Bingo571G White Paper

Authored by Jingqian Liu, Andrew Musgrave, Rahul Ramjuttun, and Taha Shabani Mirzaei

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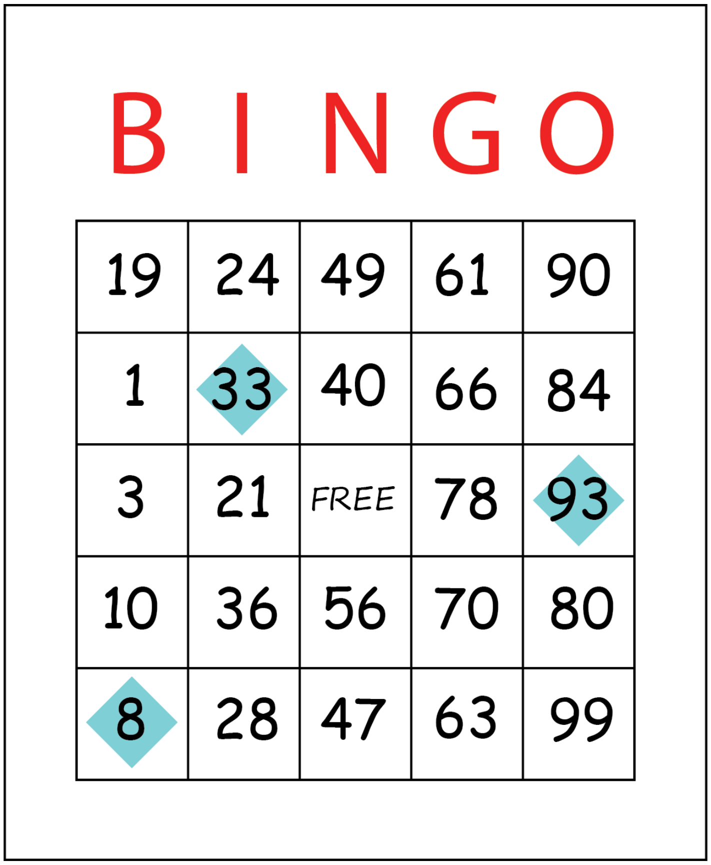
1. Introduction

The programmability of the blockchains with the Ethereum protocol[1] presents endless opportunities to bring traditional offline financial and gaming activities to decentralized online platforms. Enabled by the distributed ledger and smart contract technologies, these financial and gaming activities can be carried out with much more transparency and availability compared to traditional offline versions. In this project, our team proposes to combine traditional Bingo[2] lotteries with smart contract technology. The proposed project would enable blockchain users wishing to gamble with their cryptocurrency to safely and confidently participate in an exciting Bingo game and win a huge amount of cryptocurrency.



B	I	N	G	O
19	24	49	61	90
1	33	40	66	84
3	21	FREE	78	93
10	36	56	70	80
8	28	47	63	99

Figure 1: Sample Bingo571G card.

2. Bingo571G Contract Functionality

a. Rules of the Bingo571G Game

A Bingo board contains a 5 * 5 square grid. The first column contains five blocks containing numbers in the range 1-19, the second column contains five blocks containing numbers in the range 20-39, the third column contains four blocks containing numbers in the range 40-59, and a free block in the middle of this column, the fourth column contains five blocks containing numbers in the range 60-79 and the last column contains five blocks containing numbers in the range 80-99. The grid is generated in a way that guarantees no number is repeatedly shown on the grid. Players of the Bingo571G game can purchase a “Bingo card” from the smart contract for a specific yet started Bingo game and send a specific amount of the native token of the network to the contract. Each Bingo card contains one Bingo board. A player can hold multiple Bingo cards at the same time.

Anyone with a wallet address can start a new game and become the host of the game. To start a new Bingo game, the host needs to specify the start time of the game, the price of the Bingo cards, the interval of random number generation, and the host compensation proportion. The host compensation proportion of the total prize pool of the game is sent to the host at the end of the game. To incentivize players to join the game created, the host creating a game also needs to give a starter prize pool, which cannot be less than the value of three Bingo tickets. A higher compensation proportion may make players less willing to join the game while a lower compensation proportion may not be enough to even cover the gas fee needed to start a game. Thus hosts need to set up the compensation proportion wisely. Creating games and being hosts of the games is a form of gambling too. The hosts need to set the Bingo card price and host compensation proportion smartly to attract more players while ensuring recovering the cost to start a game and getting profitable from players’ payment for Bingo cards.

The money in the prize pot, besides the host compensation, is split up and rewarded to the winners. Here, we call a row, a column, or a diagonal of blocks ticked a **strike**. New random numbers in the range of 0-99 are drawn at the rate specified by the game host after the game’s start time. No number can be repeatedly drawn. After a new random number is drawn, there may be more than one strike formed on the cards of more than one player. When more than one player gets strikes after a new random number draw, the current prize pot is split up to all the players owning striked Bingo cards based on the ratio of the number of strikes each player has to the total number of strikes formed after the random number draw. For example, if three players each own one strike after one random number draw, the pot is split up by the three players evenly. However, if player A gets two strikes while player B gets one strike after a random number draw, player A gets two-thirds of the prize pot while player B gets one-third of the prize pot.

Due to the limit of the Ethereum protocol, there is no native way to automatically periodically call a function of a smart contract. Thus, the function to generate random numbers for Bingo games needs to be manually called for games to proceed. Ideally, the calls should be made by the hosts of the games. To ensure the games can proceed in the event that hosts find the game unprofitable and stop calling the random number generation function, we allow players to call the random number generation function as well. To incentivize players call the random number generation function, for each random number generated by a player, the player can get 1% of the game's host's compensation at the end of the game.

b. Public Smart Contract Interface

1. *createGame*
   This method can be called by users who want to be the host of games and start a new game. To call this method, the host needs to provide the start time, the random number drawing rate, and a host compensation proportion. The caller also needs to send at least three times the Bingo card price as the starting pot. This method will create a new game when called successfully.
2. *buyCard*
   This method allows players to purchase Bingo cards by sending native tokens of the network to the contract. The player needs to send at least the amount of tokens required to buy one Bingo card for the specific game. The caller of this method also needs to specify a 5 * 5 array as the grid on the Bingo card as well as a game ID for which the card is. The number in the array needs to be in the range of 0 to 99 and cannot be repeated. The game specified by the game ID cannot be already started or ended. If everything is legitimate, the contract will record a valid Bingo card with no block ticked under the calling address for the game specified by the game ID.
3. *getPlayerGames*
   Players holding Bingo cards can call this method to view the games they are currently playing. Once they get the game IDs of the games they are currently playing, they can query the games' status and see what numbers on their cards are ticked.
4. *checkGameStatus*
   Players can call this method by providing the game ID they want to query. This method will return the status of the specified game, and the numbers that are drawn so far for the game if the game has already been started.
5. *drawNumber*
   This function draws random numbers to ensure for every number drawing interval passed since the start of the game has a number drawn. This function will retry if the drawn number is already drawn for this game. After numbers are drawn, it checks if there is any player completing strikes. If it finds any player who completed strikes after the numbers are drawn, it splits the prize pool to winners, the host, and the players who called this function before following the rules specified in section 2a.

3. Conclusion

To sum up, the proposed project aims to provide gamblers and lottery lovers with a fair, and transparent platform to enjoy the Bingo game. Unlike the traditional lottery cards players can purchase in convenience stores, the operation of the Bingo571G game, backed up by smart contracts and blockchain technologies, is completely open. Players do not need to worry about the rigged probabilities and the manipulated Bingo cards as all the code sustaining the game will be completely open-sourced and verified.

With only as little as one dollar, players get to enjoy the excitement and thrill of a game of pure luck. Players can also invite friends to join the game as well, receiving special awards of referrals. Our team hopes that with such a game, everyone can have the joy of gaming without worrying about the basic funds needed to join the game or the fairness of the game.

4. References

[1] Wood, Gavin. "Ethereum: A secure decentralised generalised transaction ledger." *Ethereum project yellow paper* 151.2014 (2014): 1-32.
[2] “Bingo (American Version).” *Wikipedia*, Wikimedia Foundation, en.wikipedia.org/wiki/Bingo_(American_version).