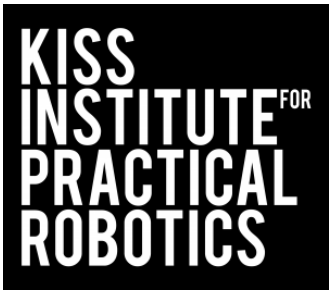
2017 Botball Game Review



Version 1.0 1/13/2017

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Revision History

Version 1.0 – January 13th, 2017 – Initial release of the 2017 Botball Game Review document.

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This Year's Game

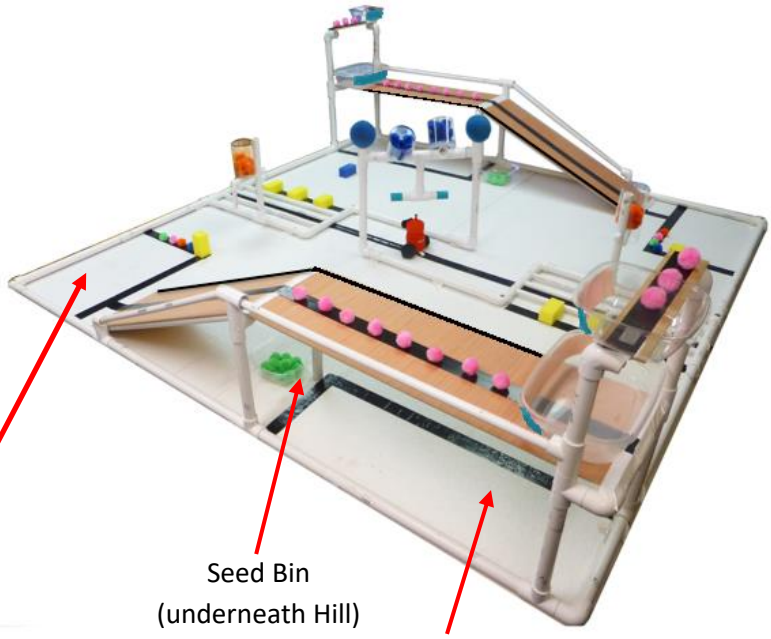
Robots Assisting a Modern Agricultural Operation

Managing a modern agricultural operation is hard work, but with the use of robotic technologies, the operations can become more efficient in their cultivation and use of resources, in particular water and fertilizer. It is planting time and Agrobot has just finished getting the family farm ready. The *Barn* has been cleared and the seed *corn* loaded into a *Seed Bin*. There is a *Greenhouse* on the *Terrace* that Agrobot has made ready for seedlings to be planted in its nursery. Seedlings have been laid out on a bench on the floor of the greenhouse for the *Green House's Lower Planter*, and more have been laid out on the *Shelf* for planting in the *Upper Planter*. *Hoppers* near the *Fields* have been loaded with fertilizer. Water has been pumped from the *Aquifer* to fill the W *Tanks*. The *Fields* have been plowed into *Furrows* and are ready to be planted with seed corn.

To help Agrobot complete preparation of the *Fields* for planting, your robots need to remove *hay bales* so planting can commence, preferably stacking them in the *Barn*. There is a *cow* that your robots need to return to the *Grazing Area* or put in the *Barn*. Your robots will be in charge of planting the seed corn in the *Field* along with the correct amount of fertilizer and water to help produce the maximum amount of yield at harvest time. In addition, your robots need to plant the seedlings in the greenhouse planters in case there is a late freeze. The seedlings also need to have the right combination of fertilizer and water to thrive. If the long-range weather forecast is okay, seedlings can be planted in the *Field* with the corn. To help your robots adapt to the job, Agrobot has provided samples of seed corn, seedlings, fertilizer, water, and a hay bale to use when you deploy your robots.

Game Board

- Seed Corn
- Seedlings
- Water
- Fertilizer
- Hay Bale
- Cow
- Water Container
- Agrobot



Seed Bin
(underneath Hill)

Barn

Field

Grazing Area
(Start Box)

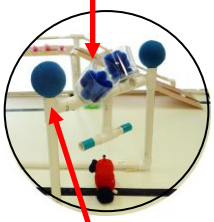
Fertilizer Hopper

Side

Aquifer

Hill

Water
Tank



Terrace

Water
Container

Lower
Planter

Upper
Planter

Furrows

Game Board Areas

Official game board specifications are on the Team Home Base. All tournament boards will match these specifications within +/-0.5 inches or 1%, whichever is greater.

The game board is composed of four 4'x4' (reusable) modules whose surfaces are pebble grain white fiberglass reinforced plastic panel (FRP). A fully assembled game board will be ~8'x8'. A panel channel or black or white duct tape is used to close exposed seams where modules abut.

For both seeding and double elimination rounds, a team is assigned the side to play on (A or B) by the KIPR scoring software. With the exception of a team's Create module, a robot can proceed from its side to the other side as part of game strategy. The game board is separated into defined areas for each team.

Starting Box – the boundary of each team's *Starting Box* (24" x 15" x 12" high) is defined by the **inside edges** of the tape lines and PVC that surround the *Starting Box*.

Grazing Area - same as the *Starting Box*.

Barn - the boundary of each team's *Barn* is defined by the **inside edges** of the tape lines and PVC that surround the *Barn*.

Field - the game table surface as separated into 3 plowed *Furrows* by the PVC.

Furrows - The 3 rows in the *Field* that have PVC tubing on all sides.

Aquifer - the area between the *Fields* and under the *Water Tank.*

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 *Grazing Area*, *Barn*, *Aquifer*, and *Field*. The white tape securing the *Hill* to the game table surface is part of the side.

Hill - the surface of the incline leading to the *Terrace*.

Terrace - the surface of the platform accessed by the *Hill*.

Shelf - the platform at the end of the *Terrace*.

Upper Planter - the small bin attached to the *Shelf*.

Lower Planter - the large bin attached to the *Terrace* and under the *Shelf*.

Seed Bin - the small bin under the *Hill* that holds the seed corn.

Water Tank - the tilt-able structure in the center of the game board for holding water.

Fertilizer Hopper - the cylindrical tank with a crank for dispensing fertilizer.

Game Pieces

- 1 - Agrobot (Botguy)
- 8 - 2" x 2”x 4” yellow foam blocks (*Hay Bales*)
- 2 - 4" blue balls (*Water Container*)
- 2 - 2" x 2”x 4” blue foam blocks (*Cows*)
- 24- orange poms (*Fertilizer*)
- 24 - blue poms (*Water*)
- 24 - green poms (*Seed Corn*)
- 24 - pink poms (*Seedlings*)

Game Piece Starting Positions

- Agrobot will be placed directly under the *Water Tank* straddling the black tape and facing the audience.
- 11 green poms will be placed in the *Seed Bin* under each *Hill*.
- 11 blue poms will be placed in each *Water Tank* cup, and a blue ball on each *Water Tank* post.
- 11 orange poms will be place in each *Fertilizer Hopper*.
- 8 pink poms will be placed at marked locations on each *Terrace*.
- 3 pink poms will be placed at marked locations on each *Shelf*.
- 3 yellow foam blocks will be placed at marked locations on the black tape line for each *Field* to project towards the *Field's* first *Furrow*.
- 1 cow will be placed on each side wistfully looking at the center hay bale.
- There will be a Hay Bale and a pom of each color that a team must place so as to touch the black tape line that immediately surrounds the *Starting Box* (does not include black tape line going up the *Hill*), but not any part of the team's entry.

Game #: _____ Table #: ___ **JUDGES' CHECKLIST** ☐ Table Reset ☐ Team Verified ☐ Robot Size Check ☐ Robots Belong to Team ☐ Calibration ☐ Hands Off

2017 Botball®

Team Name: _____ Team #: _____

1. Robots		2. Hay(stacks)		Running Total
in Barn #___ x 5 = ____		Hay on Side or Grazing Area ___ x 5 = ____		
on Hill #___ x 15 = ____		Hay in Barn ___ x 10 = ____		
on Terrace #___ x 25 = ____		Hay Stack Subtotal = ____		
		Tallest Hay Stack Height x ____		

3. Botguy & Blue Cow

	Side	Barn	Grazing Area	Hill	Terrace	
Botguy	5	5	10	15	25	= ____
Blue Cow		5	10	15	25	= ____
					Subtotal	= ____

If Botguy and Blue Cow are in the same scoring area, x2 = ____
If Botguy and 2 Blue Cows are in the same scoring area, x4 = ____

Circle points for Botguy.
Place a strike through the point to signify a cow and an X to signify two cows.

4. Water Container(s)

	Side	Barn	Grazing Area	Terrace	Lower Planter	Upper Planter	
Foam Ball	5	5	10	20	40	60	= ____

Place a strike through the point to signify a ball and an X to signify two balls.

5. Poms

on side or in Grazing Area	#____ x 1	= ____
on Terrace	#____ x 2	= ____
in Lower Planter	#____ x 5	= ____
in Upper Planter	#____ x 10	= ____

6. Field

	# Poms		# Colors	If # poms ≤ 12 in row: Unsorted	Sorted	
Furrow #1	____	x	____	x2	x10	= ____
Furrow #2	____	x	____	x2	x10	= ____
Furrow #3	____	x	____	x2	x10	= ____

Circle multiplier for Unsorted or Sorted.
Sorted defined as 2+ colors and 2+ poms of each color and the same # of poms of each color.
Poms only score if they are touching the game surface.

Judge, clearly circle winner before teams sign score sheet.

Once the sheet has been signed, **SIDE A's SCORE** cannot be challenged. Teams, ask to see Head Judge before initialing if there are any questions.

SIDE A SCORE ☐

A TEAM #: _____

A INITIAL: _____

Team Name: _____ Team #: _____

1. Robots		2. Hay(stacks)		Running Total
in Barn #___ x 5 = ____		Hay on Side or Grazing Area ___ x 5 = ____		
on Hill #___ x 15 = ____		Hay in Barn ___ x 10 = ____		
on Terrace #___ x 25 = ____		Hay Stack Subtotal = ____		
		Tallest Hay Stack Height x ____		

3. Botguy & Blue Cow

	Side	Barn	Grazing Area	Hill	Terrace	
Botguy	5	5	10	15	25	= ____
Blue Cow		5	10	15	25	= ____
					Subtotal	= ____

If Botguy and Blue Cow are in the same scoring area, x2 = ____
If Botguy and 2 Blue Cows are in the same scoring area, x4 = ____

Circle points for Botguy.
Place a strike through the point to signify a cow and an X to signify two cows.

4. Water Container(s)

	Side	Barn	Grazing Area	Terrace	Lower Planter	Upper Planter	
Foam Ball	5	5	10	20	40	60	= ____

Place a strike through the point to signify a ball and an X to signify two balls.

5. Poms

on side or in Grazing Area	#____ x 1	= ____
on Terrace	#____ x 2	= ____
in Lower Planter	#____ x 5	= ____
in Upper Planter	#____ x 10	= ____

6. Field

	# Poms		# Colors	If # poms ≤ 12 in row: Unsorted	Sorted	
Furrow #1	____	x	____	x2	x10	= ____
Furrow #2	____	x	____	x2	x10	= ____
Furrow #3	____	x	____	x2	x10	= ____

Circle multiplier for Unsorted or Sorted.
Sorted defined as 2+ colors and 2+ poms of each color and the same # of poms of each color.
Poms only score if they are touching the game surface.

Judge, clearly circle winner before teams sign score sheet.

Once the sheet has been signed, **SIDE B's SCORE** cannot be challenged. Teams, ask to see Head Judge before initialing if there are any questions.

SIDE B SCORE ☐

B TEAM #: _____

B INITIAL: _____

Scoring Rules

The official scoring rules for the 2017 Botball Game consist of the latest revision of this 2017 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 2017 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.

1. **Black Tape Rule:** A game piece touching a *Black Tape Line* does not score. Note that a robot is considered an entry, not a game piece.
2. **General Scoring Rule:** A game piece must touch the surface of the scoring area in order to score, with the exception of *Upper*/*Lower Planters* and stacked *Hay*, noted below.
3. **Planter Rule:** *Upper* and *Lower Planters* score with any game piece breaking the volume of the associated planter.
4. **Stacked Hale Rule:** Each individual Hay Bale in a stack will score as being in the associated scoring area for purposes are being part of the multiplier. Stacked Hay Bales are allowed to be supported by a robot. Stacked is defined as a Hay Bale touching the top most surface of the below in a vertical fashion.
5. **Furrow Rule:** A multiplier will be given for each *Furrow* that contains 12 or fewer poms.
6. **Furrow Sorting Rule:** Poms are considered sorted in a single *Furrow* if (a) there is more than one color of pom in the *Furrow*, and (b) there are the exact same number of poms for each color in the *Furrow*, and (c) there are at least two of the same color (one orange and one green is not sorted, but two orange and two green is)
7. **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.
8. **Terrace Rule:** A game object or robot scores on the *Terrace* if it is touching the top of the surface of the *Terrace* and is not touching any other game surface. For a robot to be on the *Terrace*, the KIPR Robot Controller power button must also be above the plane of the *Terrace* surface.
9. **Hill Rule:** A game object or robot scores on a *Hill* if it is touching the top of the surface of the *Hill* and is not touching any other game surface with the exception of the *Terrace*.
10. **Final Scoring Rule:** The score is determined by final object location, not by how it got there. Judges will wait until any scoring objects still moving have come to rest before scoring a game.
11. **Single Area Scoring Rule:** A game piece cannot score in more than one area. If it is in more than one area, then it is counted as being in the area that produces the higher overall score.
12. **DE Create Rule:** During the Double Elimination rounds, a team's entire Create chassis may not ever be entirely on the other team's side. Doing so will result in a **disqualification** for the offending team.
13. **DE Field Interference Rule:** If a non-robot structure enters the vertical projection of their opponent's field (i.e., cover the field, block any vertical space of the field to deny their opponent access, etc.), then the team will be disqualified. (See **Robot Rule** for definition of a robot.)
14. **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.

If your team doesn't 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. Teams will be required to initial the score sheet before leaving the table – this signifies that they accept the score.

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 (first condition to apply):

1. Team with the most points in their ***Field***.
2. Team with the most points in their ***Upper Planter***.
3. Team with the most points in their ***Lower Planter***.
4. Team with the most points in their ***Barn***.
5. Team with the most points in their ***Grazing Area***.
6. Team with the most points on their ***Side***.
7. Team with the fewest poms in their ***Water Tank***.
8. Team with the fewest poms in their ***Fertilizer Hopper***.
9. Team with the ***Water Container*** off of the PVC post closest to their side.
10. Team with the fewest poms on **Black Tape Line**.
11. Team with the robot (defined by the KIPR Robot Controller power switch) **closest to Agrobot**.

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.

Spirit of Botball: This is a 100% student-driven experience.
Students know this and adults know better!

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

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* as desired. Teams arrange the 4 poms and hay bale to touch the *Starting Box* tape, not touching any part of their entry. 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*. 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 visually inspect each other's robots **before calibration**. Inspection is limited to a maximum of 1 minute unless a specific challenge 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). 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. The target 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 kneel/sit at their side of the table. No part of a team's robot(s) may leave the *Starting Box* until the round has begun (movement is OK 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 although a judge may 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 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.

After the Game Begins (after the lights turn 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). 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). Incidental motion from a servo holding a position under load is OK.

If teams do 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 have to 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 (typically, 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.

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 or robot construction 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 and spectators should respect teams' and judges' 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. 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 the Double Elimination, 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.

If the igus© chain is across the vertical projection of the opponent's side, then it may not touch an opponent's robot or else the offending team will be disqualified.

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 reached).

Construction Rules

The official construction rules for the 2017 Botball Game consist of the latest revision of this 2017 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 2017 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. 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., Agrobot, poms, etc.) are not part of the kit and cannot be used on your entry. The included cameras are the only USB devices that may be plugged into a robot during the game. **Consult the official parts lists for allowable kit parts!**
2. Small removable mounting dots/strips such as those produced by Glue Dots, UGlu and/or Scotch Brand Restickable Dots/Strips (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.
   c. Standard 3/16" thick foam board as long as the amount can be taken from a standard US letter-sized or A4 footprint.
   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").

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 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. The *Starting Box* is 24" x 15" x 12" tall.
5. The *Starting Box* boundaries are given by the **interior edge** of the PVC and **interior edge** of the colored and 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 should 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!).

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.
2. The USB cables & chargers may not be used during tournament play
3. Non-radio communications among the robots forming your team's entry is allowed
4. Your robot controllers must have their Wi-Fi turned off to ensure there is no question about external communication coming into play
    a. See the workshop slides for instructions on how to ensure this is done before coming up to the table.

Teams found in violation of any communication rule may be removed 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