THE UNIVERSITY OF ALABAMA® | College of Engineering Computer Science

2017 Alabama Robotics Competition

May the Source Be With You!

You are a new Jedi who has been assigned three important tasks! You must first acquire a new lightsaber and then go on to repair some droids and help rescue your friend Rey!

Competition Rules and Problems

The following pages provide a description of each event and an overview of how points are scored. The overall ranking for the awards ceremony is determined by the total of all three events. A tie-breaker will occur at the end of the contest, if needed. Each event will have two separate playing field instances to improve waiting time.

General Scorekeeping Rules

These rules are in addition to the rules available at http://outreach.cs.ua.edu/robotics-contest/rules.html.

1. The contest consists of 3 obstacle course problems that students can attempt through 3:00pm.
2. Each challenge is worth a maximum of 100 points.
3. The overall team score is the sum of all three scores (for a total possible score of 300). Ranking will be based on the overall combined score from the individual challenges.
4. The obstacle courses and associated problems will not be revealed until the beginning of the contest.
5. Teams may work on any problem in any order.
6. Some problems have disqualification measures (*e.g.,* going off the playing field, pushing an obstacle forward a specific number of inches).
7. Event 1 and 3 must be completed within 60 seconds to receive points, and event 2 within 90 seconds.
8. All courses will have a designated starting area.
    1. The robot must start completely within the starting area.
    2. The robot may face any direction when starting.
9. Students may not touch or remotely control the robot other than to initially place and start the robot.
10. A team may try each course multiple times.
    1. Teams must start at the back of the line for each new attempt.
    2. Each team may only be in line for one event at a time. It is not permissible to spread team members across multiple lines at any specific time.
    3. When multiple attempts are made for a specific obstacle course, the best score and earliest time of all attempts will be used in computing the overall score.
    4. Teams may modify their programs and robot before making additional attempts to improve their score. Robots may not be altered such that there is a size violation (13in x 13in x 13in).
    5. Measurements on each field is allowed for 60 seconds per turn in line (students may only measure during this time, and then go back to the end of the line or their desk when done).
11. There are clear boundary lines for the starting position. A robot may start with a portion of its body on the boundary of the starting area, but not extending beyond the boundary.

Building a Lightsaber

Every Jedi must have a lightsaber! Your first task is to build a new lightsaber from raw components.

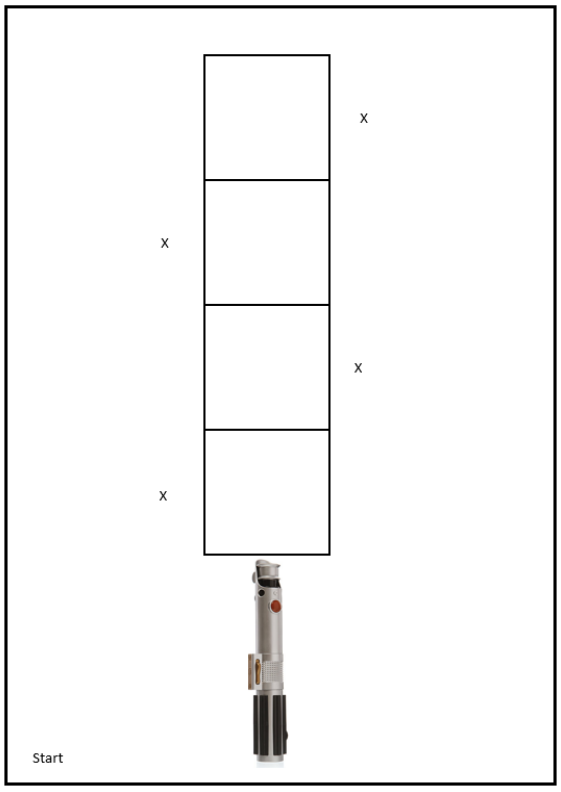
Goal: Your robot has 60 seconds to try to build a lightsaber by pushing the special crystals (cups) into the proper locations of the assembly squares. Each cup must be pushed completely into the square beside it. Each cup will be placed initially in the same location before starting each attempt. There are no variations to the game field during different attempts of play – the game has the same fixed location of each cup and assembly area.

Problem: The field contains the following features:

1. Starting area in the bottom-left
2. Four crystals (cups that are marked as x in a fixed location each time)
3. An assembly area that has four equally-sized squares

Robot Movement:

- Your robot may touch any part of the playing field without penalty (e.g., it is ok to pass over the handle of the lightsaber without any penalty)
- Your robot may go outside the square boundary of the printed field on the east, south, and west sides, but must not touch the carpet and may not go past the northern boundary (there will be another robot field just beyond the northern boundary). A robot going into the carpet or off the northern boundary will receive 0 points and the attempt is stopped.



Scoring:

- Each cup must be placed in the square beside it. Points are not awarded to cups that are placed in squares in other locations of the assembly (e.g., the cup in the bottom left must only be placed in the bottom square).
- For a correct placement, the entire cup must be in the square (i.e., no parts of the cup are allowed to touch the boundary of the square). It is ok for cups to fall down if they are still fully in the square.
- Each cup that is successfully placed within the correct square receives 25 points, for a total of 100 points. The total score is computed by how many cups are placed after 60 seconds.
- The score is only computed at the end of 60 seconds. Only the cups correctly placed at the end of 60 seconds will be added to the total score (a cup properly placed and then knocked out later does not count toward the score).

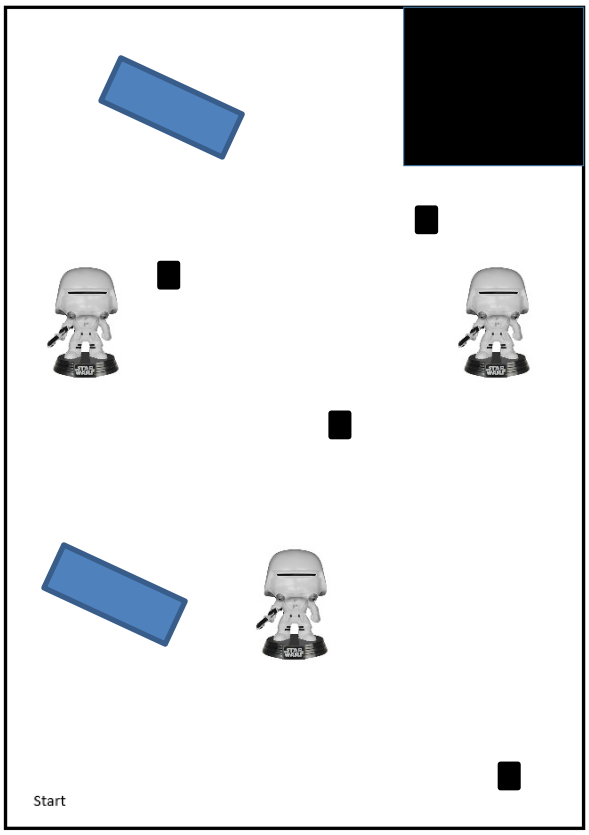
Droid Cleanup

After an intense confrontation, several of your droid friends need to be rescued for repair. Your job is to collect the droids from random places on the playing field, while avoiding several obstacles, and then reaching the safe spot.

Goal: Touch as many small squares (droids) as possible, avoiding the Snow Troopers and random obstacles, while eventually ending up in the safe place.

Problem: The field contains the following features:

1. Starting area in the bottom-left
2. Safe space (large black square in upper-right)
3. Droids that are randomly placed (small black dots)
4. Snow Troopers that are fixed in location each attempt, but if touched will destroy your robot and end your attempt.
5. Random obstacles (blue rectangles) that are randomly placed each attempt and can be touched, but not moved more than one inch.



Robot Movement:

- An attempt is over and you receive 0 total points if:
  - Your main robot (not cables) touches a Snow Trooper
  - Your robot pushes a random obstacle more than one inch, based on judge's estimation
  - Your robot moves completely outside the boundary of the printed field (partially outside is ok)

Scoring:

- 20 points will be earned when any part of your robot (except a cord) passes over a small droid square. Only 20 points per square (a square cannot be counted twice)
- 20 points for reaching the safe space (does not require droid pickup); only a portion of robot main body needs to touch the safe place
- There is a 90 second limit. The attempt is over whenever the robot touches the safe place, regardless of whether any of the droids have been collected.

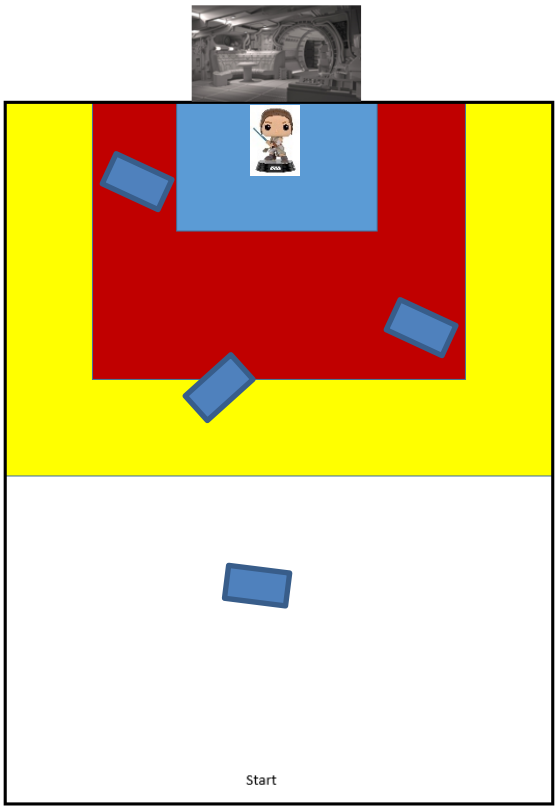
Rescuing Rey

Rey is stranded and needs your help! Bring her on board the Millenium Falcon!

Goal: Maneuver through a set of asteroids to reach Rey and help her move into the Falcon.

Problem: The field contains the following features:

1. Starting area in the bottom-center
2. Four or more asteroids that are randomly placed each attempt (blue rectangles) and can be touched, but not moved more than 3 inches.
3. Rey is waiting for you at the top-center of the field.
4. Millenium Falcon is off the field in the top-center.



Robot Movement:

- An attempt is over and you receive 0 total points if:
  - Your robot pushes an asteroid more than <u>three inches</u>, based on judge's estimation
  - Your robot moves completely outside the boundary of the printed field (partially outside is ok)

Scoring:

- Specific points will be earned when any part of your robot (except a cord) passes over the following:
  - Yellow area: 10 points
  - Red area: 20 points
  - Blue area: 30 points
- 40 points will be awarded for pushing Rey into the Millenium Falcon (she must be completely inside the Falcon with no overlap into the playing area)
- The attempt is over after 60 seconds or when Rey is pushed in the Falcon (in addition to the robot movement rules above).