Considerations for Strategy Development
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1 Introduction

When formulating a strategy, many things must be considered. Teams need to take into account what they are able to achieve and set goals accordingly. Teams must also consider which tournament they are preparing for as well as the portion of the tournament that they are focusing on when deciding how much complexity they are willing to attempt. Despite the difficulties teams face in creating their strategy, a team can be very successful if they develop the strategy that best fits the situation

2 Goals

A team's goals are what will ultimately shape a strategy. A team who wants to place in the top half will not be willing to take as many risks or tackle as challenging objectives as will a team that is shooting to sweep the entire tournament. There are several aspects a team should consider when setting their goals: the amount of talent on a team, the size of the team, and the number of kits a team has access to.

2.1 The Impact of Talent

Of all judgments to make when deciding goals and strategies, objectively assessing the talent on a team is by far the hardest and most important to get right. If a team overestimates their abilities, they are likely to set unreasonable goals and then find themselves at the tournament with a robot attempting the most points but scoring the fewest. A team must have strong members in both building and programing before setting a goal like "1st or Bust." Without a consistent build or program, robots bust. If a team has builders that could construct a national monument but programmers who don't know the difference between a semicolon and a curly bracket, they should not set their sights in the stratosphere.

2.2 The Impact of Size

The size of a team can have a huge impact on what a team can accomplish. If a team has many competent members, they can multitask and have time for multiple robots and perhaps design entirely separate strategies for seeding and double elimination rounds. If a team is small or relies on one member to build and program each and every bot, there is much less time for alternate strategies or a plethora of robots. A four hour meeting with five people being productive gives a team twenty hours of progress. With only one person working, a team only gets four hours of improvements.

2.3 The Impact of Kits

KIPR does everything that they can to even the playing field between new and older teams, but there is a distinct advantage to having several years worth of kits. With only one kit, a team has no choice but to design robots that run in both Seeding and Double Elimination. This prevents them from employing a defence only strategy or one that involves both sides of the boards. While this is common at regional tournaments and does not impair a team overly much, it becomes a huge handicap at GCER where teams have had time to score more points in Seeding and still maintain a separate team of robots for Double Elimination. If a team has access to multiple kits, they should consider building and programming two separate sets of robots in order to specialize in Seeding and Double Elimination.

3 GCER v Regionals

After goals are set, the next influence on the complexity a team may be willing to risk is which tournament a team is competing in. Robots need to be much more complex at GCER than they need to be at a regional tournament. This is because there is a larger number of teams a GCER, there is more time to prepare for GCER, and there is more time to fine tune robots to the tables at the GCER than there is at a regional tournament.

3.1 Talking Numbers

The average regional tournament hosted about 19 teams. [1] In the past few years, GCER has attracted over 60. [2] With three times the number of teams, there are many more teams that are capable of designing complex and consistent robots. At regional tournaments, there is only one team that won their region the year before. At this year's GCER, there can be up to 19 regional champions. In short, there is more talent at GCER than at regional tournaments. With that many more teams, and that many more successful teams, strategies have to be consistent enough to survive a longer tournament where each opponent is potentially stronger than any that was faced at home.

3.2 The Value of Time

During the regional season, most teams had 6-8 weeks between their workshop and their tournament. [3] During the GCER season, teams have just over 8 weeks between the unveiling of the updated rules and the start of GCER. [4] While the additional time is slim, the GCER season takes place primarily outside of the school year allowing teams to meet longer and more frequently than was possible during the regional season. This allows for teams to complete more complex strategies, complete a larger number of strategies, and potentially scrap an idea midway through the season and still have time to complete plan B.

3.3 On-Site Practice

One of the most dramatic differences between a regional tournament and a GCER tournament is the time allotted for "Open Practice Tables." At the Oklahoma Regional Tournament we were given two hours for practice before the opening rounds of Seeding, and then none after that. [5] At GCER this year, teams will receive seven and a half hours to prepare on the competition boards before Seeding begins and an additional eight hours before the final Double Elimination rounds begin. [6] This means that when preparing for regionals, teams must build robots that can operate with a huge margin of error in order to run on any board with nearly no time to adjust. At GCER, teams can safely bring robots that require more a higher degree of accuracy and the adjust them on site. This also allows teams to adjust to strategies that other teams bring. A great defense may surprise and dominate teams at a regional tournament, but if seen at GCER, teams have time to change course and avoid an otherwise crippling Create robot.

4 Seeding v Double Elimination

While Seeding and Double Elimination are governed by nearly the exact same rules the approach to each should be radically different. In Seeding, the goal is to score the most points. In Double Elimination, the goal is to score *more* points. Margin of victory is worth absolutely nothing in Double Elimination. It is a fourth of the overall Seeding score. In other words, when planning a Seeding strategy, a team should try to score as many points as they possibly can. In Double Elimination, a team doesn't need to do any better than a point more than whatever opponent they are facing. This is why defensive strategies are viable in Double Elimination.

4.1 Why Margin of Victory Matters in Seeding

The formula for a team's overall Seeding score is $.75((n-r+1)/n)+.25(a/m)$ with n being the number of teams at the tournament, r being a team's Seeding rank, a being a team's average score, and m being the tournament maximum score. [7] This roughly translates into english as "three fourths rank and one fourth margin of victory." So if Team A scores infinitely more points than Team B, they will be ahead by .25 points when entering Double Elimination, allowing Team A to place significantly lower than Team B in the Double Elimination portion of the tournament and still be ahead of Team B in the overall rankings. Hanalani is a beautiful example of this concept. The last two years they have won Seeding by large amounts but have yet to win a Double Elimination title. Never the less, they are now one of three teams to have won GCER in back to back years. [2]

4.2 Defence in Double Elimination

Again, the purpose of Double Elimination is not to score the most points, but rather more points. If Team A can prevent Team B from scoring more than 10 points, Team A does not need to spend any effort scoring more than 15 every single time. Depending on the year, it is sometimes easier to prevent an opponent from scoring than it is to score positive points. In most defensive strategies, a robot quickly travels to a location and deploys an arm or two, spins, or sometimes just sits there. In this situation, the robot only has to perform a small handful of drives and turns and be close enough to the target area that the opposing robot runs into it. The highest scoring items require robots to be dead on target after numerous turns and often sensor readings.

4.3 Is Seeding or Double Elimination more Valuable?

If Team A places first in Seeding but second in Double Elimination while Team B places second in Seeding and First in Double Elimination, who wins? This is where margin of victory plays in. After some algebra, Team A wins if $\frac{a1-a2}{m} > \frac{1}{n}$ where a1 is Team A's average score, a2 is Team B's average score, m is the tournament maximum score, and n is the number of teams at the tournament. Team B wins if the inequality is false. This equation will work for any two teams where the difference in their Seeding and Double Elimination scores are the same. (ie Team A places 3rd in Seeding and 15th in Double Elimination while Team B places 8th in Seeding and 10th in Double Elimination (8-3)=(15-10))

4.3.1 Math

The equation is derived by setting the overall score of Team 1 equal to the overall score of Team 2 discounting Documentation, solving for $\frac{a1-a2}{m}$, and then plugging in 1 for Team 1's Seeding score and Team 2s Double Elimination score and 2 for Team 1's Double Elimination score and Team 2's Seeding score.

5 Summary

To summarize, when making a strategy, teams need to create goals that are accomplishable based on demographics, consider the impact that the tournament they are attending will have on the competition, and choose whether to focus on Seeding or Double Elimination.

6 Thanks

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7 References

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