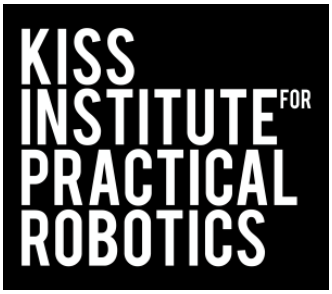
2018 Botball
Game Review



Version 1.1 11/10/2017

Contents

Revision History

Version 1.1 – November 10, 2017 – Final draft review of game document

Game Design Committee

- Wesley Myers, Co-chair
- Dr. Ross Mead, Co-chair
- Roger Clement
- Steve Goodgame
- Matthew Oelke
- Nathan Ashley
- Jon Grasmeder
- Les Newcastle
- Dr. Charles Winton
- Dr. David Miller
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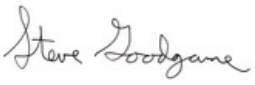
- Clemens Koza
- Dr. Terry Grant

Director's Note

Botball Community,

I am grateful to our excellent staff and our team of volunteers who contributed an incredible amount of hours putting together this year's game. I am especially excited about our teams in the Coachella Valley who are hosting us for the 2018 Global Conference on Educational Robotics. I hope that this year's game theme reflects our visit to the valley and that you are as excited as we are here at KIPR about this year's game! Good luck!

Respectfully,



Steve Goodgame

KIPR Executive Director

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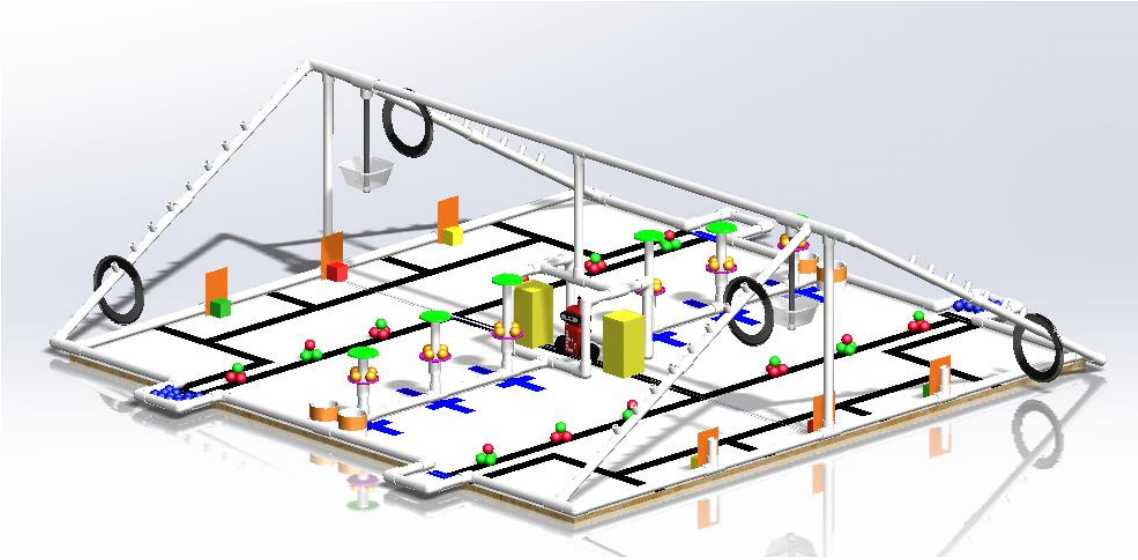
This Year's Game

Botguy Visits the Valley

After Botguy's success at improving agriculture in Oklahoma, he has made his way out West and is ready to see how he can benefit the Coachella Valley community with robotic applications in agriculture, while getting to enjoy some of the benefits the valley has to offer. The Coachella Valley is known for their date farming and their amazing aerial views from the tram. Botguy has been hired to improve tourism as well as farming practices in the area, despite frequent limitations on water for irrigation.

Botguy has been presented with many challenges in the area's agriculture operations. The first of which is the need to supply the date palms with fresh water. The water must be removed from the regional aquifer and transported through irrigation lines to one of the areas biggest cash crops. After watering the date palms, he needs to collect and sort the dates that have fallen to the ground, harvest all of the ripe dates from the trees and transfer all dates to their proper storage location.

After a long day of working the fields, Botguy is ready to enjoy the valley by taking a ride on the legendary Tramway. He will move the cars up and down the cog railway, as well as hopefully get a bird's eye view of the valley by taking a ride in the Tram!



Game Board Areas

Official game board specifications are on the Team Home Base. All tournament boards and game pieces will fulfill the following specifications within +/- 0.5 inches or up to 1% of the specification.

The game board is composed of four 4' x 4' (reusable) modules whose surfaces are pebble grain white fiberglass reinforced plastic panel (FRP). A fully assembled game board will be ~8' x 8' with two additional areas on each side that are ~8" x 7". A panel channel or black or white duct tape is used to close exposed seams where modules abut. Official tournament tables will have a FRP extension piece as the surface under the *Aquifers* and *End Zones*, but this may not be feasible on your practice table, in which case you can use cardboard, foam core or similar that is less expensive. The game board is separated into defined areas for each team.

Side – a team's *Side* is the surface of the game table as delineated by the inside edges of the surrounding PVC, but excluding the *Starting Boxes*, *Zones*, *End Zone*, *Aquifer*, *Irrigation Line*, and *Date Bins*. Additionally, *Side* will be delineated from the *Neutral Zone* by a pencil line extending from **outside edge** of the PVC connectors that bound the *Neutral Zone*.

End Zone – the **inside edge** of the surrounding PVC and the **outside edge** of the blue tape separating the bin from team's *Side*.

Starting Boxes – the boundary of each team's *Starting Boxes* (18" x 14" x 12" high) is defined by the **inside edges** of the tape lines and PVC that surround the *Starting Box*.

Red, Yellow, and Green Zones – each *Zone* is delineated by the **inside edge** of the PVC and black tape of the *Zone* that contains **only** the 2" x 2" x 2" cube of that color and only that color. This cannot be *Side*, *Starting Box*, *Aquifer*, *End Bin*, or the *Tramway*. If there is no block in a *Zone*, it will be considered a non-scoring area. The colored cube is not a scoring object and must be touching the surface and not touching black tape.

Irrigation Line – blue tape that extends from each *Date Palm*.

Aquifer – non-scoring area, opposite the *End Zone* and is delineated by the inner edge of the PVC and the inside edge of the black tape.

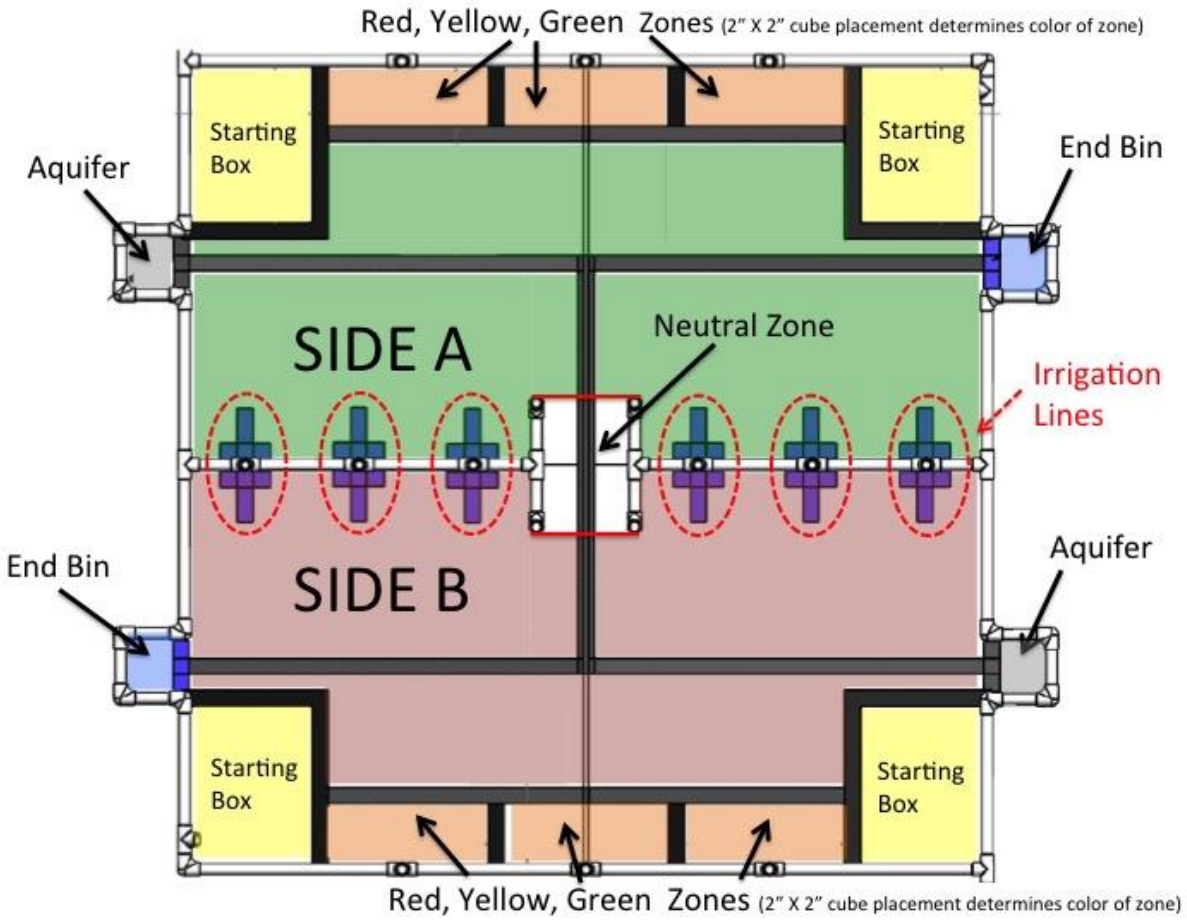
Date Bin – volumetric space confined within the 3" PVC coupler.

Tramway – moveable volumetric space confined within the small bin attached to the upper structure.

Cog Railway – the angled pegged-PVC extending from the corner of the table to the edge of the *Tramway*.

Neutral Zone – the area on the middle of the table bounded by the PVC and the pencil lines.

Date Palm – each individual structure in the middle of the table that contains two Frisbees and accompanying poms.



Game Pieces

Non Scoring Pieces

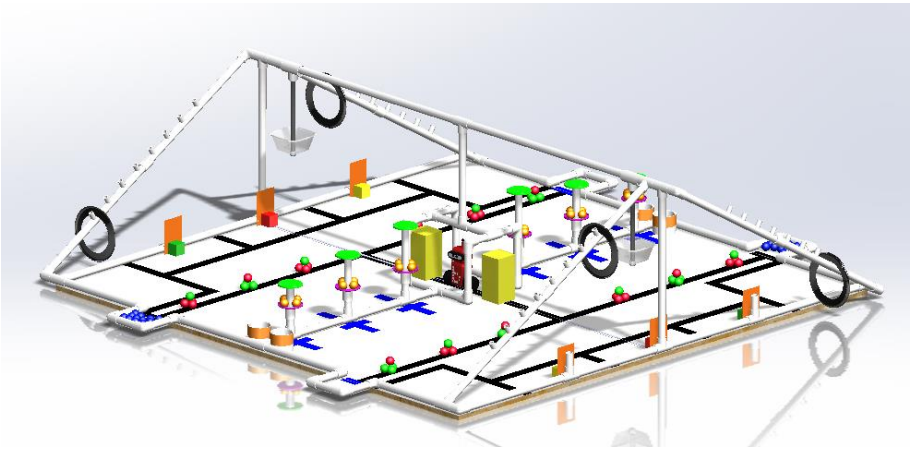
- 2 Red Targets – 2"x 2" x 2" red cubes
- 2 Yellow Targets – 2"x 2" x 2" yellow cubes
- 2 Green Targets – 2"x 2" x 2" green cubes

Scoring Pieces

- 1 – Botguy
- 4 Date Crates – 4"x 4" x 4" yellow foam blocks
- 24 Ripe Date – orange poms
- 24 Waters – blue poms
- 24 Unripe Dates – green poms
- 24 Rotten Dates – red poms
- 6 Palm Fronds – green frisbee
- 6 Bunches – pink frisbee with hole
- 4 Date Bins – orange taped-3" PVC coupler
- 4 Cars – 9" black rings

Game Piece Starting Positions

- *Botguy* will start in the center of the *Neutral Zone* with both wheels on the black tape and will be facing the audience.
- *Date Crates* will be stacked in pairs and centered on the black tape with the *Neutral Zone* side of the cube aligned with the **inside edge** of the PVC archway.
- Red, Green, and Yellow *Targets* are centered and touching the front of the orange 4" x 6" index card taped to the PVC upright. Location of the cubes will be determined at random by KIPR software after hands-off.
- 4 *Dates* will be placed on top of each of the 6 *Bunches*. They will be roughly 90 degrees apart and roughly aligned to board centerline and blue tape.
- 12 *Water* will be randomly placed in each of the *Aquifers* with all the poms touching the game table surface.
- *Unripe* and *Rotten Dates* will be placed in stacks with 3 of one color on bottom and 1 on the top of the opposite color. Each stack will be located on the black tape and the base color of each stack will alternate. The stack closest to the *Aquifer* will have a base color of red. The center of the most outer stack on each end of the line will be 6" down the tape from a line parallel to the outer edge of the coupler defining the corner of the *Aquifer* and *End Bin*. Subsequent stacks will be placed 12" and 24" on center down the black tape-line from the outermost stacks.
- *Palm Fronds* (green Frisbee) will be roughly centered and placed concave down on the top of each *Date Palm*.
- Each *Bunch* (pink Frisbee) will be placed concave up on a *Date Palm* so that they rest on the top of the coupler component of the *Date Palm*.
- *Date Bins* may be placed anywhere on a team's *Side*, at team's discretion, so long as they are upright and in contact with the surface and do not touch any black tape. Upright is defined as one of the circular profiles of the coupler in full contact with the surface. *Date Bin* placement cannot affect the starting position of any other game piece. *Date Bins* will be in the default positions at the corner of the edge of the outer PVC and the center PVC line.
- One *Car* (black Frisbee) will be placed on each angled side of the Railway. The side closest to the *Aquifer* will rest on the first or lowest cog. The *Car* closest to the *End Bin* will rest on the eighth or highest cog. A team's robot or entry may be in contact with the lower *Car* as long as the robot does not exceed *Starting Box* dimensions and the *Car* is in contact with the first cog. The Frisbee top will face towards the center of the board.
- The *Tramway* will start with the 1 1/4" PVC Tee moved to the outside of the table until it makes contact with the *Cog Railway*. The *Tramway* will be roughly centered over the black tape below.



Team Name:_____

Team Number:_____

2018 Botball

Seeding Scoring Sheet — Round 1

1. Side # Pom _____ X 1 = _____ Crate (Yellow) _____ X 10 = _____ Botguy _____ X 25 = _____ Subtotal = _____		Frisbee (Max 1, touching) X2 Sub = _____	Running Total:
2. End Zone # Pom _____ X 2 = _____ Crate (Yellow) _____ X 25 = _____ Botguy _____ X 25 = _____ Subtotal = _____		Frisbee (Max 1, touching) X2 Sub = _____	Running Total:
3. Starting Boxes (Not touching tape or other area) Robots' and poms' final resting location	# Robots w/ Poms _____	X 20 Sub = _____	Running Total:
4. Red Zone (Red Cube Only) Red Poms _____ X 8 = _____ Other Poms _____ X 2 = _____ Crate (Yellow) _____ X 25 = _____ Botguy _____ X 50 = _____ Subtotal = _____	Sorted (All same color) X2 Sub = _____	Frisbee (Max 1, touching) X2 Sub = _____	Running Total:
5. Yellow Zone (Yellow Cube Only) # Poms _____ X 2 = _____ Crate (Yellow) _____ X100 = _____ Botguy _____ X 25 = _____ Subtotal = _____	Sorted (All same color) X2 Sub = _____	Frisbee (Max 1, touching) X2 Sub = _____	Running Total:
6. Green Zone (Green Cube Only) Green Poms _____ X 8 = _____ Other Poms _____ X 2 = _____ Crate (Yellow) _____ X 25 = _____ Botguy _____ X 25 = _____ Subtotal = _____	Sorted (All same color) X2 Sub = _____	Frisbee (Max 1, touching) X2 Sub = _____	Running Total:
7. Irrigation Lines (Blue Tape) Blue Pom _____ X 10 = _____	# Blue Tape X _____	Total _____	Running Total:
8. Date Bin (Orange PVC Coupler) Orange Pom _____ X15 = _____	# Bins w/poms X _____	Total _____	Running Total:
9. Tram (Clear Plastic Hanging Basket) # Pom _____ X 10 = _____ Crate (Yellow) _____ X 25 = _____ Botguy _____ X 250 = _____ Subtotal = _____	Position 1, 2, or 3 X1 X2 X3 Sub = _____	Frisbee (Max 1, volume) X2 Sub = _____	Running Total:
10. Cog Railways (Frisbee Positioning) Aquifer Car 0 30 60 90 120 150 180 210 End Bin Car 0 30 60 90 120 150 180 210			Running Total:
11. Bonus Date Bin (Orange PVC Coupler)	3 on side 50	4 on side 100	Running Total:
		Side A Total:	

Total Score
A + B =

1. Side # Pom _____ X 1 = _____ Crate (Yellow) _____ X 10 = _____ Botguy _____ X 25 = _____ Subtotal = _____		Frisbee (Max 1, touching) X2 Sub = _____	Running Total:
2. End Bin # Pom _____ X 2 = _____ Crate (Yellow) _____ X 25 = _____ Botguy _____ X 25 = _____ Subtotal = _____		Frisbee (Max 1, touching) X2 Sub = _____	Running Total:
3. Starting Boxes (Not touching tape or other area) Robots' and poms' final resting location	# Robots w/ Poms _____	X 20 Sub = _____	Running Total:
4. Red Zone (Red Cube Only) Red Poms _____ X 8 = _____ Other Poms _____ X 2 = _____ Crate (Yellow) _____ X 25 = _____ Botguy _____ X 50 = _____ Subtotal = _____	Sorted (All same color) X2 Sub = _____	Frisbee (Max 1, touching) X2 Sub = _____	Running Total:
5. Yellow Zone (Yellow Cube Only) # Poms _____ X 2 = _____ Crate (Yellow) _____ X100 = _____ Botguy _____ X 25 = _____ Subtotal = _____	Sorted (All same color) X2 Sub = _____	Frisbee (Max 1, touching) X2 Sub = _____	Running Total:
6. Green Zone (Green Cube Only) Green Poms _____ X 8 = _____ Other Poms _____ X 2 = _____ Crate (Yellow) _____ X 25 = _____ Botguy _____ X 25 = _____ Subtotal = _____	Sorted (All same color) X2 Sub = _____	Frisbee (Max 1, touching) X2 Sub = _____	Running Total:
7. Irrigation Lines (Blue Tape) Blue Pom _____ X 10 = _____	# Tape X _____	Total _____	Running Total:
8. Date Bin (Orange PVC Coupler) Orange Pom _____ X15 = _____	# Bins _____	Total _____	Running Total:
9. Tram (Clear Plastic Hanging Basket) # Pom _____ X 10 = _____ Crate (Yellow) _____ X 25 = _____ Botguy _____ X 250 = _____ Subtotal = _____	Position X1 X2 X3 Sub = _____	Frisbee (Max 1, volume) X2 Sub = _____	Running Total:
10. Cog Railways (Frisbee Positioning) Aquifer Car 0 30 60 90 120 150 180 210 End Bin Car 0 30 60 90 120 150 180 210			Running Total:
11. Bonus Date Bin (Orange PVC Coupler)	3 on side 50	4 on side 100	Running Total:
		Side B Total:	

Team Initial

Scoring Rules

1. **Black Tape Rule:** With the exception of the *Date Bin*, a game piece touching a Black Tape line does not score.
2. **General Scoring Rule:** A game piece must touch the surface of the scoring area in order to score, with the exception of the *Date Bin* and *Tramway***,** which rely on game pieces breaking their volume.
3. **Highest Scoring Rule:** A game piece can only score in one scoring area and will be scored as if it is in the highest scoring area (as determined by base score without multipliers), not touching black tape. Example, if a blue and orange pom are touching *Side* and *Irrigation Line*, the blue pom would count toward the *Irrigation Line* and the orange would count toward *Side*. Orange could still be considered sorted if all other conditions are met.
4. **Sorted Rule:** A *Zone* is considered sorted if there is only one color represented in that *Zone*. For sorting purposes, *Botguy* is considered red. The sorted rule will not apply to *Irrigation Lines* or *Date Bins*. A sorted set of poms does not have to match the *Zone* color to be considered sorted.
5. **Robot Rule:** For the purposes of scoring, a robot is defined minimally as a KIPR Robot Controller with at least two motors or a Create connected to it. A robot with 2 controllers counts as a single robot.
6. **Frisbee Rule:** A Frisbee may be added to a scoring area to double the accumulated points of that area. Multiple Frisbees may be added to a single *Zone, Tram*, or *Side* but no more than 1 Frisbee will count for the multiplier. The Frisbee rule does not work in *Starting Box*, *Irrigation Lines*, or *Date Bins*. Frisbee cannot touch black tape and must touch the surface.
7. **Container Rule:** Objects will score in the container for the *Tramway* and *Date Bin* if they are breaking the volume of the container. *Date Bins* must be upright (upright is defined as one of the circular profiles of the coupler in full contact with the surface) and in contact with the table surface to serve as a scoring area. Black tape rule does not affect the *Date Bins* or any orange poms in the *Date Bins*. All objects inside the *Date Bin* will be considered *Date Bin* and not *Side*.
8. **Final Scoring Rule:** The score is determined by final object location, not by how it got there, with the exception of **Rule 9**. Judges will wait until any scoring objects still moving have come to rest before scoring a game.
9. **Robot Final Resting Position:** A robot will score additional points if it has a final resting position touching inside a *Starting Box*, without touching any black tape lines, a color *Zone*, or *Side* **and** is touching a pom that is fully or partially within the vertical projection of a *Starting Box*.
10. **Tramway Movement Rule:** The *Tramway* will begin in position 1 (Position 1 is the area between the *Cog Railway* and a line 12" toward the inside). If the *Tramway* moves fully past a line marked at 12" it will be scored as position 2. If it moves fully past a line marked 7" from the opposite end, it will be scored as position 3.
11. **Cog Railway Rule:** *Cog Railway* score will be determined by the distance the Frisbee is moved (either up or down depending upon the side). To score a Frisbee must touch the cog PVC or the support PVC. Each cog the Frisbee moved from its starting position is 30 pts except for being moved past the last peg on the Frisbee that moves downward.
12. **DE igus© Chain Rule:** If the igus© chain of a team is across the vertical projection of the opponent's side, then it may not make contact with an opponent's robot or else the team will be disqualified.
13. **Bonus Date Bin Rule:** A team will receive points if there are more than 2 *Date Bins* on their side

of the game table. *Date Bins* can be in any orientation so long as they are touching some game surface. (Black tape included- refer to Black Tape Rule)

14. **End Zone Clarification:** The Blue Tape at the entrance of the end zone counts as part of the end bin for scoring.

If your team does not agree with the score as calculated, then they must immediately notify the table judge(s) **before** leaving the table and **before** any items have been moved on the table. If they do not agree with the table judge's ruling, then they may ask to speak with the head judge. The head judge will spend no more than 5 minutes on the decision. Teams will be required to initial the score sheet before leaving the table, signifying acceptance of the ruling. If they do not agree with the ruling, then the head judge is permitted to sign for the team to proceed with any following round

Tie Breakers & Special Scoring Conditions

If one team never breaks any border of the *Starting Box* (including the 12" ceiling), they lose the round. If both teams break the boundary of their *Starting Box* and one team's robot does not shut down their motors or does not stop commanding their servos to move at the end, they lose the round. In the case of a tie score, a team wins if none of the above conditions apply and they are the:

1. Team with the most points scored in the *Tram*.
2. Team with the most points scored on the *Cog Railway*.
3. Team with the most points in the *Date Bin*.
4. Team with the most *Date Bins* on team side. (their half of the board)
5. Team with the most points in the *Irrigation Lines*.
6. Team with the most red poms in the *Red Zone*.
7. Team with the most *Date Crates* in the *Yellow Zone*.
8. Team with the most green poms in the *Green Zone*.
9. Team with the most points in the *End Bin*.
10. Team with the most points on *Side*.
11. Team with the most Frisbees touching team *Side*.
12. Team with the robot, defined by the KIPR Robot Controller power switch closest to Botguy.

Game Play

Fair Play and Spirit of Botball

Botball is about the development of **student** skills. Once a team enters the pits with their robots, we request that the robots not leave the pits for any purpose until the conclusion of the tournament or suspension of play for the day. Adults are not allowed into the pits (except to help teams carry in equipment as they are arriving in the morning); all adults accompanying a team should understand that responsible Botball mentorship **does not include** working on the robot entries or programming the robot entries for the students, but **does** allow for appropriate mentor guidance of the team. **Teams hosting a tournament at their school must check their robots into the pit area at least one-hour prior to the start of the seeding rounds (9:00 am).**

Spirit of Botball: This is a 100% student-driven experience.

Students know this and adults know better!

Mentors, parents, adults, or other non-students who wish to actively participate in the construction, programming, testing, and/or documentation of a robot are invited to participate in the KIPR Open or KIPR Aerial.

Practice

Teams are permitted to send up to three team members to the practice tables. Teams will have 3-5 minutes at the table to practice before being asked to wrap up. Teams should reset the table before departing.

Teams are not permitted to bring a laptop, tablet, or other programming device to the table to conduct code changes. If a team is observed doing this, then they will be asked to leave the table. If a team member is sitting in the audience reprogramming the robot wirelessly, then the team will be asked to leave the table. The objective is to reprogram your robot(s) in the pit area and bring them to the table to execute the code. Teams are allowed to bring a mouse to the table.

Robot On-Deck Inspections

Regional tournaments *might* have a robot inspection prior to teams entering the on-deck area. This is dependent on KIPR staff or volunteers who are available to execute the process. Inspectors will have a parts list on hand and may reference it as documentation if they determine there is a violation.

Only the current year's kit materials that total up to a single kit are allowed in the on-deck area (intent is two robots only).

The objective is to verify that teams have no illegal parts present on their robot. If a team is found to have an illegal part, then a couple of scenarios can play out. If a team has a timeout card available, then they may take a timeout in order to take their robot back to their pit to remove the illegal part.

The same time constraints for the timeout card apply here. If a team does not have a timeout card, then the robot with illegal parts will be disqualified for that round.

Setup – Before Hands-Off

Up to two students from a team may bring the team's robot(s) to the tournament table and perform the setup. Teams will place their robot(s) within their *Starting Box(s)* as desired. Teams may use one or both starting boxes. Teams arrange the date bins on their side as per the game piece starting position rule on page 10. Prior to the start of the game, teams may position either or both of the starting lights on their side as they wish, provided:

- Starting lights must be attached to the outside edge of the game table alongside the *Starting Box(s)*. Starting lights must either be aimed at the team's light sensors or at the floor and cannot be aimed so as to disrupt an opponent (judges' ruling).
- Starting lights may **not** break the vertical projection of the board inside its PVC boundary.
- There are two starting lights for each team, so each robot controller can have its own starting light; both lights will turn on and off at the same time and cannot be controlled individually.
- Teams cannot touch starting lights after Hands-Off.

Teams will greet each other and:

1. Visually inspect each other's robots **before calibration**. Inspection is limited to a maximum of 1 minute unless a specific part violation challenge (refer to parts challenges under Timeout Card section below) is made. Teams are encouraged to utilize the **Bill of Materials** spreadsheet provided on the Team Home Base for each of their robots to ensure they won't have a robot's construction challenged (the Bill of Materials is also useful as documentation).

2. Teams must notify table judges **before the end of "Hands-Off"** if they believe the table is not set up properly. When both teams are ready, each team positions/activates its robots and then – **Hands-Off**!

If judges determine a team is taking too long to calibrate, then they will issue a 30-second warning. At the end of the 30 seconds, a team that is not ready for "Hands-Off" will be assigned a fault, and the setup clock will be reset. If a team receives a 2nd fault in a round, then they forfeit the round. The maximum setup time (which may be extended at judges' discretion) is 90 seconds.

Before the Game Begins – After Hands-Off

Once "Hands-Off" has been declared, the team members will position themselves so as not to block the view of the table by the audience. No part of a team's robot(s) may leave the *Starting Box* until the round has begun (movement is okay so long as the *Starting Box* boundary isn't violated). If a moving violation happens, then the judges will call a fault on the team. Team members may not move the starting lights any time after hands-off. A judge may move the light to avoid potential damage to a light. If a team receives a 2nd fault in a round, then they forfeit the round. Team members may not signal to their robots after "Hands-Off" to start their robots.

Timeout Card

Each team will be given a single red Timeout Card that is labeled with their team name and number when they register on-site. Only the team whose name appears on the card may use it. The card can only be used at an on-deck robot inspection if it is being used at the tournament or while that team is at the table before "Hands-Off". While a team is at the table, any time **before** "Hands-Off", a team may turn in their timeout card and get a 3-minute timeout. The team may spend that time in the pits or at the table, but not to practice at the table (but may practice the starting sequence). Only a single timeout per team is allowed for the entire tournament. Teams are advised to save their timeout card for the Double Elimination rounds, as Seeding rounds are best 2 out of 3.

If your region has on-deck robot inspections and your robot is deemed to have an illegal part **during seeding rounds**, then you may use your time out card to take your robot to the pit to remove the part. If your region has on-deck robot inspections and your robot is deemed to have an illegal part **during double elimination rounds**, then your robot will be disqualified. It is highly recommended that teams carefully and meticulously review the parts on their robot prior to entering the inspection area.

After the Game Begins – Lights On

Once the starting lights have turned on, the round counts unless a judge rules otherwise. At the start of the game, the starting lights turn on and robots are then allowed to leave the *Starting Box*.

The round lasts two minutes (120 seconds). The lighting sequence is:

- 0 seconds: lights turn on; robots can leave start boxes
- 15 seconds: lights turn off
- 115 seconds: Lights blink turn back on and blink for five seconds.
- 120 seconds: lights turn off; game over; robots must turn off motors and freeze/power down servos.

End of Game

Robots must **cut power to their motors (including those on the Create) and stop servo motion** by the end of the round or that team will lose the round in all situations except against a team that does not break the boundary of the *Starting Box* (in Seeding, this condition will give a score of 0). Incidental motion from a servo holding a position under load is OK.

Scoring is based on the location of pieces at the end, not how the pieces got there. Scoring takes place when the round has ended and items have come to rest.

If all motion has stopped before 120 seconds, the judges may ask the teams if their robots are done and if so may end the round at that time (both teams must agree).

If team a team does not agree with a score calculation, then they (the students representing the team at the game board) must notify the judges **immediately**. Do not be afraid to talk to the judges

about your score. Any scoring issues must be addressed while both teams are at the game table. If teams do not agree with the table judges after discussing the issue, then they can ask to speak with the head judge. Once both teams agree with the judges' score and a team member from each team initials the score sheet, or the head judge has arbitrated and made a decision, the score is **final**.

Challenges

Challenges may only come from judges and team members at the table. If either team wants to challenge the validity of the robots they are facing, they have to bring it to the table judges' attention during the inspection period. Teams can bring the list of parts to the table to aid in the inspection. Challenges must be specific. Teams are encouraged to have a Bill of Materials for each robot they bring to the table as a means for minimizing the likelihood of a robot's construction being challenged. There is a Bill of Materials spreadsheet on the Team Home Base, which can be used to specify which kit parts are allowed to be used for the robots at the table.

Judges are the final arbiters. Judges can dismiss what they believe to be spurious or irrelevant challenges. Teams determined by the judges to be in safety or performance-changing violation will be given an appropriate time period by the judges (roughly a minute) to make a correction, remove offending pieces, or take the robot off the table; otherwise, they forfeit that round. A robot that is determined before the beginning of a round to be in a safety or performance-changing violation of the construction rules will not be allowed to play while in that state. A robot ruled to be unsafe for humans will not be allowed to run until modified.

A new addition to this year's rules is that if a team wants to execute a challenge then they must wager their round. If the team that makes the challenge is correct then they win the round and the other team is disqualified for that round. However, if the team that makes the challenge is incorrect then they will be disqualified for that round and the other team will win the round. In the case that both teams wish to make a challenge, the one to approach the judge with the challenge first will be the determining challenge.

Final Scoring and Rulings

There are no instant replays: no external videos will be used in consideration of scoring. If a team is unhappy with a judge's decision, then they should politely challenge it then and there. **Challenges to scoring after the teams have signed the score sheet will not be considered. Prior to leaving the table, teams may request that a table judge fetch the head judge for arbitration and a final ruling.**

Spirit of Botball: Mentors, spectators, and team members should respect teams' and judges' final decisions.

Seeding Rounds

Seeding rounds take place before Double Elimination. There will be three Seeding rounds. The order in which teams appear in each round is set by tournament software and is the same for each round. In Seeding, a team plays the game unopposed, and the score for both sides counts, where your

Seeding Round score is (*the score for your side*) + (*the score for the other side*). Note that Seeding scores are the **sum** of the entire board and **teams are encouraged to cross sides and use the whole board for scoring during Seeding**. Unlike the Double Elimination rounds, a Create chassis is permitted to cross to the other side.

Seed scores of less than 0 will be counted as 0, except when a team passes on a round, in which case their score will be -1 for the round. A team's Seed Score is the average of their best two Seeding rounds. The tableside used by a team for a Seeding round (the side from which the robots will start) is determined when teams are called to be on deck for their turn in a Seeding round.

A student team member must bring any concerns about the seeding round scores to the attention of the Head Judge before the bracketing for the double elimination rounds. Bracketing occurs within ~5 minutes of the completion of the last seeding round. Only math errors on scoring will be accounted for.

Double Elimination (DE) Rounds

A team is out of the Double Elimination tournament when it has lost two games. Initial matches are decided by KIPR tournament software using Seeding round scores. As the tournament progresses, the order of matches and table sides for the competing teams are determined using KIPR tournament software. The two teams for a match play each other and the highest score at the end of the game wins, subject to tie breakers and special scoring conditions. The size of Double Elimination scores does not affect ranking, only wins and losses.

During a Double Elimination match, a team's Create chassis may not ever be entirely on the other team's side. Judges may at any time after a game has started decide that a robot is in violation of game rules or that team members are guilty of interference, and then disqualify the team's entry for that round.

Alliance Matches

Alliance Logistics

At selected tournaments, if a team is eliminated from the Double Elimination tournament before the Finals of Double Elimination play, then that team may sign up to play in Alliance Matches. Alliance Matches will pair up two teams to play the game collaboratively with the goal of scoring the most points. Each team will bring one robot to the table to run simultaneously. The teams will place their robots in any of the *Starting Boxes* (i.e. both on the same side or split between the two sides).

Alliance Scoring

Alliance rounds will follow all of the same scoring rules as a regular Seeding round. The total Alliance score is (*Your side's score*) + (*Ally side's score*). The Alliance team with the highest combined score from a single run will win the Alliance Tournament. Alliance matches will be conducted until tournament officials suspend play (usually when the final Double Elimination rounds are near complete).

Construction Rules

The official construction rules for the 2018 Botball Game consist of the latest revision of this 2018 Botball Game Review document and any updated game rules posted on the Team Home Base (including those posted in answers to FAQs or otherwise). Posts on the 2018 Team Home Base in the Game Rules Question area will be used to update the document and provide notice of any rule changes or adjustments.

Kit Rules

1. Sensors from the 2017 kit may be used as long as they don't exceed the type or number in the 2018 kit.
2. Robots may be constructed out of any or all of this year's kit parts except: the boxes, bags, wrapping or packing material, the chargers, download cables, wrenches, screwdriver and color stickers. Materials supplied at the workshop for creating your game board (e.g., Botguy, poms, etc.) are not part of the kit and cannot be used on your entry. The included camera and Create are the only USB devices that may be plugged into a robot during the game. **Consult the official parts lists for allowable kit parts!**
3. Small removable mounting dots/strips such as those produced by Glue Dots, UGlu and/or Scotch Brand Restickable Dots/Strips, blue tack (acquired at team's expense) may be used for construction purposes. They may not be exposed for sticking things otherwise in any manner. In particular, this means you may **not** use your mounting dots/strips to contact the game board, game elements, or the other team's entry. **Note that neither hot melt glue nor any other adhesives, other than removable mounting dots/strips, are allowed in robot construction.**

   – Mounting dots/strips are available at stores such as Home Depot, and online from vendors such as Amazon.

3. Judges may require excessive adhesive to be removed. You should always try to come up with a mechanical means for construction and only resort to using adhesive methods as a last resort!
4. Supplied servo accessories such as grommets, screws, etc. may only be used to mount pieces to the servo horn.
5. Servos and motors may be mounted to structural pieces using the supplied machine screws.
6. You may trim the connector potting material as needed to ease insertion or mounting of sensors. Damaged pieces will be replaced at team's expense.
7. Servo horns may be trimmed as desired. Damaged pieces will be replaced at team's expense.
8. Extra pieces you may add to your entry are:
   a. Up to 100cm of thread or line or cable (maximum diameter 1mm) may be used as desired except for offensive measures such as entanglement and entrapment.
   b. Paper (maximum 20#) so long as the amount can be taken from a single standard US letter-sized (8.5" X 11") or A4-sized (210mm x 297mm) sheet. See rule 9.
   c. Standard 3/16" thick foam board as long as the amount can be taken from a standard US letter-sized or A4 footprint. See rule 9.

d. Up to 10 standard office rubber bands of maximum size #19 may be used (#19 is 3.5" x 1/16" x 1/32").

e. Paper Clips- Up to 10, smooth, metal (between 1" and 1 ½" in length). Paper clips can be bent in any fashion but cannot but cut, broken or plugged into any wire or robot controller

f. Pennies- Up to 100 U.S. pennies to be used as a counterweight only.

9. If your entry uses paper and/or foam core board, you MUST bring a template showing how the material you are using was cut out of **each** 8.5" X 11" (or A4) sheet. The paper/foam core board may only be held in place through the use of other kit parts (including removable mounting dots/strips detailed above if used as allowed for other kit parts). **Paper and foam core board may only be black or white; only grayscale may be used for printing including official logos for sponsors of your team, or QR codes.**
10. Rubber bands may not be glued or melted. Rubber bands may be cut, but only a total of ten whole rubber bands or five cut rubber bands may be used on a team's entry. For any combination having both whole and cut rubber bands, the limit is 5.
11. Soda straws, paper, electrical tape and/or foil may be used as light guides for sensors (light guides may be shielded by using tape, but not in a fashion that is for structural purposes or for manipulation). Light guide materials are in addition to the allowable parts.
12. **Teams are not allowed to shield robot sensors externally to their official entry (i.e., teams are not allowed to stand between their robots and the audience to keep the robots from sensing the audience). Teams should orient and calibrate the sensors on their robot appropriately so that this is not an issue. Teams using cameras may request that anyone whose attire includes significant color blobs closely matching game object colors stand well back from the table.**
13. You are limited to ten (10) 4" white zip ties (included in the kit), and they may be used for any purpose. You may replace damaged ties with ones of equivalent size (black or white).
14. Lego parts cannot be physically modified.
15. Metal parts may NOT be cut or broken to a smaller size. Straps and plates may be bent if desired.
    - Warning: KIPR will not provide replacements for metal parts that have been altered or damaged. Replacements may be purchased from the online Botball Store.
16. Optional Create parts are the top plate, dust bin, and brush bar box. If any optional pieces are removed, they may NOT be reused anywhere else on the entry. The Create may not be assembled/disassembled otherwise.
17. Teams are limited to the number and size screws as follows: 20 -#8-32 quarter inch, 45 -#8-32 half inch, and 35 -#8-32 three-quarter inch screws. All #8-32 screws are black. There are 10 silver M3 x 14mm screws and six silver M3 nuts. There is also #8-32 threaded rod: 10 - 1", 2 - 2", 2 - 3", and 1 - 6" long.

Robot Logistics

1. Each robot if named can only have a name (G-rated) approved by an adult team leader before the tournament.
2. Multiple processors (such as two KIPR robot controllers) may exist on a single robot.
3. It is not necessary to use all the parts in a kit.
4. Each *Starting Box* is 18" x 14" x 12" tall.
5. The *Starting Box* boundaries are given by the **interior edge** of the PVC and **interior edge** of the black tape that delineates it.
6. The *Starting Box* extends vertically **12 inches (30.48 cm).**
7. **All elements of a team's entry must be within the volume of the *Starting Box* at game start.**
8. After game start, robots are allowed to expand in size.
9. Starting light sensors may be shielded as demonstrated in the workshop slides and neither sensor nor shielding may extend outside the *Starting Box*.
10. All Independent structures not under computer control should be clearly marked with the team's number. Maximum label size is 1" diameter (Avery #5410), or you may use permanent marker directly on the structure. Teams may only run robots with their team number on them.
11. Robot teams can have a maximum of 4 independent structures on the game table at a time
    a. A team's entry, including any supplied game pieces, must fit in the *Starting Box* **without any external restraint** at game start (the *Starting Box* floor and border PVC is not an external restraint).
    b. Each structure must be large enough so that it does not, in the judge's opinion, constitute a jamming or entanglement hazard.
    c. Examples of structures include: robots, barricades, detachable baskets, etc.
    d. A team's entry can contain as many robots up to the structures limit as can be constructed from the parts in a single kit.
    e. Items intentionally ejected from a robot count as structures (judges judge intention); there are special rules regarding projectiles, discussed later.
    f. The igus© chain **must** be permanently affixed to a robot (defined as a KIPR Robot Controller with a minimum of two attached motors) by at least one end of the chain. Using the igus© chain in a gear-driven system for motion of a robot component counts as being affixed to the robot. The igus© chain may **not** be used as a projectile (even tethered) or as an independent structure. If the Head Judge deems the use of the igus© chain to be in violation of this rule, the offending team will be disqualified for the round.
12. No electrical modifications may be made to any KIPR robot controller, the Create, any sensors or any motors, except for substitution of batteries with one approved by KIPR.
13. No wire extensions may be used except those provided in the kit (foil may not be used as wire!).
14. Entanglement strategies are not in line with the Spirit of Botball and may be subject to disqualification as determined by the head judge.

Safety

1. Human & Robot Safety:
    a. No untethered robot-launched projectiles, other than game pieces, are allowed.
    b. No tethered projectiles containing metal pieces are allowed.
    c. No metal pieces are to be used in effectors that move or rotate at high speed.
    d. No metal protrusions are to be used that are likely to cause electrical risks for other robots.
    e. Judges will determine how safe a robot is. Teams may alert judges to a potential safety or entanglement hazard, but judges will interpret whether or not a robot is safe, needs to be modified, or is not allowed to run.
2. Electrical tape (either black or white) may be used (or required to be used by judges) to cover metal pieces that are deemed to otherwise be a safety risk to robots or humans. NOTE: tape still may not be used structurally.
3. If a robot is not considered safe, as decided by the Head Judge, then the robot will not be allowed to run until it has been modified.

External Communication

1. No external communications (e.g., IR, Bluetooth, wireless, or semaphores) may be used during tournament play with the exception of robot to robot.
2. The USB cables & chargers may not be used during tournament play with the exception of the create cable.
3. Communications among the robots forming your team's entry is allowed
4. Your robot controller may have WiFi turned on or off at the tournament, however we strongly advise teams to use USB communication at all times as teams can remotely access your wallaby and gain your password.
5. Any teams found in violation of any communication hacking or tampering with another team's robots or equipment is in violation of the "Spirit of Botball" and may be disqualified from the rest of the tournament.

Teams found in violation of any communication rule may be disqualified from the tournament.

Overall Winner Calculations

A team's overall score is calculated as the sum of their Seeding, Double Elimination, and Documentation scores. The overall score is between 0 and 3.

Documentation Scoring Formula

$$\text{DocScore} = \frac{3}{10}(\text{Period1Doc\%}) + \frac{3}{10}(\text{Period2Doc\%}) + \frac{1}{10}(\text{Period3Doc\%}) + \frac{3}{10}(\text{OnsiteDoc\%})$$

Seeding Scoring Formula

$$\text{SeedScore} = \frac{3}{4}\left(\frac{\text{n} - \text{SeedRank} + 1}{\text{n}}\right) + \frac{1}{4}\left(\frac{\text{TeamAverageSeedScore}}{\text{MaxTournamentSeedScore}}\right)$$

Double Elimination Scoring Formula

$$\text{DoubleEliminationScore} = \left(\frac{\text{n} - \text{DERank} + 1}{\text{n}}\right)$$

Note: For all formulas n = Number of Teams at Tournament