Report

COSC326 Etude 7 For Sale

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Strategy	bid	chooseCard
Strategy 1	Bids by +1 up to half of its pot before passing.	Chooses a card proportional to the standard deviation of the cards ie if the standard deviation is high, choose a high value card. There are three constant values that the standard deviation is compared against when deciding which card to choose.
Strategy 2	Bids by +1 if the current bid is an odd number, else +2 up to half of its pot before passing.	
Strategy 3	Compares the standard deviation of the cards in auction to a range of standard deviations of all cards remaining (including on the table). We then set a max bid which is proportional to how large the standard deviation is, so higher will give a higher max bid.	Chooses a card proportional to the standard deviation of the cards ie if the standard deviation is high, choose a high value card. There is one constant value (Tim's constant) with which various computations are performed to compare the standard deviations against when deciding which card to choose.
Strategy 4	Bids in relation to the median value of the property cards. On our turn, if the median property card is still on the table and it is the lowest card, then pass. Otherwise, bid +1 the current bid.	
Strategy 5 (chosen strategy)	Bids by +1 if the current bid is an odd number, else +2 up to half of its pot before passing.	Chooses a card proportional to the standard deviation of the cards ie if the standard deviation is high, choose a high value card. There is one constant value (Tim's constant) with which various computations are performed to compare the standard deviations against when deciding which card to choose.

Strategy 6	Strat 6's bid method is the same as Strat 3. Strat 6 compares the standard deviation of the cards in auction to a range of standard deviations of all cards remaining (including on the table). We then set a max bid which is proportional to how large the standard deviation is, so higher will give a higher max bid.	Strat 6's chooseCard method is similar to the bid method. We compare the standard deviation of the cards on the table to all the cards remaining and make a range of standard deviations for which card to play.

The above table demonstrates the 6 different strategies that we have implemented. Through our experimentation, we discovered that the second bid method and the second chooseCard method (both highlighted in yellow) worked the best, hence we decided to combine the two to create Strategy 5, our chosen strategy for the tournament. Towards the end, we decided to come up with an additional strategy - Strategy 6 - which was built upon Strategy 5. It was hypothesised to do better, but it did not in reality.

Strategy 1

We chose to bid +1 each time in order to conserve the amount of money we have while still being able to place a bid. We decided to stop bidding once we have finished half of our pot (the money we have) and then pass from then on so that we would not risk going bankrupt. We chose half of our pot to be the threshold value because our experimentation showed us that that was a reasonable number - anything more than that and we would risk going bankrupt, anything less than that and we would be playing too safe.

For the chooseCard method, we decided to work with the standard deviation because this is a standardised way of choosing cards based on how spread out they are from the mean. If the number of players is more than 3, we choose the worst card if the standard deviation is less than 1.0; choose from the top 4 cards if the standard deviation is less than 3.5, choose from the top 3 cards if the standard deviation is less than 5.5; and choose between the top 2 cards for all other cases. If the number of players is less than or equal to 3, we alter those constants by subtracting a constant of 0.5 off it, and then choose cards in a similar way.

Strategy 2

The bid method is similar to Strategy 1's, except it bids +1 if the current bid is an odd number, if not it bids +2 up until half of its pot before passing. So unlike Strategy 1, this bid method only ever bids even numbers. We came up with this bid method in order to maximise our return if we do not win the auction since the return is half of the bid rounded down.

The chooseCard method is identical to Strategy 1's chooseCard method.

Strategy 3

After observing how well standard deviation worked in the chooseCard method of Strat 1 & 2, we decided to apply it to the bid method of Strat 3. Strat 3 compares the standard deviation of the cards in the auction to a range of standard deviations of all cards remaining (including on the table). We then set a max bid, which is proportional to how large the standard deviation is, and bid by +1 up to that max bid. If the standard deviation is larger, our max bid for that round is larger.

The chooseCard method is similar to Strategy 1 and 2's except we introduce a constant called Tim's constant. If the maximum standard deviation minus the standard deviation of the current round is less than or equal to Tim's

constant, we choose our highest card. If the standard deviation of the current round minus the minimum standard deviation is less than or equal to Tim's constant we bet our worst card. Else, if $|(Standard\ deviation\ of\ the\ current\ round\ -\ (Maximum\ standard\ deviation\ -\ Minimum\ Standard\ deviation))| \leq Tim'$ we bet our middle card. After testing various values we decided to set Tim's constant to 2.2.

Strategy 4

For the bid method, we take note of the median value of the property cards on the first round. When it gets to our turn, if the median property card is still on the table and it is the lowest card, then we will pass, meaning we will by default get that median card. Otherwise, we will bid one more than the current bid. We came up with this method in order to maximise the value of the property card we obtain - naturally, we would aim for the property card with the highest value, however if we were to constantly aim for that, we have a high risk of going bankrupt. Hence aiming for the median has a good balance of maximising the value of the property card we obtain whilst still having a low chance of going bankrupt.

The chooseCard method is identical to Strategy 3's chooseCard method.

Strategy 5

Strategy 5 is a hybrid strategy. After testing all the previous strategies and making further new strategies based on different combinations of the bid and chooseCard methods, we discovered that the second bid method and the second chooseCard method (highlighted in yellow) worked the best. Hence we created Strategy 5 which combines the two. We created a tournament to play all the strategies against each other and found that Strategy 5 was superior, hence this is our chosen strategy for the tournament.

Strategy 6

We made Strategy 6 by building upon Strategy 5, but it did not perform better than Strategy 5.

The bid method is identical to Strategy 3's bid method.

The chooseCard method is similar to its bid method. We compare the standard deviation of the cards on the table to all the cards remaining and make a range of standard deviations for which card to play. In research it was found that all the standard deviations possible formed an almost gaussian normal distribution, so we wanted larger ranges for the tails of the distribution and smaller ranges closer to the mean. This was first done by creating a linear range from (σmin, σmax) such that depending on where the standard deviation of the current board lies in the range, a card will be played tied to that range. So with cards in hand ordered c1 < c2 < … < cn, and the range ordered as σmin < σ1 < σ2 < … < σn < σmax, if σ_board lies between σ1 and σ2 then c2 would be played etc. In order to get a σ range that has larger ranges for the tails and smaller ranges closer to the mean, we rearranged the equation for a gaussian normal distribution and plugged in our linear range to get our desired range. Note that after solving for x in this equation it was no longer a function due to being multi-valued, so we needed 2 functions for y > σ_mean and y < σ_mean where the functions were just the negatives of each other.

Conclusion

After the town hall on 27 May, it was great to find out that our strategy indeed consistently beat the Random and Null Strategies. We were also pleased to discover that our strategy performed relatively well compared with the other strategies. One thing we think we could have improved on however is to have tested our strategy more than just 500 times, possibly 1000 times. This way, perhaps the additional data points could have allowed us to fine-tune our strategy such that it outperforms the other teams' strategies, rather than just being comparable to them. Additionally, it would have been great if we had managed our time better to perform more rounds of testing as we had only done so the night before.