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P4_9 Monopoly Madness

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Abstract

In this paper, the sets in Monopoly that provide the best return on investment and the most landed on square are calculated. The most landed on square is jail at 6.4%. The set that provides the best return on investment at no houses built is the Stations at £2.8 per die roll and the set that provides the best return on investment at three houses is the orange set at £3.4 per die roll.

Introduction

The British edition of monopoly was created in 1935 by Waddingtons [1] and has since become a staple at Christmas providing the backbone for many arguments. The objective of the game is to bankrupt your opponents [2]. This is usually done by owning as many properties as possible as your opponents pay you rent when they land on them. The rent paid is increased depending on if a set is owned or if houses are built on the property. A set is a collection of properties that belong to the same colour or property type. This paper aims to determine the optimal set to collect in order to win as often as possible.

Model

To calculate the set with the best return, the probability of landing on a given square must be calculated. This was done using a model that simulated a player moving around the board. To move around the board the player must roll two die, If they roll a double then they roll again until they roll three doubles in a row, then they go straight to Jail. This was simulated using two random number generators (RNGs) and then checking if they were the same number, this simulated a double. Another issue to consider is that the player can land on a community chest or chance spot. When the player lands on these spots they draw a card, these give the player a 2/16 or a 10/16 chance to jump to a specific square respectively. This was replicated using a RNG to simulate picking a random card and then setting the players location to the location on the card drawn. There is a lot of variances in a short game so a game consisting of 100000 turns was simulated to give an accurate representation of the probability of landing on a given square. This is much longer than a typical game but is necessary to calculate the probabilities of landing on a given square These probabilities were then used to calculate the average rate of return per die roll at zero, three and five houses built. This was calculated using Eq. (1)

$$\text{Set Value} = \frac{\Sigma Ep}{T} \times 100, \tag{1}$$

The Set Value is the sum Σ of all the properties in the set. Where E is the rent paid for landing on a property, p is the probability of landing on a given property and T is the total cost of buying the set and any additional houses.

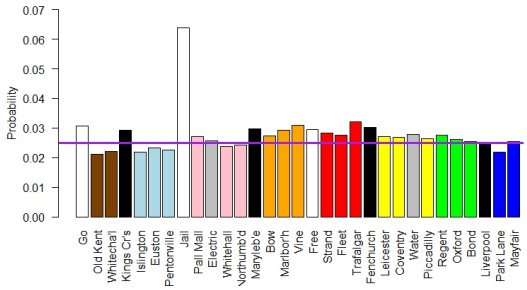

Figure 1: The probability of landing on all the possible squares omitting chance, community chest and taxes. The purple line shows the average probability.

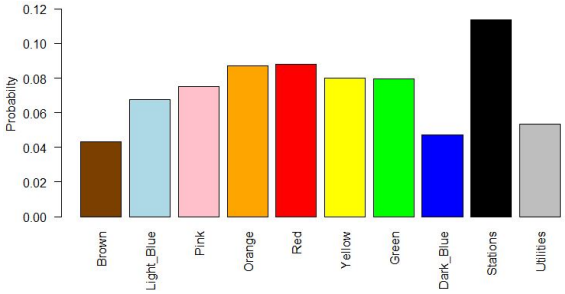

Figure 2: The probability of landing on a given set

Results

Fig. (1) shows that the most common square to land on is jail at 6.4% per roll. This makes sense since there are two squares corresponding to jail ("Go to Jail" and "Jail"). There is also community chest and chance cards that move you to jail 1/16 of the time and if you roll three doubles you also move to Jail. The squares above the purple line all primarily have a chance or community chest card that allows the player to move there or are located within the average roll of seven from Jail.

Fig. (2) shows that the stations are the most landed on set with the Orange's and Red's following closely behind. This is due to the stations having a chance card that moves the player to King's Cross Station and another two chance cards that move the player to the nearest station. They also have the most squares per set at 4. The Orange and Red sets have an 8.8% chance of being landed on each. This is because

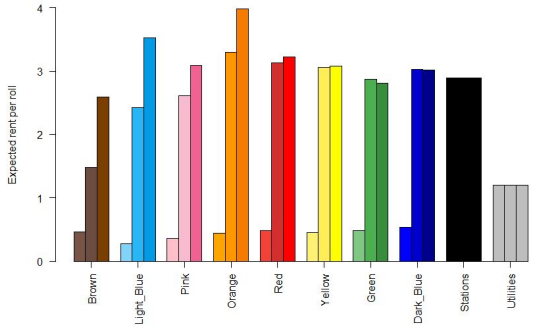

Figure 3: The expected return per cost invested given no houses, 3 houses and 5 houses (hotel) are built on each property.

of the proximity of the set to Jail.

Fig. (3) shows that when no houses are built the Stations are the best set. This is because they are the most landed on set with 4 properties and at a rent of £200. They also instantly pay back the cost of buying one of the stations when landed on. The three-house mark was chosen since all properties either break even or make a profit at this point. Fig. (3) shows that the Orange set provides the best return per die roll of £3.50. This puts it £0.90 above the average of £2.60. This rises to £4.20 per dice roll when a hotel is built on them.

Conclusion

The Orange set is the best set to own past three houses built as it has the highest return per die roll. If the game has a lot of players then the chance of making a set is decreased. This means collecting the Stations is the way to go as they provide the best return on investment with no houses at £2.80 per die roll. It is also worth noting that the Brown, Light Blue and Orange sets become substantially better when building a hotel on them suggesting that developing multiple cheaper sets is better than focusing on one.

References

[1] BBC, `https://bbc.in/3o2ujZm` [Accessed 28 November 2021]

[2] Waddingtons, `https://bit.ly/3cWWBhy` [Accessed 28 November 2021]