

# CPE 470/670 – Autonomous Mobile Robots

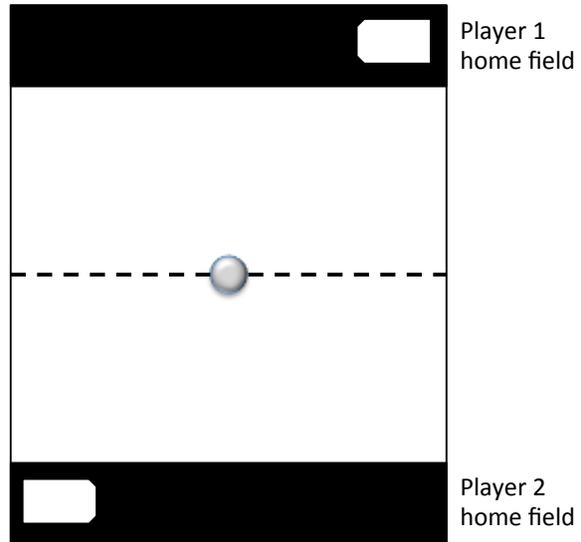
Instructor: Monica Nicolescu

Fall 2014 - Final Contest

## ROBO SOCCER

The final competition is a robot soccer game, a variation of soccer adapted for play by robots. This is a two-robot challenge. Robots will perform on a flat, white playing field. One soccer ball (a HiTechnic Infrared Electronic Ball) is present in the middle of the field at the beginning of the game. The goal of each robot is to score as many goals as possible in the other player's home field. The figure on the right shows the playing table.

Pairs of robots play against each other in a *double elimination* format competition in games that last 2 1/2 minutes.



### Competition Format

The competition is of a double elimination format. That is to say, a robot is not out of the competition until it loses twice.

Initially the robots are paired and each play one game. Consequently, each robot is then assigned to either the "winners bracket" or the "losers bracket". Games then continue to be played with winners playing winners and losers playing losers. When a robot playing in the winners bracket loses a game, it is sent down to the losers bracket. When a robot playing in the losers bracket loses a game, it is out of the competition (because it is the second time in a row that it lost a game).

Eventually there is only one robot left in each of the two brackets and they then play off against each other in the final. If the robot from the losers bracket loses this game, then it its second loss and the competition is over. But if it wins this game then an additional final game is necessary because at this point the robot from the winners bracket has only lost one game.

### Rules (subject to minor changes)

1. Each game will last 2 1/2 minutes and losing robots will be eliminated using the "double elimination" scheme.
2. The robots will start in a home location at opposite corners of the arena. Each robot will be facing as shown in the figure.

3. A robot must be properly positioned in its starting area and be ready to play within one minute of its game being announced, or the referee may declare the robot to have forfeited the game.
4. Each game is started by the referee and the robots should be able to begin playing at the referee's start command.
5. The robots are awarded a point for each time they place the ball in the other robot's home field. The ball is considered "IN" if its center passes the black line marking the opponent's home field.
6. In the event of a tie the robots will shoot 5 penalty kicks each. For this, the ball will be placed at the middle of the field (same as the starting position) and the robots will be placed in the middle of their own field, facing the ball. The robots will take turns taking the kicks: one robot aims to score while the other tries to defend its home field and block the shot. The robots will be placed as follows: the defender will be in the middle of his home field, facing the center and the kicker can be placed at any distance in the other half of the field, but has to be directly behind the ball and facing directly the opponent. **Note:** The robots could be placed in front of the black area, with the back of the robot touching the edge of the black stripe. If the score is tied after the first 5 penalty kicks, the robots will keep shooting 1 penalty kick each until one robot fails to score.
7. The robot's physical design must be such as not to impede access to the ball for the other robots. If a gripper design is used for the front to guide the ball, then the ball should not be able to go in between the gripper by more than a half (that is, the arms of the gripper should be short enough not to go over the mid-section of the ball).
8. Neither the robot's hardware nor its software may be changed in any way once the competition has begun, except for the replacement of failed or detached components.
9. Robots that engage in behavior that the referee considers likely to damage their opponent will suffer expulsion from that game and be awarded zero points for that game.
10. No adhesive of any form may be used for any purpose except the attachment of non-structural decoration. Violators will be removed from the playing surface and will receive zero points for the game.
11. Robots should completely fit into the black starting area.
12. **Robots will at all times refrain from unsportsmanlike conduct.** This includes ramming, spearing, kicking, biting, swearing, and spitting. Any robot that engages in unsportsmanlike conduct will be removed from the playing surface and will receive zero points for the game.
13. Robots that get stuck in any way that, in the opinion of the referee, prevents a competing robot that is trying to gain access to the ball will be translated into its home area by the referee. "Translated" means to be lifted, moved without rotation, and then placed un-rotated in the home area. Power will not be cycled. No form of reset will be permitted. Note that "stuck" includes both the case where the robot is not moving and also the case where the robot is moving but fails to grant access to the ball to the other robot within a time that the referee considers reasonable.

14. One robot may not "hold" another. Holding occurs when one robot is applying pressure to another robot that is in contact with anything else and fails to cease that application of pressure within a time that the referee considers reasonable. A violating robot will be translated to its own home base.
15. Once a game has started, the robots may not be touched, except for separation, expulsion and translation by the referee, except that a team may request the referee to remove its robot from the field of play to prevent additional damage to it and a team may request the referee to power down their robot (to conserve its batteries) if it has become non-functional and is stationary.
16. The referee may declare a game void for any reason (but not for no reason!) providing that the game's score has not been officially posted.
17. Robots may be decorated with additional Lego mini-figures, as long as the decoration is completely non-functional.
18. All of the referee's decisions are both right and final!