estimated by numerical methods such as

Newton’s method. Having defined \( \alpha(n) \), we are in a position to define the probabilities

assigned the wheels:

For Wheel \( i \), \( 1 \leq i \leq 4 \),

\( p_{0,i} = 1 \) for \( i = 1 \), 0 otherwise 1709,

\[ p_{a,i} = W_i^{-\alpha(n)} / [W_1^{-\alpha(n)} + W_2^{-\alpha(n)} + W_3^{-\alpha(n)} + W_4^{-\alpha(n)}], \ 0 < n < 37,500 \ 1710, \]

\( p_{n,i} = 1 \) for \( i = 4 \), 0 otherwise, \( n \geq 37,500 \ 1711. \)
In other words, for \( n = 0 \) entries, Wheel 1 is chosen 100% of the time. As \( n \) increases, the weighting gradually shifts toward Wheel 4, so that for \( n \geq 37,500 \), Wheel 4 is chosen 100% of the time. Also, observe that for \( n > 0 \), it is always possible for Wheel 4 to be chosen, as the probability of Wheel 4 is greater than 0. The jackpot contribution \( j_n \) is 1712 is defined to be the difference between 70% and the expected value of the wheels (excluding progressive contributions). That is, the return for the game is 70%.

This embodiment is designed so that the average winning jackpot is at least $1,000,000. We explain:

As the slot for the jackpot is on Wheel 4, which has 36 slots, the probability of the jackpot being won for a particular drawing is \( p_{n,4}/36 \). In Figure 18, it is shown that for \( n, 0 < n < 37500 \), the jackpot contribution, \( j_n \), divided by \( p_{n,4}/36 \) is $500,000. Moreover, for \( n = 37500 \), it is easily shown that

\[
j_{37500} / (p_{37500,4}/36) = 2 \times 37500(70\% - W_4) \times 36 = 1,890,000 - 1,390,000 = $500,000.
\]

It follows that for \( n > 37500 \), \( j_n / (p_{n,4}/36) > $500,000 \). (That’s because the probability of the jackpot being won is the same as for \( n = 37500 \), but the jackpot contribution is greater.) In short, if \( n > 0 \), then \( j_n / (p_{n,4}/36) \geq $500,000 \). Those skilled in the art of Mathematics can show that the fact that \( j_n / (p_{n,4}/36) \geq $500,000 \) for all \( n > 0 \), implies that the average total jackpot contributions per winning jackpot is at least $500,000. Thus, since the initial starting jackpot is $500,000 and the average total jackpot contributions per winning jackpot total is at least $500,000, regardless of the number of entries, the average winning jackpot is at least $1,000,000, regardless of the number of entries.
We have described a system for assigning probabilities to the four wheels in Figure 14. Rather than computing these probabilities during the course of a game, they may be determined in advance and stored in a database. For example, consider the table 1900 in Figure 19. It contains 37,499 records, one for each \( n, 0 < n < 37500 \). A record comprises 6 fields: (1) the number of entries 1901 (the index), (2) \( p_1 \) 1902, the probability of Wheel 1, (3) \( p_2 \) 1903, the probability of Wheel 2, (4) \( p_3 \) 1904, the probability of Wheel 3, (5) \( p_4 \) 1905, the probability of Wheel 4, and (6) the jackpot contribution 1906 (in dollars, not percentage of sales). Suppose, for example, the number of entries for a drawing is 5,218. The probabilities for the four wheels as well as the jackpot contribution are found in record 5,218. To select a wheel based on these probabilities, the unit interval is partitioned into 4 subintervals by the 3 points:

\[
p_1 = 0.311276115156 \text{ 1909},
p_1 + p_2 = 0.660482200625 \text{ 1910}, \text{ and}
p_1 + p_2 + p_3 = 0.899788052709 \text{ 1911}.
\]

A random number between 0 and 1 is generated: 0.823614834169 1912. As the random number falls in the third interval, Wheel 3 is selected and the jackpot contribution is that indicated in record 5218, $1,391.832601274.

An exemplary ticket 1500 for this monitor game embodiment is in Figure 15. Figures 20 and 21 illustrate the two scenarios for the monitor game from the player’s point-of-view. The sequence 2000 in Figure 20 illustrates a game for which the wheel indicates a letter. The game opens with the monitor displaying the draw number 2001. The number of players is disclosed 2002. (Knowing the number of players enables the player to gauge her chances of winning a raffle prize.) One of the four wheels is selected, in this case, it is Wheel 1 2003. The wheel is spun and indicates a “P” 2004. The winning letter is displayed on the monitor 2005: All plays that begin with P win $20.
The sequence 2100 in Figure 21 illustrates a game for which the wheel indicates a prize. The game opens with the monitor displaying the draw number 2101. The number of players is disclosed 2102. One of the four wheels is selected, in this case, Wheel 3 2103. The wheel is spun and lands on $5,000 2104. An entry is randomly selected and displayed in an animation 2105 such as a raffle ticket being pulled out of a hat. The winning raffle identifier and prize are displayed on the monitor 2106.

Example 6: Figure 22 illustrates a variation of the embodiment in example 5. This embodiment is exactly the same as that in Example 5, except that Wheels 1 through 4 are equally weighted wherein the number of entries \( n \geq 11,106 \). The significance of 11,106 is that for \( n < 11,106, \alpha(n) \geq 1708 \). Figure 17 is greater than 0 and for \( n \geq 11,106, \alpha(n) < 0 \). That is, 11,106 is roughly the point where \( \alpha(n) = 0 \), and if \( \alpha(n) = 0 \) then the probabilities for the 4 wheels as defined in 1710 are equal. This embodiment represents the philosophy that for a very large number of players it is more aesthetic for the wheels to be equally weighted as opposed to the entire weight being on the premium wheel, Wheel 4.

Example 7: This embodiment is the same as that in Example 5, except that it offers a deluxe play for $5 (vs. $2 for a regular play). In a deluxe play, the letter-match prize is $100 (20 times the price point), whereas in a regular play the letter-match prize is $20 (10 times the price point). An exemplary ticket 1600 is in Figure 16.

The probabilities assigned to the wheels as well as the jackpot contribution is still based on the number of entries, regardless of the price point. That way, the $2 player is indifferent to whether or not another player opts for the $5 deluxe play: The weightings of the wheels and the size of the jackpot is the same either way.
Unlike the return for a regular $2 play, a constant 70%, the return for a deluxe play decreases as the number of entries increases. For \( n = 1 \), the return for the deluxe player is 89.5%. For an extremely low number of entries (\( n < 132 \)) the lottery actually makes less on a $5 purchase than a $2 purchase. But as \( n \) increases the actual profit, in terms of dollars, for a $5 entry approaches $1.38 (as opposed to a constant $0.60 for a $2 purchase). From the player’s point-of-view, as \( n \) approaches infinity, the return to the deluxe player decreases to 72.4%. Though, while the return for the deluxe player decreases with the number of players, the $5 purchase is always a better value, in terms of return to the player, than a regular $2 play.

Summary

Figure 23 summarizes the inventive game:

Is there another player 2301? In other words, are sales open and raffle identifiers still available? (Ideally, the game should be embodied in such a way so that there is a virtually inexhaustible supply of raffle identifiers.) The player selects a letter 2302 that is extended to a unique raffle identifier 2303. Increment the Price Point counter 2304. (In some embodiments it is necessary only to track the number of entries. In others, it is necessary to track the number of entries at the different price-points.) Are letter-match prizes to be assigned at issuance as is the case of some embodiments 2305? If yes, assign the letter-match prize before the ticket is printed 2306. (It may be the case that the potential letter-match prize is printed beside the raffle identifier.) Issue the ticket 2307.
Once all of the plays have been entered into the system, the drawing may be conducted. Is it a multi-wheel system 2308, as would be the case for a monitor game? If yes, assign probabilities to each of the wheels based on the number of entries 2309. Randomly select one of the wheels subject to the probability distribution 2310. Contribute the appropriate amount to the progressive jackpot or special prize fund, whatever the case may be 2311. The raffle wheel is spun 2312. Does it land on a letter 2313? If so, the drawing is finished. Otherwise, the raffle wheel has landed on a prize (or plurality of prizes) and a drawing (or drawings) for individual winners is held 2314.

After the drawing, the lottery is in a position to assign prizes to the entries 2315. Prizes can now be publicized, such as on television, in the newspaper, on a website, or on a monitor 2316 and players can redeem their tickets 2317.

Finally, the inventive game should be distinguished from a recent patent by the same inventor: “Extension to a lottery game for which winning indicia are set by selections made by winners of a base lottery game” disclosed in U.S. Pat. No.7,213,811. In “Extension to a lottery game,” a player selects a symbol, which is assigned a raffle number. Suggestive of “Extension to a lottery game,” a player in the inventive game selects a letter that is augmented to a unique raffle identifier. After this, “Extension to a lottery game” and the inventive game proceed differently.

Put succinctly, the “Extension to a lottery game” comprises two games with two outcomes for which the outcome of one depends on the outcome of the other: The winning symbol is defined to be that selected by the winning raffle winner. The inventive game comprises one game for which there is one winning outcome: a letter, or, a raffle prize (or prizes).

The essence of “Extension to a lottery game” is that player selections influence the outcome of the game. A popular symbol is more likely to win because it is more likely to have been chosen by the winning raffle player. In the inventive game, player selections have no affect whatsoever on the outcome of the game.
Also, in “Extension to a lottery game,” prizes based on the player-selected symbol must be paid on a pari-mutuel basis. This is because the probability of a symbol winning is not known in advance, but depends on player selections. In the inventive game, all game indicia have an equally likely chance of winning. Therefore, letter-match prizes for the inventive game may be awarded in a variety of ways, including fixed prizes.
Claims

What is claimed is:

1. A method for implementing and playing a lottery game with a plurality of players comprising:
   Each player paying an entry fee;
   Each player selecting game indicia;
   The lottery augmenting the said player-selected game indicia to a unique raffle identifier;
   A first stage of a random drawing for which the outcome is either game indicia or one or more raffle prizes;
   Prizes being awarded to entries for which the player-selected game indicia part of the raffle identifier matches the said outcome of the first stage of the random drawing, if that outcome is game indicia;
   A second stage of the said random drawing comprising a raffle drawing or drawings for the winner or winners of the said one or more raffle prizes, if the said outcome of the first stage of the random drawing is one or more raffle prizes.

2. The method of claim 1 wherein the said first stage of the random drawing is the spinning of a wheel comprising slots occupied by game indicia interspersed with raffle prizes.

3. The method of claim 2 wherein the said wheel is one of a system of wheels each assigned a probability; the said wheel being spun having been randomly selected subject to the said probability distribution.

4. The method of claim 3 wherein the said probabilities assigned to the wheels are based on the number of entries.

5. The method of claim 3 wherein there is no requirement as to the minimum number of entries.

6. The method of claim 3 wherein the return to the player is independent of the number of entries.
7. The method of claim 3 wherein the said lottery game is an automated monitor game.
Figure 6
Dynamic System for Extending "B" to a Unique Raffle Identifier
Example of Dynamically Extending "B" to a Unique Raffle Identifier

**Figure 7**

- **Initialization:**
  - draw = 478
  - max term # = 4859
  - m = 4, n = 2
  - local B_cnt = 0

- **Central Computer:**
  - B_N1 = 2315 - 1 = 2314
  - B_N2 = 4859 + 2315 - 1 = 7173

- **Terminal #2315:**
  - floor(19.283/10^4) x 20 = 478 modulo 20
  - 19.283 modulo 10^4
  - B = 389-28399

- **Central B_cnt:**
  - central B_cnt = 28895

- **For term #2315:**
  - local B_cnt = 199
  - B_N1 = 19283
  - B_N2 = 20849

- **Later:**
  - player picks B

- **Central Computer:**
  - Since 199 ends in 10^2 - 1, replace B_N1 = 19283 with B_N2 = 20849.
  - Increment local B_cnt (199 to 200).
  - Send in entry B = 389-28399.

- **Terminal #2315:**
  - B = 389-28399

- **Later:**
  - new B_N2 = 268895
Method for Assigning Letter-Match Prizes after the Drawing.

Start

Wheel hits a letter?

Yes

Set M = number of entries matching winning letter.

Assign a $50 prize to each of the M winning entries.

Upgrade fund = 17% sales + roll

N = floor(upgrade fund / $1,700)

16N upgrades:
N "to $500" upgrades ($450),
5N "to $200" upgrades ($150),
10N "to $100" upgrades ($50)

No

Upgrade 16N prizes.

No

Is M ≥ 16N?

Yes

End

Upgrade all M winners to a higher prize starting with the "to $500" upgrades and continuing in non-increasing order until there are no more winners.

Pool the remaining 16N - M upgrades, and roll to the next game.

Upgrade fund - $1,700N rolls to the next game.
$20.00

September 18, 2007
Draw #387

If the Palmetto is hit tonight, there will be a drawing for fifty $5,000 winners!

A - 070-00030 $100 0p
B - 070-00085 $50 0p
C - 070-00060 $50 0p
D - 070-00589 $200 0p
E - 070-00056 $50 0p

Figure 10

Figure 9

Palmetto CASH RAFFLE

ABCDEF GH IJ KLMNOP

XYZA BCD EFGH IJ KLM

NOPQ RST UVW

XYZA BCD EFGH IJ KLM

NOPQ RST UVW
Figure 13
A Multi-Jurisdictional Random Drawing

1301
Start

1302
Another raffle prize?

1303
Yes
Assign each jurisdiction the proportion of entries from that jurisdiction.

1304
Randomly select a jurisdiction subject to the assigned probability distribution.

1306
Remove the selected entry from the random sample.

1307
Decrement the number of entries from the selected jurisdiction by 1.

1305
Randomly select an entry from the selected jurisdiction.

Each jurisdiction sends the "Raffle America" operations center:
(1) the number of entries,
(2) a sufficiently large random sample.
price = $2,

n = number of entries,

letter-match prize = $20,

\[ S_2 = \frac{500}{9}, \quad S_3 = \frac{2972}{9}, \quad S_4 = \frac{17777}{9}, \]

\[ W_1 = \frac{38}{13} \% , \quad W_i = \left( \frac{S_i}{n} / 2 + \frac{27}{9} \% \right) , \quad 2 \leq i \leq 4, \]

\[ \alpha(n), \quad 0 < n < 37,500, \quad \text{such that} \quad 72n \left[ \sum_{i=1}^{4} (70\% - W_i)(W_4/W_i)^{\alpha(n)} \right] = 500,000, \]

For \( i, \quad 1 \leq i \leq 4, \)

\[ p_{0,i} = 1, \quad \text{for} \quad i = 1, \quad 0 \quad \text{otherwise}, \]

\[ p_{n,i} = \frac{W_i^{-\alpha(n)}}{W_1^{-\alpha(n)} + W_2^{-\alpha(n)} + W_3^{-\alpha(n)} + W_4^{-\alpha(n)}}, \quad 0 < n < 37,500, \]

\[ p_{n,i} = 1, \quad \text{for} \quad i = 4, \quad 0 \quad \text{otherwise}, \quad n \geq 37,500, \]

jackpot contribution for \( n \) entries \( n = 2n \left[ 70\% - \sum_{i=1}^{4} p_{n,i} W_i \right] \)
For $n$, $0 < n < 37500$,

$$j_n/(p_{n,4}/36) =$$

$$= 2n(70\%-\sum_{i=1}^{4} p_{n,i}W_i) \times 36(1/p_{n,4}) =$$

$$= 36(2n)(70\%-\sum_{i=1}^{4} p_{n,i}W_i) \times (\sum_{i=1}^{4} W_i^{-a}(n)/ W_4^{-a}(n)) =$$

$$= 36(2n)\left(70\%\sum_{i=1}^{4} W_i^{-a}(n)/ W_4^{-a}(n) - \left(\sum_{i=1}^{4} W_i^{-a}(n)\right)\left(\sum_{i=1}^{4} W_i^{-a}(n)/ W_4^{-a}(n)\right)\right) =$$

$$= 36(2n)\left(70\%\sum_{i=1}^{4} W_i^{-a}(n)/ W_4^{-a}(n) - \left(\sum_{i=1}^{4} W_i^{-a}(n)/ W_4^{-a}(n)\right)\right) =$$

$$= 72n\left(\sum_{i=1}^{4} 70\%(W_4/W_i)^{-a}(n) - \sum_{i=1}^{4} W_i(W_4/W_i)^{-a}(n)\right) =$$

$$= 72n]\left(70\% - W_i(W_4/W_i)^{-a}(n)\right] = \$500,000$$

Figure 18
## Retrieving Probabilities for the Wheels in a Database

### Probabilities Table

<table>
<thead>
<tr>
<th>Number of Entries</th>
<th>p1</th>
<th>p2</th>
<th>p3</th>
<th>p4</th>
<th>Jackpot Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.999460476054</td>
<td>0.0000474661304</td>
<td>0.00000057865888</td>
<td>0.0000005796744</td>
<td>$0.0971789797</td>
</tr>
<tr>
<td>2</td>
<td>0.998894517158</td>
<td>0.000976222757</td>
<td>0.0000146783517</td>
<td>0.0000135581368</td>
<td>$0.1868630113</td>
</tr>
<tr>
<td>3</td>
<td>0.998315234931</td>
<td>0.001491361532</td>
<td>0.0000173439094</td>
<td>0.000019964443</td>
<td>$0.277283937</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>5,217</td>
<td>0.311293715447</td>
<td>0.349225575968</td>
<td>0.239292053641</td>
<td>0.100187654944</td>
<td>$1.391495207546</td>
</tr>
<tr>
<td>5,218</td>
<td>0.311276115156</td>
<td>0.34920685469</td>
<td>0.239305852084</td>
<td>0.10021947291</td>
<td>$1.39182601274</td>
</tr>
<tr>
<td>5,219</td>
<td>0.311258519703</td>
<td>0.34918659821</td>
<td>0.239316844187</td>
<td>0.100236240269</td>
<td>$1.39217000412</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>37,497</td>
<td>0.000106772576</td>
<td>0.000000000305</td>
<td>0.00000002587244</td>
<td>0.999352960395</td>
<td>$13.887402227697</td>
</tr>
<tr>
<td>37,498</td>
<td>0.000001233762</td>
<td>0.0000000003643</td>
<td>0.0000000132168</td>
<td>0.99992630427</td>
<td>$13.8876404650</td>
</tr>
<tr>
<td>37,499</td>
<td>0.00000235647780</td>
<td>0.000000000380</td>
<td>0.0000000041905</td>
<td>0.999964309445</td>
<td>$13.888393186727</td>
</tr>
</tbody>
</table>

1900 to 1907

1908

wheel 1: 0.311276115156
wheel 2: 0.660482200625
wheel 3: 0.89781052709
wheel 4: 0.823614834169

wheel number = 3, jackpot contribution = $1,391.832601274

Figure 19
There are 3,194 Raffle Wheel players across the lovely state of Maryland.

Congratulations!
The winning letter is P.

Game #251674

EASY Raffle

Game #251674
There are 3,581 Raffle Wheel players across the lovely state of Maryland

Congratulations! A0000815 wins $5,000

Game #251675

POWER RAFFLE

Game #251675

RAFFLE NUMBER A0000815
Weighting Wheels Equally for a Large Number of Entries

For $i$, $1 \leq i \leq 4$,

$p_{0,i} = 1$, for $i = 1$, 0 otherwise,

$$p_{n,i} = \frac{W_i^{-\alpha(n)}}{W_1^{-\alpha(n)} + W_2^{-\alpha(n)} + W_3^{-\alpha(n)} + W_4^{-\alpha(n)}}, \; 0 < n < 11106,$$

$p_{n,i} = 1/4$, $n \geq 11106$,

$$j_n = \text{jackpot contribution} = 2n \left[ 70\% - \sum_{i=1}^{4} p_{n,i}W_i \right]$$

Figure 22