13. Robot Design Judging Materials

ROBOT DESIGN RUBRIC

	Needs Improvement	Fair	Good	Excellent
Innovative Design	Design, drive train, and structure are standard. Manipulators/sensors used in expected ways, if used. Strategy for combining missions expected. Programming written as expected.	Design creative, unique use of drive train or structure. Manipulators/sensors used in unexpected ways, if used. Unique/creative strategy for coordinating missions. Programming tasks used in unexpected ways. (For this category, 1 of the 4 above is demonstrated.)	Design creative, unique use of drive train or structure. Manipulators/sensors used in unexpected ways, if used. Unique/creative strategy for coordinating missions. Programming tasks used in unexpected ways. (For this category, 2 of the 4 above are demonstrated.)	Design creative, unique use of drive train or structure. Manipulators/sensors used in unexpected ways, if used. Unique/creative strategy for coordinating missions. Programming tasks used in unexpected ways. (For this category, 1 done exceptionally or 3 of 4 above demonstrated.)
Strategy, Process, Problem Solving	Uses standard design. No design process (from initial concept through build, test, refinement) communicated. Strategy based only on ease of task - did not maximize time, combine mission tasks or consider points.	Some forethought in initial design. Refinement of robot and programs not communicated. Strategy often based on ease of task - few risks taken. Some consideration of time, mission combinations or maximizing points.	Basic understanding of design process, evidence of conceptual planning, building, testing, refining of robot, manipulators, programs. Effective strategic planning, combining mission tasks, plotting routes, using manipulators and/or program slots.	Communicates complete design process, from initial concept through build, test, and refinement. Excellent/innovative strategy, combining mission tasks, plotting routes, maximizing points.
Locomotion and Navigation	Difficulty going same distance on repeated missions. Too fast for accuracy, or too slow to accomplish mission. Turns inaccurate or inconsistent. Moves between two points inconsistently. No effort to know position on table beyond distance and accurate turns.	Goes defined distances sometimes. Turns sometimes accurate. Sometimes moves between two points consistently. Little or no effort to know position on table beyond distance and accurate turns.	Goes defined distances most of time. Not too fast for accuracy or too slow to accomplish mission. Turns reasonably accurate and consistent. Allows for variables. Moves between two points with reasonable accuracy and consistency. May use various sensors.	Goes defined distances efficiently. Adjusts speed, position sensing for optimum speed and accuracy. Turns accurately and consistently. Allows for variables (battery wear, obstacles). Moves between two points with very good accuracy and consistency. May use various sensors.
Programming	Programs disorganized Programs inefficient Results unpredictable Sensors inadequately used Programs do not accomplish expected tasks Variables, loops, subroutines and conditions defined but unused Children can't describe what run will do.	Programs somewhat organized Programs efficient at completing some tasks Results somewhat unpredictable Programs do some of what is expected Variables, loops, subroutines and conditions, if used, not understood.	Programs organized Programs efficient at completing most tasks Programs do what they're expected to do Sensors used effectively, if used Variables, loops, subroutines and conditions, if used, are needed Children can describe most of mission.	Programs logically organized Programs very efficient Programs always work, even for complex tasks Sensors, if used, guarantee certain actions in every trial Programs work in competition as in practice Variables, loops, subroutines and conditions, if used, are effective Children can describe mission and reference the program.

ROBOT DESIGN RUBRIC (cont.)

	Needs Improvement	Fair	Good	Excellent
Children Did the Work	Little knowledge of why some parts are located as they are on the robot. Little or no understanding of what pieces did. Building/programming appears primarily done by coach.	Knowledge of robot structure and programming shows minimal understanding of underlying design, science, and technology (age specific expectations). Building and programming seems primarily directed by coach.	Knowledge of robot structure and programming shows moderate understanding of underlying design, science, and technology (age specific expectations). Building/programming mostly directed by team members, with help from coach.	Knowledge of robot structure and programming shows thorough understanding of underlying design, science, and technology (age specific expectations). Building/programming was done by team members.
	Okay for team members to have different roles, as long as work is done by children.			
Structural	Difficulty with robot assembly during demo. Base weak, falls apart when handled or run. Attachments, if used, weak and fall apart often; difficulty completing task; or overly complex. Robot design from book, little modification by team.	Robot assembly done with few errors. Robot base structure has some stability Attachments, if used, difficult to apply; and/or not modular; not precise or not repeatable. Robot shows signs of team's design ideas.	Slow robot assembly, with no errors. Robot base stable, but not robust. Attachments, if used, modular; function most of the time; and/or take some time to assemble; somewhat precise and/or repeatable. Robot designed by team	Robot assembles easily. Robot base stable and robust. Attachments, if used, modular, function as expected and easily added/removed from robot. Robot displays wide range of capabilities. Attachments, if used, perform tasks extremely well and are repeatable. Robot designed by team; design is unique and creative.
Overall Design	Robot lacks most critical design components: works, stays together, efficient parts use, attachments easy to add/remove, simpler than comparable robots. Few components work together; few components look like they belong together.	Robot lacks many critical design components: works, stays together, efficient parts use, attachments easy to add/remove, simpler than comparable robots. Some components work together; some components look like they belong together.	Robot lacks some critical design components: works, stays together, efficient parts use, attachments easy to add/remove, simpler than comparable robots. Most components work together; most components look like they belong together.	Robot is elegant, complete system. All components work well together. All components look like they belong together.

Robot Design & Programming Questions
Strategy, Process, Problem-Solving Questions
What was the greatest design or programming difficulty you encountered? How did you solve that problem?
Innovative Design Question
What part of your design, program or strategy do you think is unique to your team? How did you come up with the idea?
Locomotion & Navigation Questions
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?
Would you explain which sensors were used? Why? How? (If no sensors were used) 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.
Children Did the Work Question
How did your coach help the team be successful?
Programming Question
What mission is your favorite? Explain the steps in the program for that mission.
Structural Questions
How did you get your robot to stay together?
If your robot has attachments, tell us about them. Which attachments are most difficult to put on and/or take off?
Overall Design Questions
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 design of your robot. Tell us about your robot, its attachments and sensors and the missions the robot attempts so that we will understand why your robot has a good overall design.
Additional Questions
Show me the run that uses this part.
What jobs/roles did each child have on the team?
What program are you particularly proud of? Why?
Show me the program for your favorite run.
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 of steering methods or functional aspects that work and you have no idea 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?