FIRST® LEGO® LEAGUE 2012

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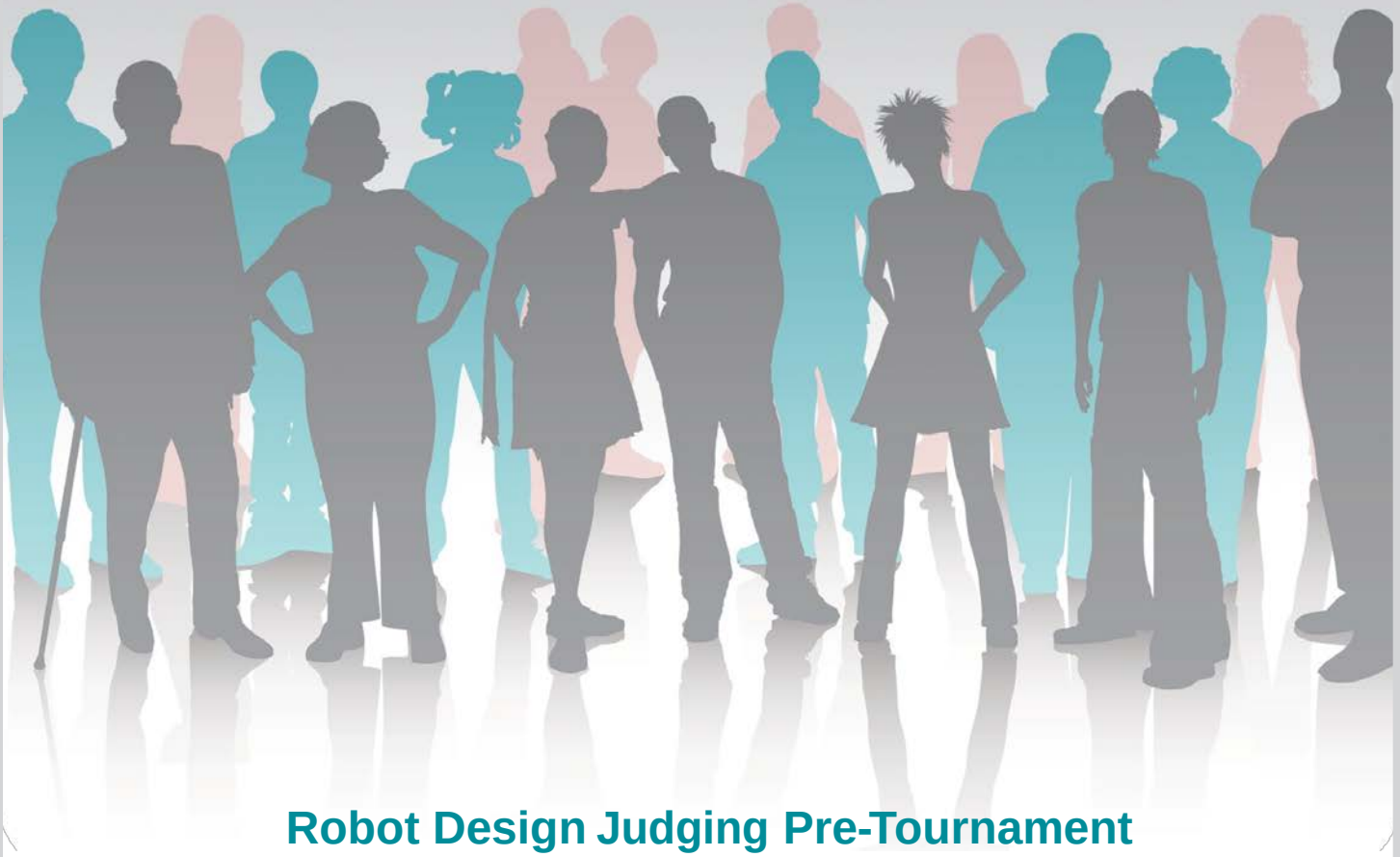

Robot Design Judging Pre-Tournament Preparation Pack

Championship and Expanded Qualifier Edition

FLL

FIRST® LEGO® League

www.firstlegoleague.org

FLL Core Values

We are a team.

We do the work to find solutions with guidance from our coaches and mentors.

We know our coaches and mentors don't have all the answers; we learn together.

We honor the spirit of friendly competition.

What we discover is more important than what we win.

We share our experiences with others.

We display Gracious Professionalism in everything we do.

We have fun.

10 Things to Know As an FLL Judge

Please be sure to check out www.firstlegoleague.org for additional information, including Judging and other official Q & A from throughout the season:

Robot Game Updates: http://firstlegoleague.org/media/twocol.aspx?id=268
Project FAQ: http://www.firstlegoleague.org/media/twocol.aspx?id=314
Judging Questions: flljudge@usfirst.org

Thank you for agreeing to be a judge with *FIRST*® LEGO® League. The information in this packet is designed to help you prepare as an FLL Judge this season. It is intended to offer background information that will be useful to review prior to your tournament. You should also participate in training sessions that may be offered through your local tournament organizer and/or FLL. We hope your experience as an FLL Judge is rewarding and enjoyable!

10. Have fun – you and the kids
The most important thing to know about an FLL tournament is that it is supposed to be **FUN**. The mission of *FIRST* is to get kids excited about science and technology. A competition is a celebration of what the children have accomplished throughout the season. It should be serious and competitive, but not so much that the fun is lost.

9. Exhibit Gracious Professionalism and honor FLL Core Values
These are the basic foundations of *FIRST* LEGO League, and should always be at the forefront in everyone's minds. We offer specific awards to recognize FLL Core Values excellence, but a significant concern can impact team eligibility in *any* award category.

8. Be a good role model for technology and engineering careers
Give the kids a chance to see what makes engineers, scientists, computer programmers and educators special. Share your experiences without sharing your agendas. Be professional – show the kids that what they have accomplished is appreciated and valuable. Show interest in their presentations and discussions, and be personable.

7. Respect the children
Please keep negative comments to yourself, away from the ears of the kids, parents, and coaches. All teams should be given the benefit of the doubt when questions arise about adult involvement. If you suspect the kids did not do the work, it is your job to probe further to prove it, rather than assuming that the kids did not do the work. Remember that these are kids who worked hard all season to make it to the tournament. Treat their accomplishments with respect, and be sure that other judges do so as well. One negative comment from a judge can have a devastating effect on teams. Make it your goal as a judge to ensure that the teams know what they did well, and that they have a positive experience showcasing their achievements.

6. Respect the judging process
Stay on schedule. The kids have a more challenging schedule than you do. Remember the FLL awards philosophy. Remember that the whole judging process is subjective. Concentrate on providing a great experience for the kids and try not to get caught up in the mechanics of the process. Do not share scores or awards discussions with the kids, coaches or parents.

5. Evaluate teams completely and fairly
Each rubric is designed to evaluate many areas of a team's performance, and gives equal weighting to several factors tied to specific awards. All Core Awards are of equal importance, except for our Champion's Award that recognizes all-around excellence. Be objective, both on a team-by-team basis and a total rubric evaluation basis. Familiarize yourself with the levels of achievement. Identify any conflicts of interest you have before the competition, and refrain from involving yourself in discussions about any team when you have a conflict.

4. Consider age appropriateness and experience
Consider age when evaluating teams. Certain skills, knowledge, and capabilities are more likely to be exhibited by the kids as they get older and more experienced in general and in FLL in particular. You may also see rookie teams that are more polished and understand FLL better than experienced teams.

3. Reward excellence and celebrate achievement
For a team to be considered for an award, they should be evaluated at an Exemplary level of achievement in that category whenever possible. Award distribution is spread as equitably as possible among the teams, with the goal of no team winning more than one judged award.

2. Provide specific and constructive feedback
Please be specific when providing feedback comments to teams. This will also help when it comes to awards deliberations – specific examples are very helpful when differentiating between teams. "This team's willingness to help other teams (by providing programming mentorship, for example) is exemplary" is more descriptive and helpful than "that team was so nice and polite and exhibited gracious professionalism." Take lots of notes if you need to!

1. See #10 again!

Robot Design Judging Primer

Robot Design judging in FLL can be compared to an engineering design review in the "real world". Design teams present their robots to panels tasked with selecting the robots that best meet the requirements (completion of missions) given constraints like size, parts usage and software. The natural inclination for engineers and technical people is to say, "There is an easy test to see which robots are best – the competition!" However, in FLL, and often in the "real world", decisions are made based on how well a team can explain their design and all the things they considered while developing it. The FLL Robot Design rubric represents a set of criteria that we feel are important "takeaways" from participating in the design of an FLL competition robot. They are analogous to evaluation criteria used when selecting between competing designs. Judges gather information about teams' mechanical design, programming and overall design process to evaluate a team and its robot.

As a judge, here are some overall things to consider:

- The Robot Design judging session is more about the team's ability to present the robot and all the thoughts and considerations that went into their final product than it is about its performance. The performance is covered under the Robot Performance Award. The judging session is the time for the judges to learn from the teams the design processes they used to make decisions and gain understanding; it also allows discussion so that judges can be sure that the teams did the work.
- You may ask teams to perform missions with their robot on the judging table. Give teams the benefit of the doubt should these missions not work successfully all the time. Judging tables and field setup kits are not usually built or maintained to the same standards as competition ones. There is also a tendency for Murphy's Law to rule in these sessions and for teams to be nervous and mistake prone when running missions in a judging setting.
- Teams may bring additional prototypes of their robot or attachments into a judging session. Sometimes these prototypes utilize additional electrical parts beyond those allowable in competition. Remember that electrical parts and software rules apply only to the robot used in the competition itself, and that extra parts or software used by teams to demonstrate designs are perfectly allowable.
- Simpler is usually better. Don't be overly impressed with complicated robots. The complication must be used fo a purpose.
- Remember that this is an engineering challenge for autonomous robots. Small imperfections in the field, mission models and environmental variations must be considered by Accomplished and Exemplary teams.

Mechanical Design

Durability – The robot should be able to withstand the rigors of the competition, for example it should be able to contact walls or missions models without pieces falling off or breaking. Attachments should be similarly robust. Long arms that delicately grip a lever aren't very effective if they don't stay attached to the robot.

Mechanical Efficiency – Here the judges are looking for robot structures and attachments which show a judicious use of parts. For example, using six pins to tie two beams together is not as efficient as using one at each end. One note here: don't over penalize the teams for adding small bits of "flair" or pieces that are fun for them to use to express their creativity. Remember the Core Value "We have fun!"

Mechanization – Judges look here for how the robot moves and operates. They look to see whether the robot balances speed and power.

Programming

Just as with Mechanical Design, simplicity is desired when it comes to programs. Teams can develop amazing programs that aren't necessarily better than simple programs that perform the same purpose.

Programming Quality – The robot's programs should work consistently, producing the same results every time. Examples of quality code could include audible checks or a simplified menu system that teams use to make sure they are running the appropriate section of code for a particular mission. Be careful to attempt to assess how the robot's programs would operate independent of mechanical faults.

Programming Efficiency – The goal here is to encourage teams to develop code that is modular, portable and flexible, so that it can be used in multiple situations. This criterion also addresses readability and documentation of code, both of which are good programming practices.

Automation/Navigation – Autonomy in FLL means that the robot operates with minimal driver intervention. Retrieving a robot and taking a touch penalty may be part of an acceptable strategy for a team, but it is still driver intervention. So for this instance, a team might have an Accomplished Mission Strategy, but only score Developing for Automation. This criterion also doesn't distinguish between sensor use/feedback and mechanical feedback. For example, it is valid for a team to use an aligning jig in base followed by a robot using the wall or a mission model to align itself before activating an attachment. It is also just as valid for a team to use a light sensor to follow a line to the same mission model. Teams should try to avoid just using driver aiming, motor rotations and timing to navigate the field, as these methods often become unreliable under variations in field or environmental conditions. Remember that lack of sensors isn't necessarily a bad thing. Lack of Automation, however, should be considered.

Strategy & Innovation

Remember that Strategy and Innovation can be seen in Mechanical Design or Programming, as well as the integration of both.

Design Process – Accomplished teams move beyond a trial and error approach to robot improvements to utilize testing cycles where systematic processes are used. Frequently you will hear teams say, "We tried a lot of different things and this one was the best." You are looking for more details and more organization to their process than that for teams who are Accomplished or Exemplary.

Mission Strategy – This is fairly straightforward. Judges can ask teams, "What is your strategy to complete the missions?" and "How did you make decisions to support that strategy when designing your robot?"

Innovation – This is often a hard area for judges to judge. Things to be on the lookout for here include creativity, uniqueness, a cool attachment or programming trick, or something similar. Most competitions will have one or more robots that will have some feature that captures the judges' attention. Remember that Innovation implies added benefit, so make sure that the team can state the benefits of their cool feature.

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Robot Design

Team Number

Judging Room

Directions: For each skill area, clearly mark the box that best describes the team's accomplishments. If the team does not demonstrate skill in a particular area, then put an 'X' in the first box for Not Demonstrated (ND). Please provide as many written comments as you can to acknowledge each team's hard work and to help teams improve. *When you have completed the evaluation, please circle the awards for which you would like this team to be considered.*

Mechanical Design

	Beginning	Developing	Accomplished	Exemplary
Durability	Evidence of structural integrity; ability to withstand rigors of competition			
ND	quite fragile; breaks a lot	frequent or significant faults/repairs	rare faults/repairs	sound construction; no repairs
Mechanical Efficiency	Economic use of parts and time; easy to repair and modify			
ND	excessive parts or time to repair/modify	inefficient parts or time to repair/modify	appropriate use of parts and time to repair/modify	streamlined use of parts and time to repair/modify
Mechanization	Ability of robot mechanisms to move or act with appropriate speed, strength and accuracy for intended tasks (propulsion and execution)			
ND	imbalance of speed, strength and accuracy on most tasks	imbalance of speed, strength and accuracy on some tasks	appropriate balance of speed, strength and accuracy on most tasks	appropriate balance of speed, strength and accuracy on every task

Comments:

Programming

Programming Quality	Programs are appropriate for the intended purpose and would achieve consistent results, assuming no mechanical faults			
ND	would not achieve purpose AND would be inconsistent	would not achieve purpose OR would be inconsistent	should achieve purpose repeatedly	should achieve purpose every time
Programming Efficiency	Programs are modular, streamlined, and understandable			
ND	excessive code and difficult to understand	inefficient code and challenge to understand	appropriate code and easy to understand	streamlined code and easy for anyone to understand
Automation/Navigation	Ability of the robot to move or act as intended using mechanical and/or sensor feedback (with minimal reliance on driver intervention and/or program timing)			
ND	frequent driver intervention to aim AND retrieve robot	frequent driver intervention to aim OR retrieve robot	robot moves/acts as intended repeatedly w/ occasional driver intervention	robot moves/acts as intended every time with no driver intervention

Comments:

Strategy & Innovation

Design Process	Ability to develop and explain improvement cycles where alternatives are considered and narrowed, selections tested, designs improved (applies to programming as well as mechanical design)			
ND	organization AND explanation need improvement	organization OR explanation need improvement	systematic and well-explained	systematic, well-explained and well-documented
Mission Strategy	Ability to clearly define and describe the team's game strategy			
ND	no clear goals AND no clear strategy	no clear goals OR no clear strategy	clear strategy to accomplish the team's well defined goals	clear strategy to accomplish most/all game missions
Innovation	Creation of new, unique, or unexpected feature(s) (e.g. designs, programs, strategies or applications) that are beneficial in performing the specified tasks			
ND	original feature(s) with no added value or potential	original feature(s) with some added value or potential	original feature(s) with the potential to add significant	original feature(s) that add significant value

Comments:

Awards Consideration: Mechanical Design Programming Strategy & Innovation

What to Expect as a Judge

Day of the Event

Before Judging Sessions

- Meeting with the Judge Advisor to review
  - Event schedule
  - Judging procedures
  - Judging Deliverables
  - Last minute items
- Meet your judging partner(s) and the rest of the panel
- Attend the Opening Ceremonies

During Team Evaluations

- Interview teams
- Make sure sessions stay on schedule
- Evaluate each team according to rubric criteria and note constructive comments
- Keep additional notes of team specifics if needed
- Note and report:
  - cases of adult intervention
  - demonstrations of GP & FLL Core Values

During Deliberations

- Submit award nominations and rankings by your judging pair
- Participate with all area judges to determine award candidates/merged preliminary ranking
- Work with judges of other categories to determine the Champion's Award winner(s)
- Work with all judges to finalize remaining awards and prepare scripts

During the Awards Ceremony

- Attend the Awards Ceremony (if possible)
- Help distribute medals, awards and other team recognition
- Join the high-five line, congratulate all teams and have fun!

Judging Process

You will work with other judges throughout the tournament using FLL's process to evaluate teams and determine awards

Note that you may work with different judges at different times

Judging Pairs

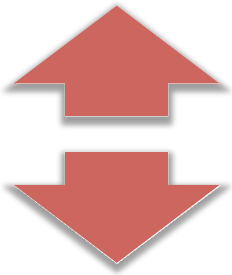
Three Judging Areas

All Judges

Judging Process

Team Evaluation and Feedback

Awards Deliberations



During Team Evaluation and Feedback, the focus of the judges is on evaluating each team and providing them with constructive feedback

During Awards Deliberations, the focus of the judges is on determining the teams worthy of awards and recognition

FLL Core Awards

Champion's Award

This award recognizes a team that embodies the FLL experience, by fully embracing our Core Values while achieving excellence and innovation in both the Robot Game and Project.

Robot Awards

Mechanical Design

This award recognizes a team that designs and develops a mechanically sound robot that is durable, efficient and highly capable of performing challenge missions.

Programming

This award recognizes a team that utilizes outstanding programming principles, including clear, concise and reusable code that allows their robot to perform challenge missions autonomously and consistently.

Strategy & Innovation

This award recognizes a team that uses solid engineering practices and a well-developed strategy to design and build an innovative, high performing robot.

Robot Performance

This award recognizes a team that scores the most points during the Robot Game. Teams have a chance to compete in at least three 2.5 minute matches and their highest score counts.

Project Awards

Research

This award recognizes a team that utilizes diverse resources to formulate an in-depth and comprehensive understanding of the problem they have identified.

Innovative Solution

This award recognizes a team's solution that is exceptionally well-considered and creative, with good potential to solve the problem researched.

Presentation

This award recognizes a team that effectively communicates the problem they have identified and their proposed solution to both the judges and other potential supporters.

Core Values Awards

Inspiration

This award celebrates a team that is empowered by their FLL experience and displays extraordinary enthusiasm and spirit.

Teamwork

This award recognizes a team that is able to accomplish more together than they could as individuals through shared goals, strong communication, effective problem solving and excellent time management.

Gracious Professionalism™

This award recognizes a team whose members show each other and other teams respect at all times. They recognize that both friendly competition and mutual gain are possible, on and off the playing field.

Judges Awards

During the course of competition the judges may encounter teams whose unique efforts, performance or dynamics merit recognition. Some teams have a story that sets them apart in a noteworthy way. Sometimes a team is so close to winning an award that the judges choose to give special recognition to the team. Judges Awards allow the freedom to recognize remarkable teams that stand out for reasons other than the Core Award categories.

Examples include:

Against All Odds *or* Overcoming Adversity *or* Perseverance

This award goes to the team that improvises and overcomes a difficult situation while still making a respectable showing, with an attitude that shows, “We can overcome incredible odds if we never give up, no matter what!”

Rising Star

This award recognizes a team that the judges notice and expect great things from in the future.

Special Recognition Awards

Outstanding Volunteer Award

The FLL program would not exist without its volunteers. This award honors an extraordinary volunteer(s) whose dedication to the FLL program has a positive impact on the team experience.

Adult Coach/Mentor Award

Many teams reach significant milestones thanks to their close relationship with an adult mentor. This award goes to the coach or mentor whose wisdom, guidance, and devotion are most clearly evident in the team's discussion with the judges.

Young Adult Mentor Award

FLL presents this award to the young adult, high school or college mentor whose support, impact, inspiration, and guidance are most clearly evident in the team's discussion with the judges.

Robot Design Sample Questions

Mechanical Design

Durability

- How did you get your robot to stay together?
- How often does your robot fall apart? What happens and have you thought about ways to fix this?

Mechanical Efficiency

- Would it be possible to use fewer pieces or components for your robot and still accomplish the same missions?
- If your robot has attachments, tell us about them.

Mechanization

- Tell us about how your robot uses attachments or other mechanisms to complete missions.
- Describe how your robot moves from place to place, or overcomes obstacles, and balances speed and power.

Programming

Programming Quality

- What program do you feel is your best? Why?
- Do your robot's programs achieve the same result every time? If not, why do you think this might happen?

Programming Efficiency

- What did you do to make your programs more understandable and easier to use?
- What mission is your favorite? Explain the steps in the program for that mission.

Automation/Navigation

- Would you explain how your robot turns (or travels a specific distance, or goes from base to a specific destination)? How satisfied are you with this?
- As your robot moves around the field, was there one area that was more difficult to navigate than another? If so, what did your team do to overcome this challenge?
- Would you explain which sensors you used, and how and why you used them?
- Would you explain how your robot knows where it is on the field? Note: Sensing includes not only touch and rotation sensors, but time (timers in the RCX) and passive sensing such as referencing to walls or other objects, etc.

Strategy & Innovation

Design Process

- What was the greatest design or programming difficulty you encountered? How did you solve that problem?
- How did you test your designs?
- Describe one way your robot got better over the course of the season.

Mission Strategy

- How did your team decide which missions to tackle?
- How many of the missions has ***this*** robot completed successfully in a single match (includes a tournament match, a tournament practice, or home practice)?
- We want to consider the overall strategy behind your robot's design. Tell us about your robot, its attachments and sensors and the missions the robot attempts so that we will understand your team's design strategy.
- Which attachments are most difficult to put on and/or take off?

Innovation

- What part of your design, program or strategy do you think is unique to your team?
- How did you come up with the idea?

Look For:

- Unusual strategy, programming or design.
- Propulsion or steering methods or functional aspects that no one else has or you are surprised someone would try.
- Robot is able to effectively perform the same task over and over.
- Parts or functional aspects that make something difficult look very easy.
- Parts or mechanisms that perform several functions.
- Propulsion, steering methods or functional aspects that work, but children have no understanding how.
- Children can describe what the robot will do based on the program.
- Does the team look to the coach for answers or are they focused on the robot and judges?
- Noteworthy observations about FLL Core Values to share with the judging team.

Robot Game — Field Setup

The field is where the Robot Game takes place.

- It consists of a field mat, on a table, with mission models arranged on top.
- The field mat and the LEGO® pieces for building the mission models are part of your Field Setup Kit.
- The instructions for building the mission models are on a CD, in the same box as the LEGO pieces.
- The instructions for how to build the table and how to arrange everything on it are in this document.

TABLE CONSTRUCTION

The Robot Game takes place on a specially designed table, so you'll need to build one to practice on if you don't already have access to one. With safety, weight, height, and cost in mind, a simple design is offered here, but as long as your surface is smooth, and your border walls are located properly, how you build the understructure is up to you. The construction is simple, but does require some wood-working skills.

At a tournament, two tables are placed back to back, but you only operate on one table, so you only need to build one table to practice on. However, since a tournament setup has a double wall at the interactive area where the two tables meet, practice tables need an extra wall of type B on the corresponding side. So here are the instructions for building one "half-table" including a double north wall:

Materials

Material	Quantity
Field Setup Kit (mission model LEGO elements, mat, CD, Dual Lock™)	1
sanded plywood (or other very smooth board) 96" X 48" X at least 3/8" (2438mm X 1219mm X 10mm)	1
two-by-three, 8' (2438mm) [actual cross-section = 1-1/2" X 2-1/2" (38mm X 64mm)]	6
flat black paint	1 pt. (1/2 L)
coarse drywall screws, 2-1/2" (64mm)	1/2 lb. (1/4 kg)
saw horses, about 24" (610mm) high and 36" (914mm) wide	2

Parts

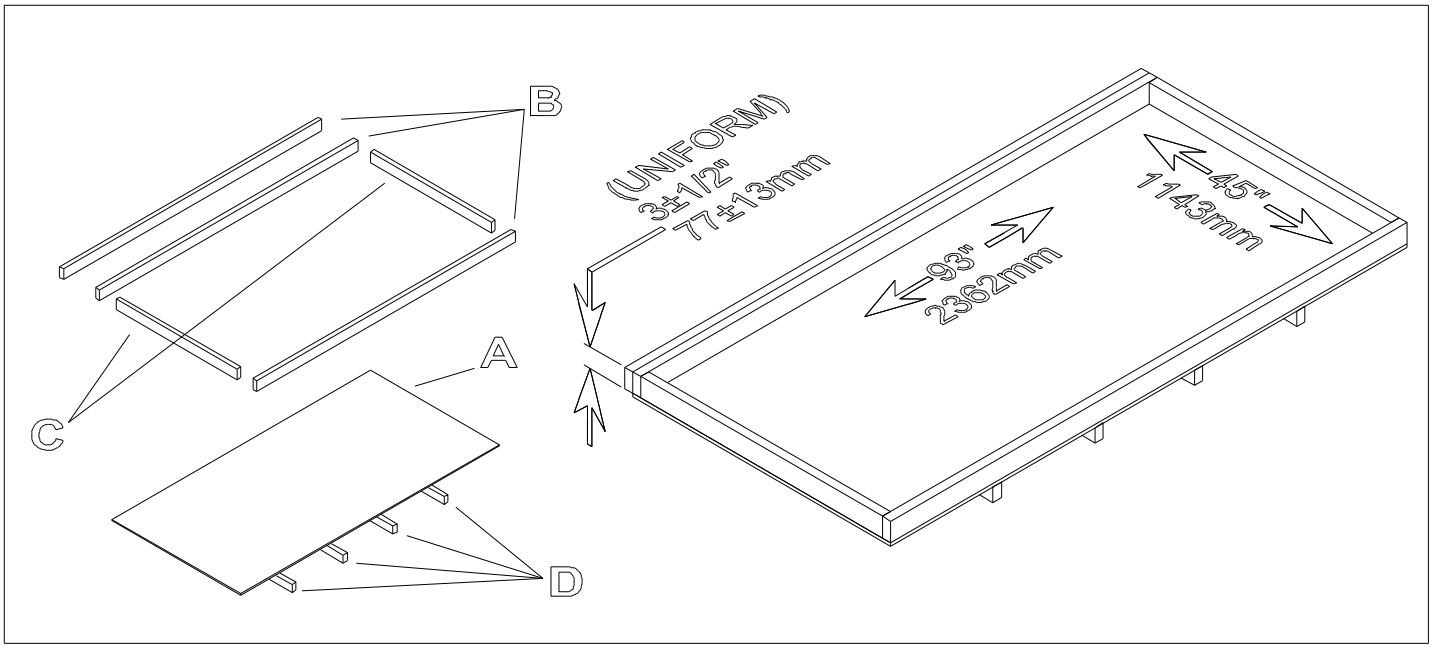
Part	Make From	Dimensions	Paint	Quantity
table surface (**A**)	plywood	96" X 48" (2438mm X 1219mm)	no	1
long border wall (**B**)	two-by-three	96" (2438mm)	yes	3
short border wall (**C**)	two-by-three	45" (1143mm)	yes	2
stiffener (**D**)	two-by-three	48" (1219mm)	no	4
saw horse	purchase	H ≈ 24" (610mm) W ≈ 36" (914mm)	no	2

Assembly

Step 1 - Determine which face of the plywood (**A**) is least smooth, and consider that the bottom face. On the bottom face, locate, clamp, and screw on the stiffeners (**D**) (about every 18 inches or 457mm). Be sure screw head tops are flush. Sand any splinters.

Step 2 - On the top face of the plywood, locate, clamp, and screw on the border walls (**B**,**C**) around the top perimeter. The wall-to-wall dimensions must measure 93±1/8" by 45±1/8" (2362±3mm by 1143±3mm), and the height of **B** and **C** must measure 3±1/2" (77±13mm), with all border walls being the same height as each other.

Step 3 - With the help of another person, place this table top on short saw horses (or milk crates, or anything else short and solid).



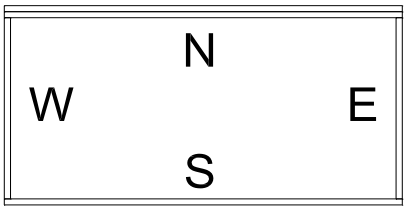
FIELD MAT PLACEMENT

Step 1 - Vacuum the table top. Even the tiniest particle under the mat can give the robot trouble. After vacuuming, run your hand over the surface and sand or file down any protruding imperfections you find. Then vacuum again.

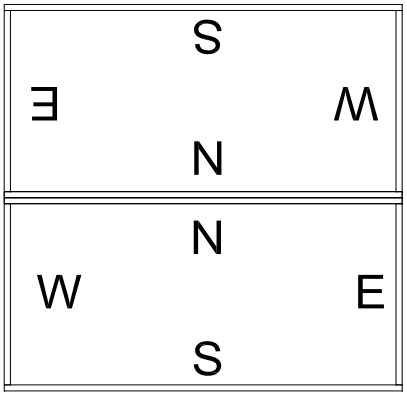
Step 2 - On the vacuumed surface (never unroll the mat in an area where it could pick up particles), unroll the mat so the image is up and its north edge is near the north/double border wall (note the location of the double wall in each table sketch below).

Step 3 - The mat is smaller than the playing surface by design. Slide and align it so that there is no gap between the south edge of the mat and the south border wall. Center the mat in the east-west direction (look for equal gaps at left and right).

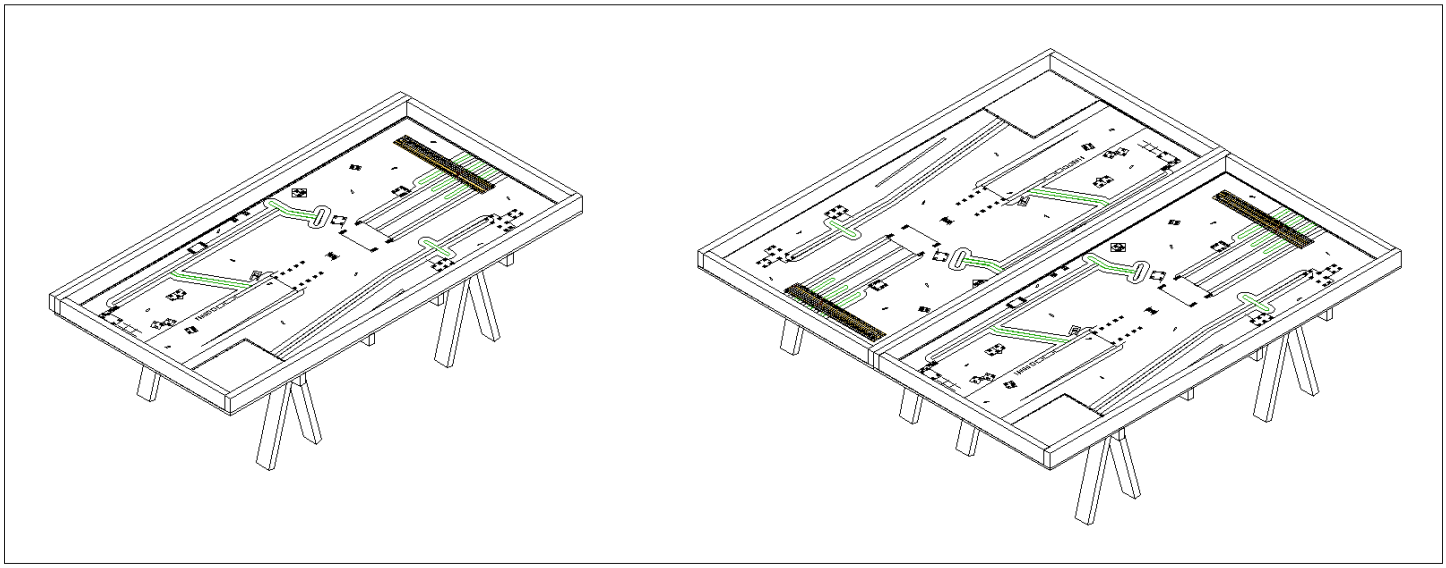
Step 4 - With help from others, pull the mat at opposite ends and massage out any waviness away from the center and re-check the requirement of Step 3. It is expected that some waviness will persist, but that should relax over time. Some teams use a hair dryer to speed the relaxation of the waviness.



PRACTICE ("HALF TABLE")



TOURNAMENT ("FULL TABLE")



MISSION MODEL CONSTRUCTION

Build the mission models - Use the LEGO elements and instruction CD from your Field Setup Kit. It will take a single person three to four hours to do this, so it's best done in a work party. For any team members with little or no experience building with LEGO elements, mission model construction is a great way to learn. This step is also a nice time for new team members to get acquainted with each other.

MISSION MODEL ARRANGEMENT AND SETUP

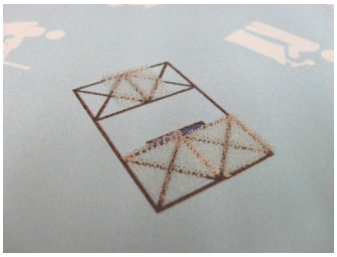
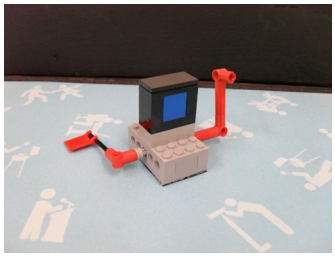
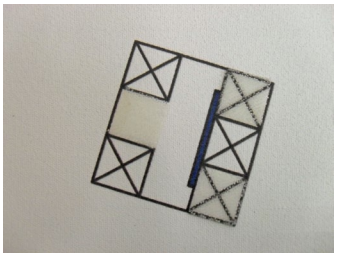
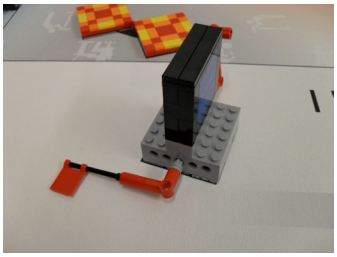
Dual Lock

Some models are secured to the mat, others are not. Where a model needs to be secured, the connection is made using the re-usable fastening material from 3M called Dual Lock, which comes in the flat clear bag with the LEGO elements in your Field Setup Kit. Dual Lock is designed to stick or "lock" to itself when two faces of it are pressed together, but you can unlock it too, for ease of transport and storage. The application process for the Dual Lock is only needed once. Later, the models can simply be locked onto the mat or unlocked. To apply Dual Lock:

Step 1 - Stick one square, adhesive side down, on each box you see on the mat with an "X" in it (Exception: Senior Solutions design changes after mat production allow for less Dual Lock than originally shown. Omit as described below.)
Step 2 - Press a second square on top of each of those, "Locking" them on, adhesive side up. TIP: Instead of using your finger, use a bit of the wax paper the squares came on.
Step 3 - Lower the model onto the squares.
CAUTION - Be sure to place each square precisely on its box, and each model precisely over its marks.
CAUTION - When pressing a model down, press down on its lowest solid structure instead of crushing the whole model. Pull on that same structure if later you need to separate the model from the mat.
TIP: For large and/or flexible models, apply only one or two sets at a time.

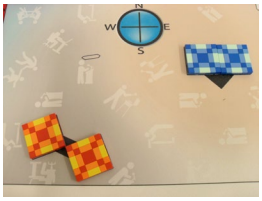
(**NOTE**: The rings in the pictures below are not part of setup and don't come in your kit – they're just in the pictures to help show areas of no Dual Lock.)

VIDEO SCREENS – For each screen, Dual Lock in 3 places as shown in the pictures. Set position is with the flag laid back and out as shown.

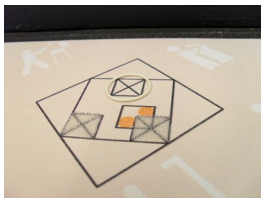





QUILTS – Dual Lock in 5 places for the blue pair and 6 places for the other pair, as shown on the mat.
GARDEN – Dual Lock in 2 places as shown in the picture. Omit the pair indicated by the ring. Orient with the brown crate over its mark on the mat. Number, shape and placement of the flowers on their base is non-critical and allowed/ expected to vary. The crate's contents are also non-critical.
STOVE – Dual Lock in 4 places as shown on the mat. Set position is with the two red burners showing.
COOPERATION – Dual Lock in 4 places as shown on the mat. Set position is with the pointer leaning east.

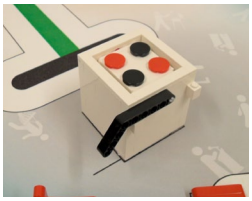
QUILTS



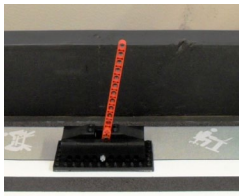
GARDEN



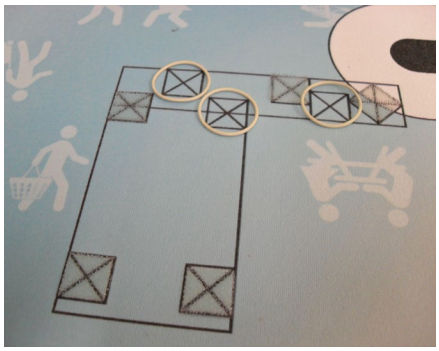
STOVE

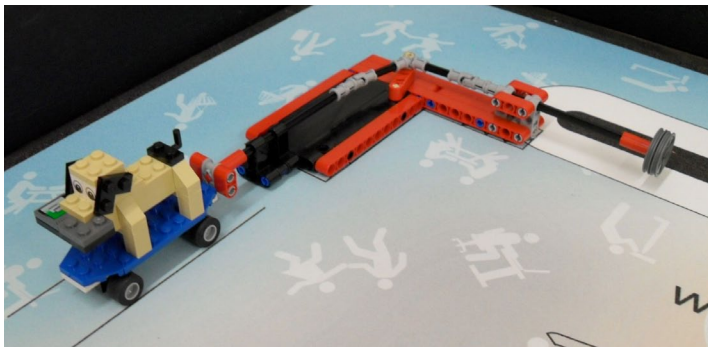


COOPERATION

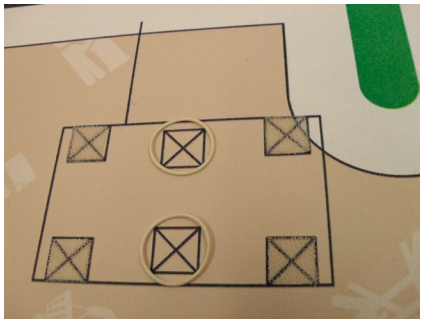


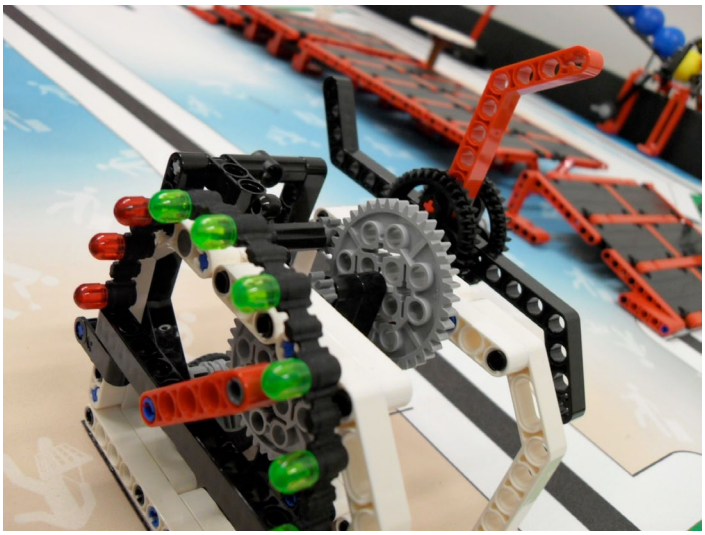
DOG – Dual Lock in 5 places as shown in the picture. Omit the pairs indicated by the white rings. Set position is with the gray disc pulled all the way east, and with the skateboard accurately placed between its location lines, in contact with the south ram. Activate and reset by pushing/pulling on the gray disc only. Don't try to push the south ram north.



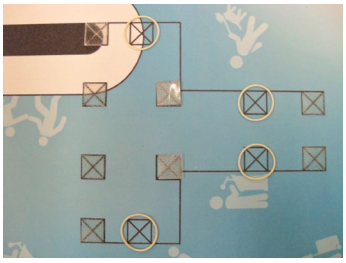


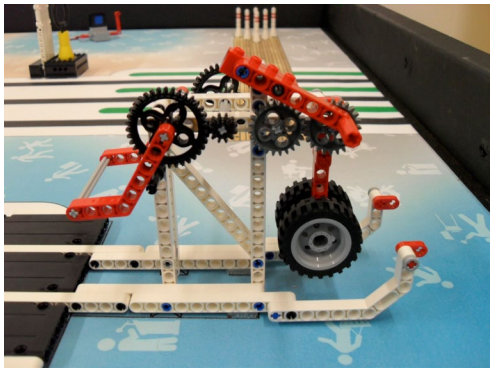
CARDIO MACHINE – Dual Lock in 4 places as shown in the picture. Omit the pairs indicated by the rings. Set position is with a RED pinwheel arm UP AND the pointer exactly aligned with the 3rd green light



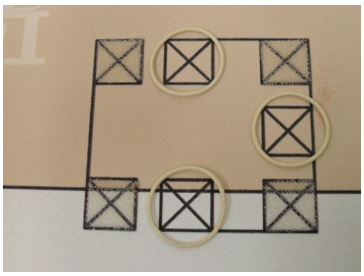


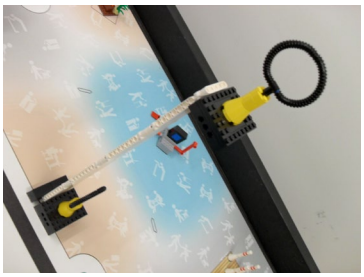
WEIGHT MACHINE – Dual Lock in 8 places as shown in the picture. Omit the pairs indicated by the rings. Set position is with the wheel hanging directly down, and with the ratchet/catch lever resting on the east side as shown.





SHELVES – Dual Lock in 4 places as shown in the picture. Omit the pairs indicated by the rings. Setup position is with one loop accurately centered on each shelf. The lower loop is parallel with the white panels, the upper one is 90° from the panels. Loops must be vertical and not distorted.





CHAIR AND TABLE – Dual Lock in 4 places as shown on the mat. Setup position is with the chair aligned accurately with its mark and "broken" as shown. The south side of the small part swings west. Both black connecting pins are in the small part, but only the north pin is in the large part.

UNRELATED – Please ignore the model on the left if you see it. It doesn't come in your kit, shouldn't be on your field, and pretty much has nothing to do with anything. It is a patently useless model from 2011, whose breathtaking insanity is exceeded only by its off-the-wall aggression. Unfortunately, problems with this enormously irritating troublemaker have escalated severely over the last 9 months to the point where the even the authorities are afraid. Be careful not to confuse the unstable nuisance with the character on the right, known to be agreeable, intelligent and funny, though still profoundly inconsequential. Finally, please ignore this entire paragraph if it confuses you in any way.

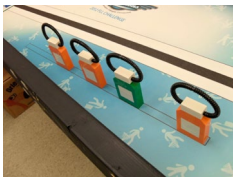
COMBATIVE

OKAY

BOWLING PINS – Place on their marks accurately. Check for straightness (press lengthwise) with every reset.

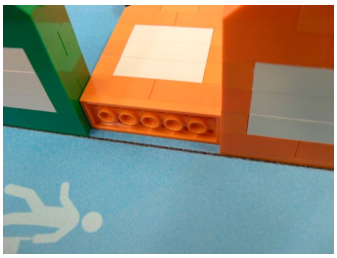
MEDICINE BOTTLES – Place bottles accurately within their marks, but in random order of color, and at random locations along the length of the marks, except that they must be spaced at least one unit of their own width from each other. The white labels face south. Loops must be vertical and not distorted.

RANDOM

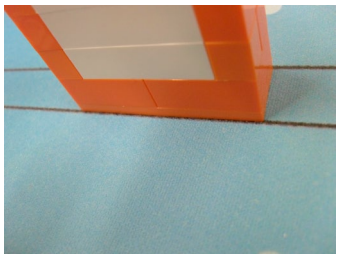


RANDOM

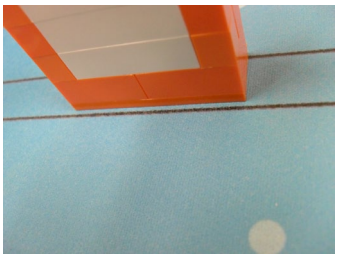
MINIMUM SPACING



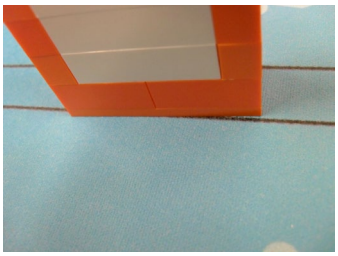
ACCURATE ALIGNMENT



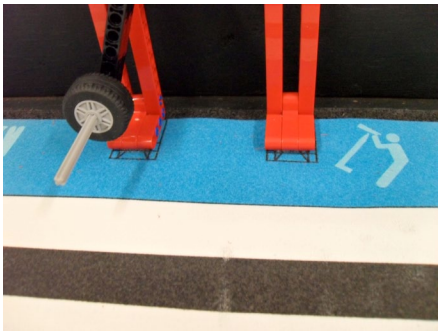
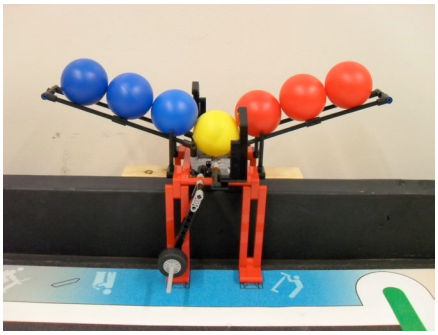
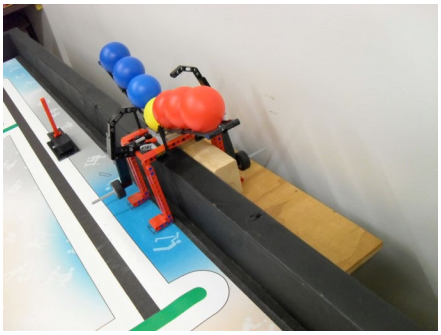
BAD



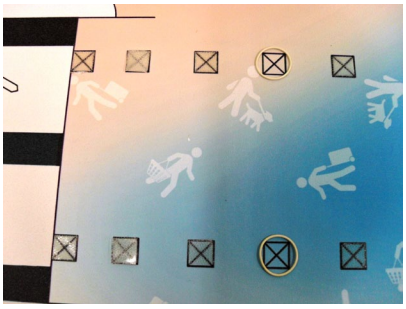
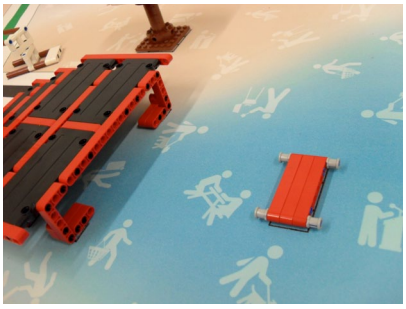
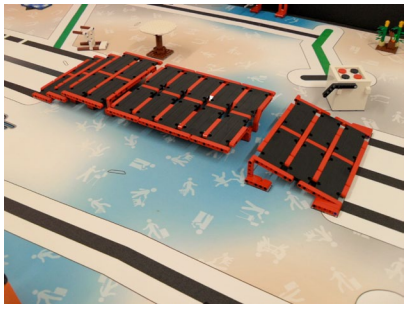
BAD



BALL RACKS – At a tournament, this model is centered exactly and shared by two back-to-back fields. If you have only one field for practice (which is normal, and all you need), this model extends half off the north center of your field, so you need to place one or more boards as needed to support that side evenly. Dual Lock in 2 places as shown on the mat, and 2 more places as needed on the other side. Place balls as shown. The center ball must be yellow, and the other balls must be segregated by color – but it doesn't matter which side has which color.

TRANSITIONS – For the stairs, Dual Lock in 8 places as shown in the picture. Omit the pairs indicated by the rings. For the platform's anchor, and the ramp, Dual Lock in 2 places and 8 places respectively, as shown on the mat. Center the tipping platform so it's trapped over its anchor. The platform should align with the stairs and ramp, and tip north or south, but not slide anywhere.

BASE – Place the remaining 4 quilt squares, plants, and yellow ball in Base. It doesn't matter how they're placed there, since you're allowed to move things around in Base and other storage areas any time.

REFERENCE LEFT SIDE VIEW

REFERENCE RIGHT SIDE VIEW

FIELD MAINTENANCE

- **Border Walls** - Remove any obvious splinters, and cover any obvious holes.
- **Field Mat** - Make sure the mat touches the south border wall, and is centered east to west. Avoid cleaning the mat with anything that will leave a residue. Any residue, sticky or slippery, will affect the robot's performance compared to a new mat (many tournaments use new mats). Use a vacuum and/or damp cloth for dust and debris (above and below the mat). To get marks off, try a white-plastic pencil eraser. When moving the mat for transport and storage, be sure not to let it bend into a sharp kink point, which could affect the robot's movement. Tournaments using new mats should unroll the mats as far in advance of the tournament day as possible. For added control at the east or west edges of the mat, tape is allowed, with a maximum of ¼" (6 mm) overlap. Foam tape is not allowed.
- **Mission Models** - Keep the models in original condition by straightening and tightening solid connections often. Ensure that spinning axles spin freely by checking for end-to-end play and replacing any that are bent.

Robot Game — Missions

KEEP IN MIND: You LOVE a senior. You will BE a senior. The Senior Solutions℠ challenge is about concepts that affect everyone, directly and indirectly, both now and later.

Seniors need and want the same things they did when they were young – the same things YOU want. They want to be:

INDEPENDENT – to do what they want, when they want, the way they want (no matter where they live)
ENGAGED – to feel needed, and productive, and to have fun
CONNECTED – to have meaningful relationships with family and friends

Seniors have wisdom and perspective, from a full lifetime of experience. The problem is that the older we get, the more difficult life gets. We lose strength, speed, flexibility, and memory. Our hearing, eye sight, and other senses are diminished. It's harder to get around. Health problems creep in. Loved ones pass away. New technologies are unfamiliar to us…

In the Senior Solutions robot game, you and your robot will manage a mix of challenges and activities related to being independent, engaged, or connected. None of them really has to do with being "old," but a few of them have a harder version and an easier version. As you notice how much harder the hard versions are, and design your robot to master them, imagine what innovative technical designs and improvements you could make in real life that would make life easier for seniors – for your loved ones, and for your future self!

FRIENDLY WARNING: While it's obvious that everyone needs to become an expert on the details of the **Missions** below, it's also EXTREMELY IMPORTANT for everyone, vets as well as rookies, to read the OTHER THREE CRITICAL ROBOT GAME PAGES: **Field Setup** + **Rules** + **Updates** and go back to them repeatedly. Look at the benefits…

TEAMS WHO READ EVERYTHING
— have fewer questions
— have less rework
— have fewer surprises at tournaments
— score higher
— have more fun

TEAMS WHO DON'T
— operate in a fog
— start over and lose time
— learn a lot from… referees
— lose points
— get stressed

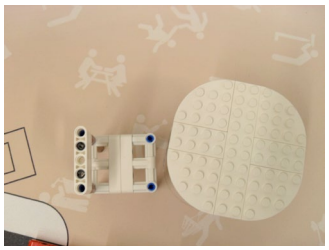
WOOD WORKING

Basic Description: Robot gets the chair to Base. You fix the chair by hand. Robot brings the chair to the table.

PRECISE SCORING CONDITIONS:

— Chair is fixed and in Base: 15
— OR —
— Chair is fixed and any part of it is in the space under the table: 25

Example - NO SCORE



Example - SCORE

MEDICINE

Basic Description: The bottles are arranged randomly before the start of each match (See Field Setup). Robot gets the green medicine bottle to Base without disturbing orange ones.

PRECISE SCORING CONDITIONS:

— Green bottle in Base and no orange bottles obviously moved or angled out of setup position: 25

SERVICE ANIMALS

Basic Description: Robot applies force to gray disc, causing dog with phone to move toward Base.

PRECISE SCORING CONDITIONS:

— Dog is in Base: 20

METHOD RESTRICTION:

— The dog's initial movement to Base must be caused by a push or impact to the gray disc.

BOWLING

Basic Description: Robot sends balls to knock pins down. If the pins are not all down after the first try using a yellow ball, the referee returns that ball to Base for a second try (this can only happen once per match).

PRECISE SCORING CONDITIONS:

— 1 to 5 pins down: 7 EACH

— OR —

— 6 pins down: 60

METHOD RESTRICTION:

— Each pin's fall must be caused by impact from a completely loose and independent ball (not touching or guided by anything at the time of impact) or another loose/independent pin. Pins falling for any other reason are worth 0.

STRENGTH EXERCISE

Basic Description: Robot lifts the west bar to make the weight rise.

PRECISE SCORING CONDITIONS:

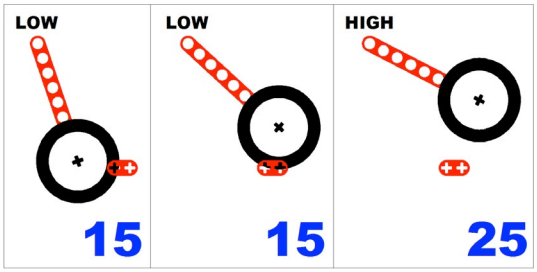
— Weight height equal to or between the ones labeled LOW: 15

— OR —

— Heights equal to or higher than the one labeled HIGH: 25

METHOD RESTRICTION:

— The weight must rise due to the west bar being lifted.



STOVE

Basic Description: Robot gets all burners to show black.

PRECISE SCORING CONDITIONS:

— All 4 burners black: 25

GARDENING

Basic Description: Robot adds to the garden.

PRECISE SCORING CONDITIONS:

— Plant's base touching a white target area: 25

VIDEO CALL

Basic Description: Robot gets the flags to rise.

PRECISE SCORING CONDITIONS:

— Flags all the way up: 20 EACH

QUILTING

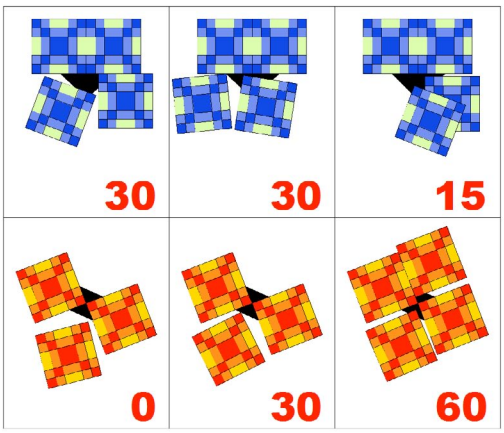
Basic Description: Robot adds squares to quilts.

PRECISE SCORING CONDITIONS:

— Blue quilt squares touching their black target regions: 15 EACH

— ALSO —

— Orange quilt squares touching their black target area: 30 EACH



CARDIOVASCULAR EXERCISE

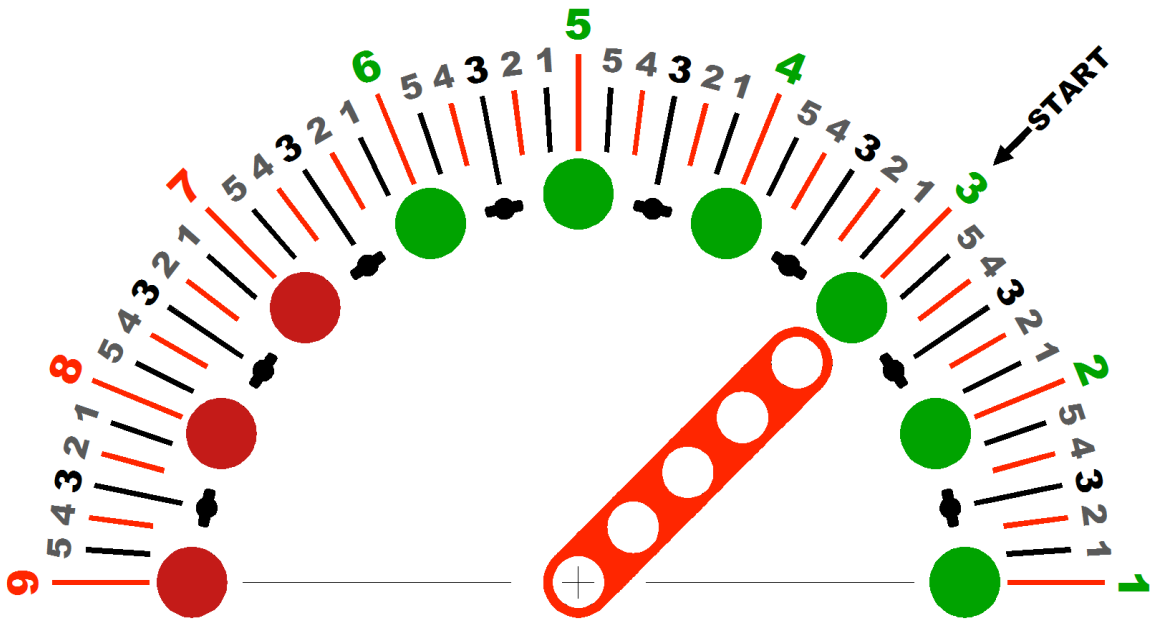
Basic Description: Robot turns the pinwheel 90° at a time.

PRECISE SCORING CONDITIONS:

— Points are shown in red on the chart.

METHOD RESTRICTION:

— Between every click of the wheel and the next, the robot must get completely into Base at least once.



POINTER POSITION	POINTS
9-0	118
8-5	117
8-4	116
8-3	115
8-2	114
8-1	113
8-0	112
7-5	111
7-4	110
7-3	109
7-2	108
7-1	107
7-0	106
6-5	103
6-4	100
6-3	97
6-2	94
6-1	91
6-0	78
5-5	75
5-4	72
5-3	69
5-2	66
5-1	63
5-0	60
4-5	55
4-4	50
4-3	45
4-2	40
4-1	35
4-0	30
3-5	25
3-4	20
3-3	15
3-2	10
3-1	5
3-0	0
2-5	-5
2-4	-10
2-3	-15
2-2	-20
2-1	-25
2-0	-30
1-5	-35
1-4	-40
1-3	-45
1-2	-50
1-1	-55
1-0	-60

FLEXIBILITY

Basic Description: Robot gets yellow loops to Base.

PRECISE SCORING CONDITIONS

Yellow loops in Base: 20 EACH

TRANSITIONS

Basic Description: Robot gets onto the center platform and is there when the match ends.

PRECISE SCORING CONDITIONS:

— Robot touching tilted center platform only: 45

— OR —

— Robot touching balanced center platform only: 65

For either case:

The center platform must not be touching anything but the mat and the robot.

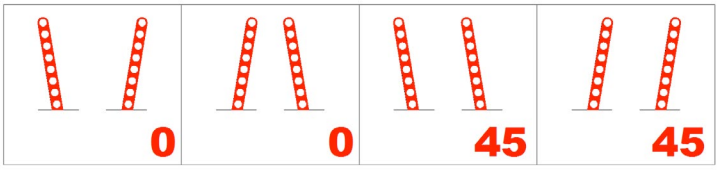
The center platform must remain between the stairs and the ramp.

SIMILARITY RECOGNITION AND COOPERATION

Basic Description: Robot aligns your pointer with the other team's pointer.

PRECISE SCORING CONDITIONS:

— Pointer on your field is parallel with pointer on other field (direction doesn't matter): 45



BALL GAME "FUTURE EFFECTS OF OUR CURRENT DECISIONS"

Basic Description: Both teams get points for the total number of balls on the racks at the end of the match, but only one team gets points when their color is at the center.

SCORING CONDITIONS

Balls on the racks (all balls, center + sides, any color, added together): 10 EACH FOR BOTH TEAMS

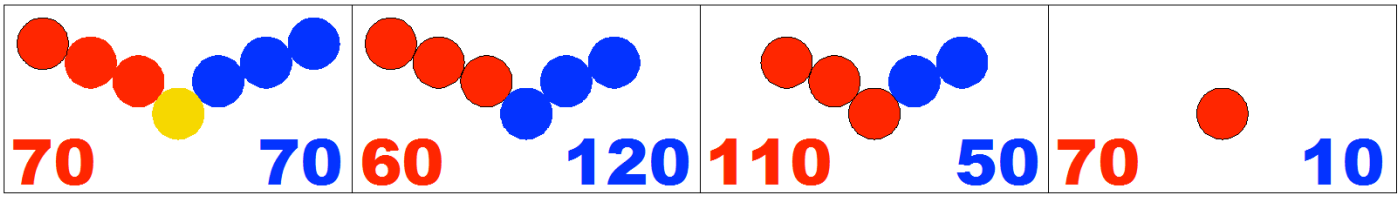
— ALSO —

Your color ball in the center position: 60 FOR YOUR TEAM ONLY

METHOD RESTRICTION:

— A push of the lever is the only allowable way for your robot to cause a ball of the other team's color to fall.

— Only one ball of the other team's color is allowed to fall for any push of the lever by your robot.



FACT: Referees note the current number of balls left at all times.

FACT: If the ball game model becomes jammed, broken, or drops any ball other than the center position, this will be known as a "glitch."

If a glitch is caused by either of these reasons:

- **your robot pushes the lever on your side eastward, but too fast, too far, or not far enough…**

— OR —

- **your robot interacts with the model in any other way than pushing the lever eastward the appropriate speed and distance…**

— Both teams get credit for whatever balls were left on the rack before this happened.

— The other team (only) gets credit for center position (60).

If the referee determines that a glitch has occurred due to the model's design, setup, or maintenance, both parts of the ball game mission are frozen and score as follows:

- **Both teams get credit for whatever balls were left on the rack before this happened.**
- **Both teams get credit for center position (60).**

TOUCH PENALTY – If you touch the robot while it's outside Base, the referee clicks the cardiovascular exercise dial one click toward zero.

Robot Game — Rules

(Including Philosophies, Definitions, and Procedures)

1 - GRACIOUS PROFESSIONALISM®

- You are "Gracious Professionals." You are competing hard against PROBLEMS, while treating PEOPLE with respect and kindness - people from your own team, as well people from other teams.
- You build onto other people's ideas instead of resisting or defeating them.

2 - PARTICIPATION

- The maximum allowable team size is ten (10) members, not including coaches and mentors.
- Allowable ages vary by region. Contact your operational partner for specifics if needed.
- At the tournament, only TWO team members at a time are allowed right up at the competition table except during repair emergencies.
- The rest of the team must stay back from the table, but close enough for different members to tag in or out as desired at any time. Exact positioning is decided by the tournament officials.

3 – INTERPRETATION

- Robot game text means exactly and only what it says, so it should be taken literally whenever possible.
- Do not interpret text based on your assumption about intent, or on how a situation might be in "real life."
  - Example: If a mission is to "enter the house," the window is just as valid an entry point as the door.
- If a detail isn't mentioned, then it doesn't matter.
  - Example: If a mission is to "put the cup on the table," upside down is just as valid as right side up.
  - Example: If a mission is to "put one object on the other," it doesn't matter which is on top.
- There are no hidden requirements or restrictions, but there are hidden freedoms, and you're encouraged to find them!

4 – EQUIPMENT

- EVERYTHING you use in the competition area directly or indirectly for strategy (mission-related goals) must be made entirely of LEGO-manufactured elements in original factory condition. Stickers are not allowed, except LEGO stickers, applied per LEGO instructions. Paint, tape, glue, oil, zip-ties, etc. are not allowed.
  - Exception 1: You may reference a paper list to keep track of robot programs.
  - Exception 2: LEGO string and tubing may be cut to length.
  - Exception 3: Marker may be used only in hidden areas, for ownership identification.
  - Exception 4: Carts, trays, and boxes may be used for hand-transport and storage, off the table only.

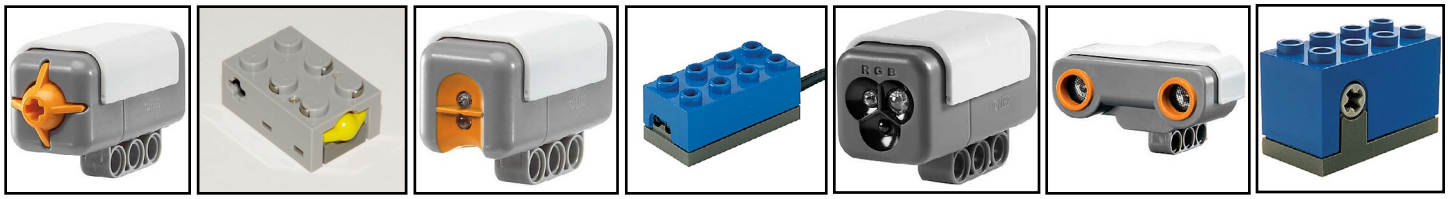
- REGULAR ELEMENTS - You may use as many non-electric LEGO elements as you like, including pneumatics, rubber bands, and string, and they may be from any source or set (MINDSTORMS®/TECHNIC/DUPLO®/ BIONICLE™/STAR WARS™/HARRY POTTER™/etc.). Exception: Factory-made wind-up/pull-back "motors" are not allowed.

- CONTROLLERS - You are allowed a maximum of one controller in the competition area in any one match. Choose one of the two LEGO-manufactured types shown here. No other controller is allowed.

- SENSORS - You are allowed as many sensors as you like, but the types are limited as follows:
  - o They may only be touch, light, color, rotation, or ultrasonic.
  - o They must be LEGO-manufactured MINDSTORMS type as shown here.

  WARNING 1: The fact that a sensor was/is being sold by an official LEGO shopping source does not mean that sensor was made by LEGO.

  WARNING 2: The presence of the LEGO logo on a sensor does NOT mean it was made by LEGO.
  - o Be SURE any sensor you buy or use looks exactly like one pictured here.



- MOTORS - You are allowed a maximum of three MINDSTORMS motors in the competition area. Choose your favorite combination from among the two LEGO-manufactured types shown here. No other motors are allowed.

- Quantity limits don't just apply to what's on your robot "right now." The referee (the "ref") adds up everything you have with you in your boxes, your hands, your trays, and on the table. All of it counts towards your total.
  - o Example: If you have multiple motorized attachments, but it takes two motors to drive the robot, you must find a way to switch that third/last legal motor from one attachment to the next.
  - o A fourth motor in the competition area is not allowed, no matter what.
  - o Even if you plan to run only three motors at a time, a fourth motor is not allowed.
  - o Even as a spare, a weight, or a decoration, a fourth motor is not allowed.
- You may not use more than one robot in any one match, but it's okay to use a different robot in a different match.
- LEGO wires and converter cables are allowed as needed.
- No other electric elements nor devices are allowed for use in any way in the competition area.
- Spare electrical parts are allowed in the PIT area.
- Objects functioning as remote controls are not allowed anywhere, any time.

- NON-ROBOT EQUIPMENT - Your equipment may include LEGO elements or devices other than the robot and its attachments.
  - o Example 1: You may use a frame/"jig" to help aim your robot in Base.
  - o Example 2: The robot may carry a ramp out to help itself cross a barrier.

  If outside Base, such "strategic objects" are left wherever the robot leaves them.

- SOFTWARE - The robot may only be programmed using LEGO MINDSTORMS, RoboLab, or NXT-G software (any release). No other software is allowed. Patches, add-ons, and new versions of the allowable software from the manufacturers (LEGO and National Instruments) are allowed, but tool kits, including the LabVIEW tool kit, are not allowed.

- VIOLATION - If the robot is in violation of the equipment rule and cannot be corrected, the decision about exactly what to do rests with the tournament officials, but it is possible the team may not be eligible for awards.

5 – MISSION

- A mission is one or more achievable objectives/results worth points, as detailed on the "**Missions**" page.
- You decide the order in which to try the missions, and how many to try with each program on the robot.
- You don't have to try every mission.
- You may re-try missions when that's possible, but the field is not reset for that purpose. Example: If a mission is for the robot to topple a stack eastward, and the robot doesn't reach it, you could try again later, since the stack is undisturbed. But if the active robot topples the stack westward, the mission is impossible to re-try, and does not get reset.

6 – MATCH

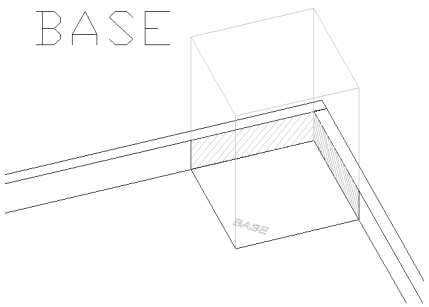
- At a tournament, two robot game fields are joined back to back, and you are paired opposite another team to compete in a match. There are at least three matches. Each match lasts 2-1/2 minutes. Here's the process:
- You get to the competition table and have at least one minute to prepare your equipment.
- The match starts and you start the robot from Base. Once started, the robot is "active" and is understood to be working "autonomously" on missions, under its own power and programming, allowed to grow to any size and go anywhere.
- The robot might get a lot done, or a little, but eventually you are likely to need/want to handle it. For example, it might get stuck, or you might want to add an attachment or unload some cargo.
- If you do decide to touch the robot while it's active, no matter where it is or what it's doing, that makes it "inactive," and it must immediately be carried to Base if it's not already there.
- While the inactive robot is in Base, you prepare it for its next active period, and restart it.
- These steps repeat (often with music, an announcer, and cheering in the background!) until the match end signal sounds. The timer never pauses during a match.
- You play at least three matches a tournament, each one being a fresh chance for you to get your best score.
- No match has anything to do with another, and only your best score counts specifically toward the Robot Performance Award except when breaking ties. "Playoffs" if held, are just for added fun.
- If it is known in advance that you will not have another team opposite you, a volunteer or "house" team substitutes. If not, and you compete against an empty table, you get the points for any missions you tried but could not complete because the other team was missing.
- After the match, no one is allowed to touch anything on the field until the ref has recorded the condition of the field and come to agreement with you (kids only) about what points were scored or missed and why.
- Data is marked on a sheet which you initial, making the sheet final.

7 – ROUND

- The process of cycling all teams through one match each is called a round.

8 – BASE

- Base is an imaginary box formed by vertical walls that rise from the perimeter of the Base area, including the inside surface of the border walls, and by an invisible ceiling 16" (406mm) high.
- This means Base is not just an area on the mat – it's a VOLUME.
- Usually there is a gap between the mat and a side border wall… Base includes this gap.
- Anything even barely in Base counts as being in Base unless the robot moves it completely out.
- Anything in the team's possession is understood to count as being in Base, and is okay to store or handle.



9 – FIELD

- The field is where the robot game takes place. It consists of mission models on a field mat on a table.
- The field mat and the LEGO elements for building the mission models are part of your Field Setup Kit.
- The instructions for building the mission models are on a CD which comes in the same box as the LEGO elements and mat.
- All details about how to set up the mission models after they've been built are on the **Field Setup** page.

10 - MISSION MODELS

- Mission models are the objects that are already on the field when you walk up to it.
- You may not bring duplicate mission models to the table if they could confuse scoring.
- You may not take mission models apart, even temporarily.
- You may not add to nor trap mission models by hand as to cause a failure of the "gravity test."

11 - GRAVITY TEST

- Any time you (by HAND) make an individual mission model touch, trap, or be trapped by ANY other object (including the robot, other team-supplied items, and other models) - Gravity alone should be able to separate them if the heavier were picked up and/or turned over.
- In the case of identical models, it doesn't matter which is picked up.
- The team performs this "gravity test," only if asked by the ref, and only when failure looks probable.
- The ref does not allow a start unless all mission models in Base could pass the gravity test.
- Only if there is no hand-help at all, the ROBOT is allowed to cause models to fail the gravity test.

12 – ROBOT

- The robot is the controller and anything joined with it by hand (any method, any configuration) which is designed not to separate from it except by hand.

13 – CARGO

- Cargo is anything the robot has with it for transport or release.

14 - AUTONOMY - The robot game is played by an "autonomous" robot.

- That means the robot must do its work without any influence/help from you while it's working. You PREPARE the robot, but it PERFORMS on its own.
- The robot is allowed to perform in or out of Base, but preparation must take place in Base.

15 - ACTIVE ROBOT <> INACTIVE ROBOT

- The moment the robot is started, it becomes "ACTIVE," and remains so until the next time you touch/influence it.
- At the moment of that touch, the robot becomes "INACTIVE," and is hand-prepared for restart from Base.

16 – HANDLING

- **Calibration** – During your pre-match setup time only, you may calibrate light & color sensors outside Base.
- **Quality Control** – During your pre-match setup time only, you may ask the ref to double-check that a particular setup is correct/within spec, but you may not request any custom setup, in or out of the specified setup range.
- **Strategic Hand-Action** – Your hands may not directly or indirectly strategically place, extend, roll, topple, drop, throw, eject, slide, shoot, or otherwise send things outside Base. Your hands may not directly or indirectly strategically change the position, motion, quantity, or other status of things outside Base. Only the robot may make strategic changes outside Base.

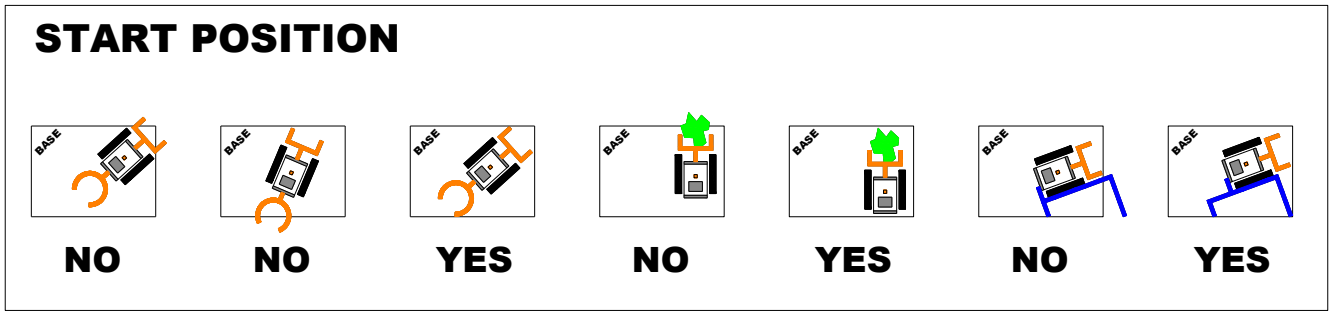
- **Stored Objects** – You may at any time, in Base, or storage areas, handle stored objects the robot is not currently touching or using. Stored objects are not allowed to make contact with anything outside Base except other stored objects, and the movement of stored objects is not allowed to be strategic in any way.
- **Inactive Robot Handling** – During setup, and whenever else the robot is inactive, you may repair it, aim it, switch attachments, select programs, reset features, and load/unload cargo in Base, or other storage areas.
- **Aiming** – You may use a frame/"jig" to aim the robot, but its use must be completely in Base at all times, and you must let go of it prior to starting/restarting.
- **Staging** – You are allowed to place objects in the robot's path, completely in Base only.
- **Chain Reactions** – If moving the robot by hand outside Base will unavoidably allow/cause the movement of any non-cargo object, such as something being "held up" or "held back," the movement of that retained object (the chain reaction) must be kept to an absolute minimum. Allow the stored energy to dissipate slowly over as little distance as possible.
- **Strategic Rescue** – Stopping the robot during a strategically precise window of opportunity for progress toward a mission task is not allowed.
- **Broken Robot** – You may at any time recover pieces of an obviously broken robot.

17 – STORAGE AND WORKSPACE

- Once the ref inspects your equipment, you may store things as needed in Base, or in a box, or by hand, or possibly on a stand, if stands are allowed at your event (decided by your tournament's officials – check with them in advance).
- If you feel crowded in Base, storage and handling of the robot and other objects may extend over/outside Base lines, as long as there is absolutely nothing strategic or disruptive about the placement.
- Mission models and objects worth points in Base must always stay in view of the ref.
- Nothing is allowed on the floor.

18 – START/RESTART POSITION

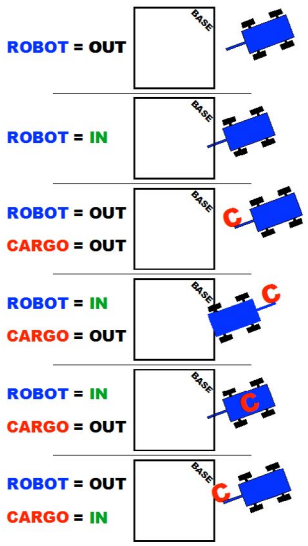
- For the match start and all restarts, EVERY BIT of the robot, including its installed attachments & wires, everything touching it, and any objects it is about to move or use, must ALL fit COMPLETELY in Base.
- The ROBOT MAY be touching objects it is about to move or use.
- YOU may NOT be touching objects the robot is about to move or use.
- YOU may NOT be touching objects the robot is touching.
- Everything must be motionless.
- All mission models in Base must be able to pass the gravity test.



19 – STARTING PROCEDURE

- For the match start, the ref checks that things are in proper starting position, then signals your readiness to the announcer.
  - As the countdown starts, you reach in with one hand, ready to either touch a button, or signal a sensor, to start or resume the robot's program.
  - When you hear the sound, you activate (start) the robot. The exact time to start is at the beginning of the last word in the countdown, such as "Ready, set, GO!"
  - If a non-word signal is used, like a beep or buzzer, the start is at the beginning of that signal.
  - You may not handle the robot or anything it's about to move or use during the countdown, except for the single action needed to get the program running. If you do, the ref has you restart.
- For all other starts (called restarts), there's no countdown. The ref watches to be sure things are in proper starting position, and you activate the robot when you decide.
- If the robot enters and leaves Base with no interruption or influence from you, this is not considered a restart, so starting position is not required.

20 - TOUCH PENALTIES (this rule is about what happens when you touch the robot)



- If you touch the active robot or anything it's touching while the ROBOT is completely outside Base, you get a "touch penalty" (identified in the Missions).
- If you touch the active robot or anything it's touching while its CARGO is outside Base:
  - if the robot had the cargo the most recent time the robot was in Base, the cargo goes back to Base.
  - otherwise the ref keeps the cargo.
- Warning: Avoid touching a robot entering Base until its cargo has also reached Base!
- If the only part of the robot in Base at the time of the touch is a cord, hose, wire, tube, chain, string, or other feature obviously used purely for avoiding a touch penalty, you get a touch penalty anyway.
- In rare situations when the robot is outside Base, straining its motors, and no longer traveling, you may non-strategically shut it off and leave it in place with no penalty.

21 – FAILURE AND LOSS (this rule has nothing to do with you touching the robot)

- Anything (allowable) done to your field outside Base stays that way, unless the ROBOT changes it.
- Objects moved/left outside Base are not replaced or moved out of the way by hand.
- Damage and chaos caused by an active robot are not repaired or reset by hand.
- Cargo the robot loses contact with is left wherever it comes to rest (if it goes off the table, the ref keeps it).
- This means the robot can ruin its own opportunity to accomplish tasks, and it can even spoil previous results.

Exception: Parts not designed to separate from the robot, but which separate due to obviously accidental DAMAGE may be recovered by YOU, by hand, at any time – even if they have cargo (gift: you keep any cargo in question).

22 – MODEL DAMAGE

- This is when a model outside Base is made defective and/or its Dual Lock is separated by an active robot.
- Model damage is not repaired during the match.
- If a model is manipulated into a scoring condition, but gets damaged
  - during the process, the condition is marked scoreless.
  - during an obviously unrelated action later (even seconds later), as long as the scoring condition is visible it can still score.

- Any scoring success which obviously depended on model damage is marked scoreless.
- This means the robot can ruin its own opportunity to accomplish tasks, and it can even spoil previous results.
- Any model damage obviously due to poor setup or lack of maintenance is treated with benefit of the doubt.

23 – REVERSIBILE ACCIDENTS

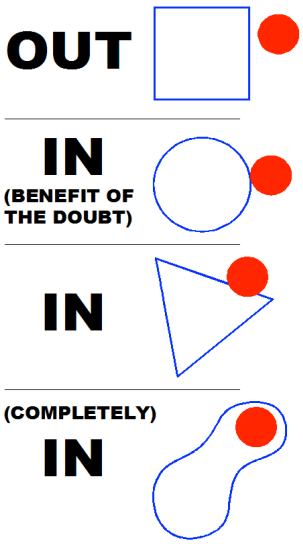
- When things such as a sleeve, table-bump, or illegal action disturb the field in any way, the ref physically reverses the change if he or she feels that's easy. If the change is too hard to undo…
  - o if the accident was the team's fault, negative scoring effects stand, and positive scoring effects do not.
  - o If the accident not the team's fault, the team gets benefit of the doubt on all related scoring questions.

24 - INTERFERENCE

- Your robot may not have any effect on the other team's robot, field, or strategy except near the model(s) shared between both teams, where accidental interference is expected and acceptable.
- If Robot X deliberately blocks or un-scores Robot Y's progress/results, Robot X's mission(s) in that area are marked no score, and Robot Y's are marked as complete.
- If two robots become entangled, they are both allowed to restart without penalty. Any cargo involved is given to the team in Base, whether or not it has ever been there before.
- As a matter of luck, the other team might out-perform you in a competitive interactive mission, or might fail to help you in a cooperative interactive mission. The net effect is the same, and this is not considered interference.

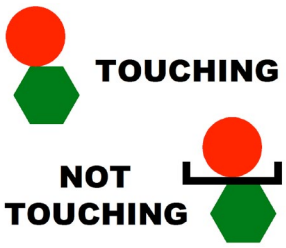
25 – IN

- **A** is "in," "into," or has "reached" **B** if any bit of **A** is directly over or under **B**.
- Barely "in" is considered "in" unless "completely "in" is required.
- **A** can be "in" **B** without touching **B**.
- Objects are ruled on independent of each other, and independent of their transports/containers.
- "Outside" is the opposite of "in" and means completely out.



26 – TOUCHING

- **A** is "touching" **B** only if **A** is making direct contact with **B**. Exception: If **B** were your hand, both examples would count as touching, since even an indirect touch from your hand is considered a touch.
- Any amount of direct contact counts as touching.



27 – SCORING

- Unless a specific method is required, your score is assessed based on the conditions at the exact time the match ends only.
- Points are not given for results the robot produces during the match but then trashes before the end.
- Points are not given nor taken away for results produced after the match end signal ends.
- When a mission is required to be achieved through a specific method, but is achieved by some other method, it is marked scoreless.

28 - AFTER THE MATCH

- No one is allowed to touch anything on the field yet:
- The ref first needs time to record the condition of the field, and come to agreement with you (kids only) about what points were scored or missed and why (and to be sure you're not walking away with any of that field's mission models!). Data is marked on a sheet which you initial, making the sheet final.
- The scores are tallied by computer, with ties being broken using 2nd, then 3rd highest scores. If more than one team gets a perfect score in all regular rounds, tournament officials decide what to do. Options include a variety of playoffs, or simply awarding multiple same-place awards.
- Don't walk away with mission models from the competition area. Bring them back if you do. Thanks.

29 - BENEFIT OF THE DOUBT

- You get the benefit of the doubt when:
  - incorrect/poor model setup or maintenance is the obvious cause.
  - a split-second or the thickness of a (thin) line is a factor.
  - a situation could "go either way" due to confusing, conflicting, or missing information.
  - a ref is tempted to rule based on the "intent" of a requirement or constraint.
  - no one's really sure WHAT just happened!
  - If you (kids, not coach) disagree with the ref and can respectfully raise sufficient doubt in his/her mind during your post-match chat, your ref meets with the head ref, and the resultant decision is final. This rule is not an order for the refs to be lenient, but for them to rule in your favor when they've done all they can to rule correctly, yet the answer's still unclear.

30 - DOWNLOADING

- Downloading programs to robots may take place in the pits only - never in the competition area.
- Always download by cable. Bluetooth must be switched off at all times.

31 – VARIABILITY

- As you build and program, keep in mind that our suppliers, donors, and volunteers make every effort to ensure that all fields are correct and identical, but you should always expect some variability, such as:
- flaws in the border walls.
- variety in lighting conditions, from hour to hour, and/or table to table.
- texture/bumps under the mat.
- presence or absence of tape at the East and West edges of the mat.
- waviness in the mat itself. At many tournaments, it is impossible for the mats to be rolled out in time to lose their waviness. Location and severity of waviness varies. You are being warned here. Consider this while designing.
- Two important building techniques you can use to limit the effects of variability are:
  - Avoid steering systems that involve something sliding on the mat or border walls.
  - Cover your light sensors from surrounding light.
- Questions about conditions at a particular tournament should only be directed to that tournament's officials.

32 - PRECEDENCE/AUTHORITY

- Once in a while, you'll see conflict within or between different robot game documents. So here is the order of precedence for the sources:
  1 = CURRENT **Robot Game Updates**, 2 = **Missions** and **Field Setup**, 3 = **Rules**
- If something on a page conflicts with something else on the same page, the most sensible interpretation is assumed. If two interpretations seem equal, the interpretation most favorable for the team is assumed.

- On all pages, videos and pictures are for guidance and example only. Often they can not express complete information, and are therefore misleading. When there is conflict between pictures/videos and text, the text takes precedence!
- The head ref at a tournament is required to base decisions on the information above, in the order shown above. No other source of information is official, including e-mails from Robot Game Support.

33- ROBOT GAME SUPPORT

- The best first place to go for Robot Game support is the Robot Game Updates page.
- If that doesn't help, expert support is available directly from the designer/author (Scott – Hi!) at **fllrobotgame@usfirst.org** (usual response in 1-2 business days).
- When e-mailing, please state your role in FLL (member, coach, parent, mentor, referee, Partner).
- No question is a bad question, but some are much better than others!
- If it's obvious you're not at least a little familiar with the text of the various important pages, you'll be referred to it.
- If you're not sure how to interpret or apply a particular bit of text, you'll be told how a good referee likely would.
- If you expose missing or problematic text so common or severe as to potentially cause problems at events, an addition, correction, or ruling will be posted on the Updates page.
- Questions organized into short simple parts get the fastest and most useful answers.
- Tournament refs are not obligated to read individual response e-mails.
- No new Robot Game Updates are posted after 3PM (eastern U.S.) on Fridays.
- You won't get help/advice about building or programming (that's your challenge).
- Questions about LEGO product in general get redirected: Instead call (U.S.) 1-866-349-LEGO.
- Questions posted in the discussion forum are not seen nor responded to by Robot Game Support.

WARNING: The forum is great for sharing ideas and getting tips from other teams, but it is not an official source of answers about anything.

34 - COACHES' MEETING

- If a question does come up right before the tournament, your last chance to ask it is at the "Coaches' Meeting" (if there is one) the morning of the tournament.
- The head ref and coaches meet to identify and settle any differences BEFORE the first match.
- For the rest of the day, the ref's calls are final when you leave the table.

CHANGES FOR 2012

- There are no more quantity limits on sensors.
- The robot is defined.
- It's now clearly okay to shut off the robot when you're "done" and not get a touch penalty.