# Optimal Yahtzee
## Project Specification

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# Introduction

We have chosen "Optimal Yahtzee" as the topic of our Bachelor's essay because of the way that it demonstrates the potential of being able to traverse a full search space in order to find an optimal solution, the topic at hand is though also dependent on the factor of luck and therefore an optimal algorithm doesn't per se imply perfect results. Our task will be to develop an optimal algorithm, compare it against other Yahtzee algorithms and analyze the resulting differences.

Yahtzee is a game played with five dice and a scorecard. The goal of the game is to gather as many points as possible, which is done by getting different combinations of dice. There are in total thirteen different combinations divided in a lower section and a upper section.

The current state of research considering the game of Yahtzee is that an optimal strategy for maximizing the average amount of points has been developed[1]. Furthermore research in developing an optimal multi-player strategy, an algorithm for maximizing the amount of victories, has been done[2] but as of yet, a fully optimal strategy has not been found.

# Problem statement

1. How long does it take for our implemented optimal Yahtzee algorithm to run?
2. Does an optimal Yahtzee algorithm for single-player use necessarily also mean it being an optimal algorithm for multi-player use?
3. If not, what does it take to make an algorithm that can beat the single-player optimal algorithm in multi-player?
4. What are the average win-lose ratios for the single-player optimal algorithm compared to simpler algorithms such as greedy algorithms or random?

# Approach

We will start by implementing the algorithm as described by Glenn, J's article. When that is done, focus will be on developing alternative algorithms that may or may not be better suited for multi-player use than the single-player optimal algorithm. We would as an alternative algorithm also like to continue on the work of Pawlewicz, J, with constructing an optimal algorithm for multi-player Yahtzee, but this will be prioritized after our time constraints in mind. After all this is done, we will analyze the results and come to our conclusions regarding the answers to the problems as previously stated.

## References

1. Glenn, J. (2006). *AN OPTIMAL STRATEGY FOR YAHTZEE.* Available: http://www.cs.loyola.edu/~jglenn/research/optimal_yahtzee.pdf. Last accessed 3rd Feb 2013.
2. Pawlewicz, J. (2010). *A Nearly Optimal Computer Player in Multi-player Yahtzee.* Available: http://www.mimuw.edu.pl/~pan/papers/yahtzee.pdf. Last accessed 3rd Feb 2013.

## Time Plan

8 Mar: Halfway meeting
12 Apr: Hand in the essay
23 Apr: Hand in the review
24 Apr - 25 Apr: Exjobbs conference

4 Feb - 23 Feb: Implement single-player optimal algorithm
24 Feb - 23 Mar: Implement multi-player algorithms
      24 Feb - 2 Mar: Implement an algorithm that plays randomly
      24 Feb - 2 Mar: Implement an algorithm that plays greedy
      3 Mar - 21 Mar: Improve single-player optimal algorithm for multi-player use (own algorithms and/or Pawlewicz's )
      22 Mar - 23 Mar: Gather win-lose data from the algorithms
24 Mar - 12 Apr: Essay writing