RoboPlay

RoboPlay Challenge

Competition

NSF

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COLLEGE of ENGINEERING

Sandia National Laboratories

Barobo
Research Grade Modular Robots

hp
invent

DEPARTMENT OF EDUCATION
STATE OF CALIFORNIA

C-STEM Day
Saturday, May 31, 2014
UC Davis

Paton
GROUP
EDUCATION THROUGH INNOVATION

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INTERNATIONAL
PROGRAMS

Math Programming

Competition

UC Davis Center for Integrated Computing and STEM Education
http://c-stem.ucdavis.edu

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Middle School

Message From the Director

The UC Davis C-STEM Center aims to close the achievement gap by broadening participation of students traditionally underrepresented in computing and STEM fields and to develop students' computer-aided problem-solving skills through engagement in real-world STEM problems. Through cutting edge research with funding from the National Science Foundation, the C-STEM Center, in collaboration with our industry partners, has developed innovative educational computing and robotics technologies for K-14 hands-on learning. These technologies are implemented in classrooms and afterschool programs around the state, culminating in the annual C-STEM Day, which includes the curriculum-based RoboPlay Competition and Math Programming Competition.

C-STEM Day is an opportunity to further engage students in project based team activities and to showcase their accomplishments and creativity in not only STEM topics, but also in writing, art, music, and film productions.

The RoboPlay Competition brings together student teams to participate in a series of challenges that require the integration of creativity, programming, robotics knowledge, collaboration and critical thinking.

The Math Programming Competition provides students in secondary schools an opportunity to demonstrate their understanding of mathematics through real world programming applications.

By continuing to successfully implement the C-STEM curriculum in classrooms and after school programs and by participating in the annual curriculum-base C-STEM Day competitions, we inspire students to pursue computing and STEM related careers and post-secondary study.

I would like to thank all of our participants for their hardwork, including the teachers and students. I would like to express my gratitude and deep appreciation to all of our volunteers for organizing this event, especially our two regional coordinators, Heidi Espindola at the UC Davis site, Merry Kim in Orange County, and also Rex Schrader and other HP engineers who have worked tirelessly creating the online scoring system and the challenge tasks for the RoboPlay Challenge Competition. Thank you also to all of our sponsors for making this C-STEM Day event possible.

Dr. Harry Cheng
C-STEM Center Director

NEW! C-STEM is now an option for new undergraduate applicants to select as a UC approved educational preparation program, commencing fall 2015 for all UC campuses. C-STEM student and team awards are now recognized in the UC admissions process as achievements that have explicitly prepared students for college and career.

C-STEM Day Schedule: May 31, 2014

Time	Event	Location
7:30am-8:30am	Registration and Setup for RoboPlay Challenge Competition	Pavilion
7:30am-8:30am	Registration for Math Programming Competition	Pavilion
8:30am-8:40am	Welcome and Introduction	Pavilion
8:40am-9:00am	RoboPlay Challenge Competition Introduction	Pavilion
9:00am-12:00pm	RoboPlay Challenge Competition Problem Solving	Pavilion
8:50am-11:40am	Math Programming Competition	2121A Bainer Hall
12:00pm-12:45pm	Lunch Break	
12:45pm-3:45pm	RoboPlay Challenge Competition	Pavilion
3:45pm-4:00pm	Break	
4:00pm-5:00pm	Awards Ceremony: • C-STEM Awards of Achievement • RoboPlay Video Competition Winners • C-STEM Awards of Excellence • RoboPlay Challenge Competition Winners • C-STEM Scholarship • GIRL's Leadership Award • UC Davis Math Programming Competition Winners	Pavilion

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Challenges

Maps

Schedule for RoboPlay Challenge Competition
Middle Schools

School	Teacher	Team #	Board	Practice Times	Competition Times
American Canyon	Lee	1	A	10:00 - 10:15 11:00 - 11:15	12:45 - 1:00 / 1:45 - 2:00 / 2:45 - 3:00
American Canyon	Lee	2	A	10:20 - 10:35 11:20 - 11:35	1:05 - 1:20 / 2:05 - 2:20 / 3:05 - 3:20
School of Engineering & Sciences	Besk	3	A	10:40 - 10:55 11:40 - 11:55	1:25 - 1:40 / 2:25 - 2:40 / 3:25 - 3:40
School of Engineering & Sciences	Besk	4	B	10:00 - 10:15 11:00 - 11:15	12:45 - 1:00 / 1:45 - 2:00 / 2:45 - 3:00
Douglass	Gonzales	5	B	10:20 - 10:35 11:20 - 11:35	1:05 - 1:20 / 2:05 - 2:20 / 3:05 - 3:20
Douglass	Gonzales	6	B	10:40 - 10:55 11:40 - 11:55	1:25 - 1:40 / 2:25 - 2:40 / 3:25 - 3:40
Riverbank	Saul	7	C	10:00 - 10:15 11:00 - 11:15	12:45 - 1:00 / 1:45 - 2:00 / 2:45 - 3:00
Bridgeway Island	Schoellhamer	8	C	10:20 - 10:35 11:20 - 11:35	1:05 - 1:20 / 2:05 - 2:20 / 3:05 - 3:20
Bridgeway Island	Schoellhamer	9	C	10:40 - 10:55 11:40 - 11:55	1:25 - 1:40 / 2:25 - 2:40 / 3:25 - 3:40
Lee	Turner	10	D	10:00 - 10:15 11:00 - 11:15	12:45 - 1:00 / 1:45 - 2:00 / 2:45 - 3:00
Elkhorn Village	Wright	11	D	10:20 - 10:35 11:20 - 11:35	1:05 - 1:20 / 2:05 - 2:20 / 3:05 - 3:20
Elkhorn Village	Wright	12	D	10:40 - 10:55 11:40 - 11:55	1:25 - 1:40 / 2:25 - 2:40 / 3:25 - 3:40
California MS	Aguilar	13	E	10:00 - 10:15 11:00 - 11:15	12:45 - 1:00 / 1:45 - 2:00 / 2:45 - 3:00
California MS	Aguilar	14	E	10:20 - 10:35 11:20 - 11:35	1:05 - 1:20 / 2:05 - 2:20 / 3:05 - 3:20
California MS	Aguilar	15	E	10:40 - 10:55 11:40 - 11:55	1:25 - 1:40 / 2:25 - 2:40 / 3:25 - 3:40
California MS	Aguilar	16	F	10:00 - 10:15 11:00 - 11:15	12:45 - 1:00 / 1:45 - 2:00 / 2:45 - 3:00
California MS	Aguilar	17	F	10:20 - 10:35 11:20 - 11:35	1:05 - 1:20 / 2:05 - 2:20 / 3:05 - 3:20

Schedule for RoboPlay Challenge Competition
High Schools

School	Teacher	Team #	Board	Practice Times	Competition Times
Luther Bank High School	Dagler	18	G	10:00 - 10:15 11:00 - 11:15	12:45 - 1:00 / 1:45 - 2:00 / 2:45 - 3:00
Luther Bank High School	Dagler	19	G	10:20 - 10:35 11:20 - 11:35	1:05 - 1:20 / 2:05 - 2:20 / 3:05 - 3:20
Luther Bank High School	Jennings	20	G	10:40 - 10:55 11:40 - 11:55	1:25 - 1:40 / 2:25 - 2:40 / 3:25 - 3:40
School of Engineering & Sciences	Mangan	21	H	10:00 - 10:15 11:00 - 11:15	12:45 - 1:00 / 1:45 - 2:00 / 2:45 - 3:00
Franklin High School	Akuna	22	H	10:20 - 10:35 11:20 - 11:35	1:05 - 1:20 / 2:05 - 2:20 / 3:05 - 3:20
Franklin High School	Akuna	23	H	10:40 - 10:55 11:40 - 11:55	1:25 - 1:40 / 2:25 - 2:40 / 3:25 - 3:40
Livermore High School	Johnston	24	I	10:00 - 10:15 11:00 - 11:15	12:45 - 1:00 / 1:45 - 2:00 / 2:45 - 3:00
Livermore High School	Johnston	25	I	10:20 - 10:35 11:20 - 11:35	1:05 - 1:20 / 2:05 - 2:20 / 3:05 - 3:20
Livermore High School	Woodworth	26	I	10:40 - 10:55 11:40 - 11:55	1:25 - 1:40 / 2:25 - 2:40 / 3:25 - 3:40
Fred C. Beyer High School	Iazo	27	J	10:00 - 10:15 11:00 - 11:15	12:45 - 1:00 / 1:45 - 2:00 / 2:45 - 3:00
River City High School	Fagout	28	J	10:20 - 10:35 11:20 - 11:35	1:05 - 1:20 / 2:05 - 2:20 / 3:05 - 3:20

Overview

General Rules
1. You have 10 challenges to do in any order you like. Successful completion of each challenge earns your team points. The goal is to get as many points as possible.
2. The challenges must begin at one or more of the starting zones unless stated otherwise.
3. Teams may bring as many laptops as they have students to the competition and kept in their practice area (pit).
4. Only one laptop may be used at the competition table.
5. Use of other electronics during the competition, including other computers, calculators, cell phones, and other computing devices is not allowed.
6. Teams cannot use custom-made parts.
7. All challenge tasks must be completed using a computer program (no tilt drive or copy cat). Programs for controlling the robots must be written in Ch from SoftIntegration, Inc.
8. There will be no internet access during the competition. If a team is caught using the internet during the competition, the team will be disqualified.
9. Once the competition has begun, the teams may speak to the Judges for clarification on problems, but should not talk to anyone else outside of their team.

Practice Information
1. All teams will be provided a designated practice area (pit) to place their practice board.
2. You are given two 15-minute practice periods to practice on the official board between 10am and noon. (15 minute periods can be found on the RoboPlay Competition schedule page.)
3. Each 15 minute period starts and ends when specified in the schedule. You will not be given 15 minutes from when you arrive. Please be prompt.

Competition Information
1. You are given three 15-minute competition periods to compete on the official board between 12:45pm and 3:45pm. (15 minute periods can be found on the RoboPlay Competition schedule page.)
2. In between each team's run, there will be a five minute passing period.
3. No robots may be run on the competition board during the five minute passing period.
4. Any challenge that is on-going when your 15 minute period ends will be immediately stopped and points will be calculated.
5. You are allowed to attempt each challenge as many times as you like within the allotted competition time.
6. If you attempt a challenge multiple times, only the points from the highest scoring run will be kept.
7. Challenges may not be "chained together" meaning you cannot do two challenges simultaneously with the same program.
8. Teams are responsible for setting up the board for each run of each challenge.
9. Teams may not use more than five I-bots and one L-bot simultaneously.

Reminders for Students

General
- Measure everything with a measuring tape. Don't trust the given dimensions to be completely accurate.
- Read how assignments are scored to figure out the best strategy to get points.
- Ask questions if you are unclear about something.

Assigned Boards
- These will be the boards you will practice on and compete on.
- Make sure you know where your assigned board is at all times.
- Refer to diagram given or ask someone.

Practice/competition times
- 15 minute practice/competition times will be marked by a whistle being blown.
- Arrive 5 minutes early for your allotted practice/competition time and stand in the designated waiting area.
- Refer to packet if you don't know when your practice/competition times are.
- Keep your name tag on at all times. You will need it to gain access to the board during your 15 minute period as well as to your pit area.

Challenge Materials

Each team will have the following parts to complete the challenges.

Part	Quantity		Recommended/Necessary Accessories
Linkbot-I	5		Protractor
Linkbot-L	1		Writing Utensils
Snap Connector	14		Compass
Caster	2		Timer/Stopwatch
3.5" Wheel	8		String
Bridge Connector	2		USB flash drives
Gripper	1		Ruler & Measuring Tape (min. 8 feet)
Cube Connector	1		Extension Cord
Soccer Scoop	2		Skiva PowerFlow Four Port
Hacky Sack	1		USB Charger (Qty: 2)

Definitions and Common Terms

Whole Inch
>A distance/measurement rounded down to the nearest inch.
>Examples:
>- 3.75 inches = 3 whole inches
>- 1.95 inches = 1 whole inch
>- ½ inch = 0 whole inches.

Nearest Point
>The nearest point is a measurement taken from the nearest edge of the robot to the reference point by the shortest straight line distance. The measurement will be taken by placing a measuring tape on the table under the bot and placing a pipe on top of it, against the nearest part of the bot down to the tape.

Pipe Moved
>Pieces of pipe are used as obstacles and pylons for some challenges. These pipes are placed on dots on the board. A pipe will be considered moved if it is knocked over or the dot is visible around the outer edge of the pipe.


No Penalty as long as no Green Color appears on the side of the Pipe even if the pipe is moved.

Penalty if the Pipe is moved and the Green Color appears on the side of the Pipe.

Same Time
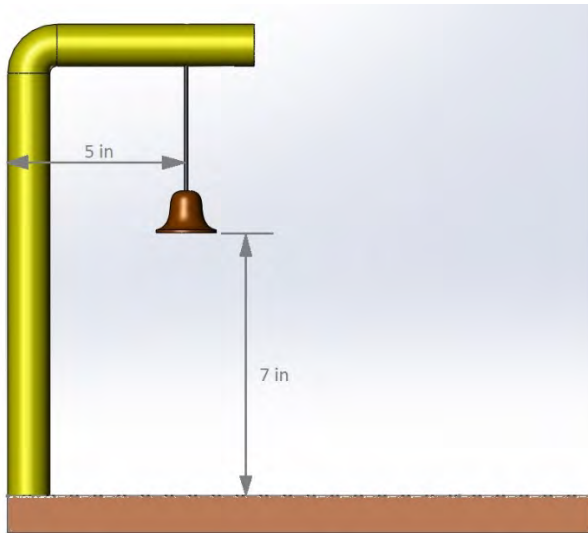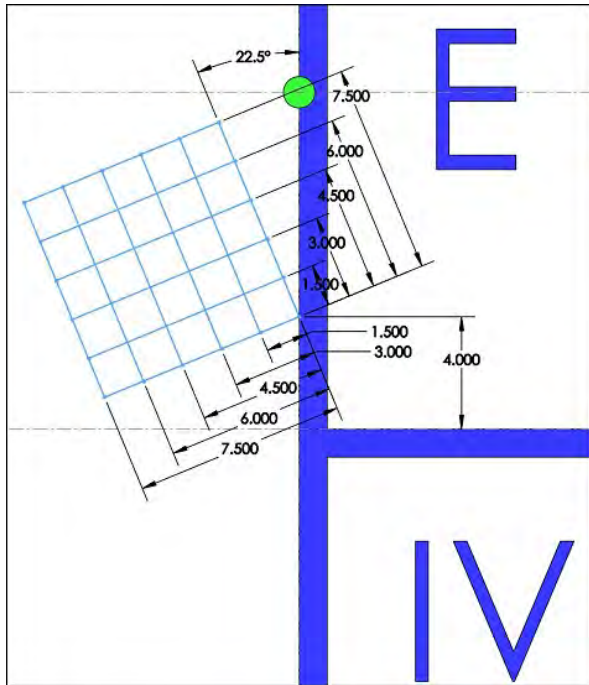>For the purposes of scoring, events which happen within one second of each other shall be considered the same time.
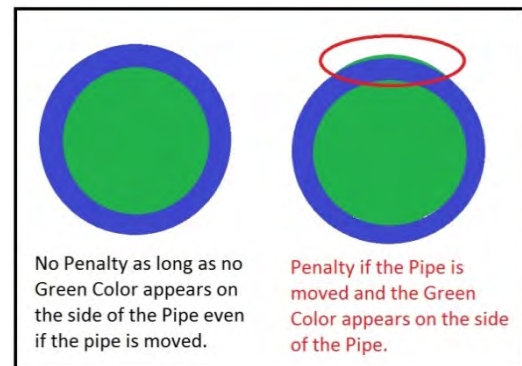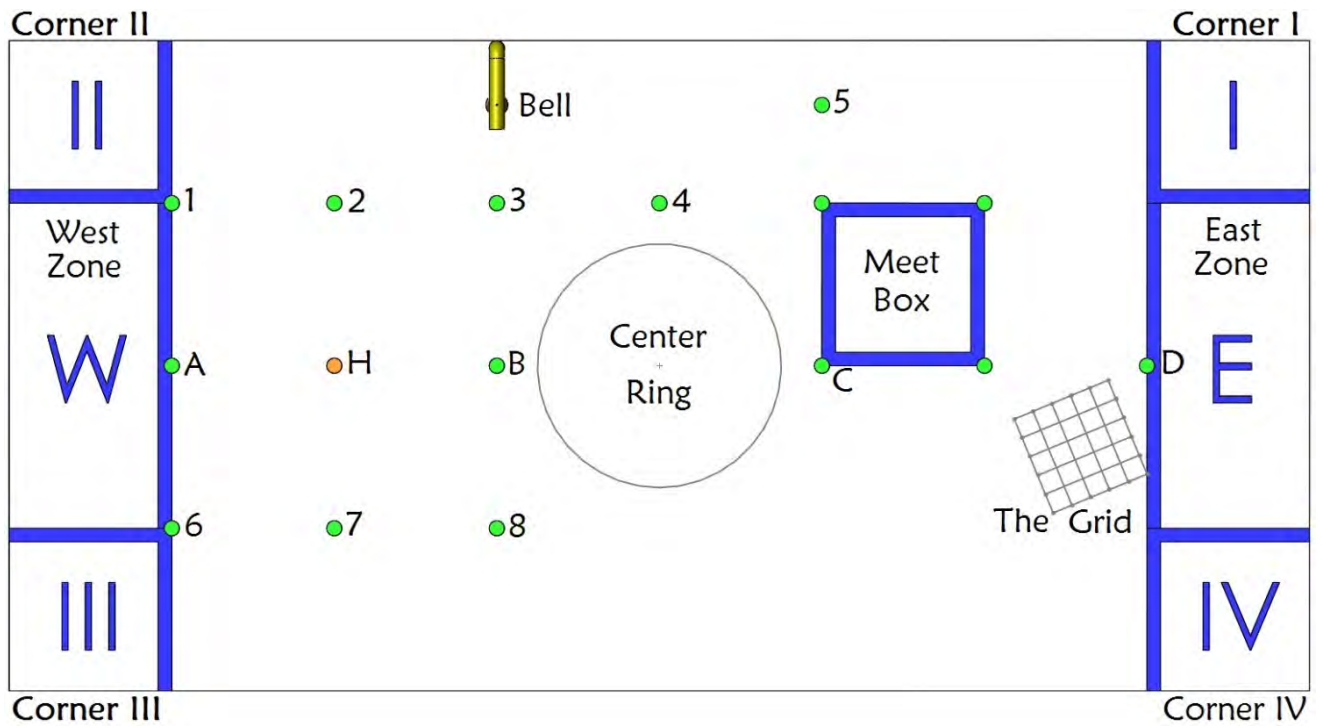
Map of the Challenge Board

Grid =- 1 ft Square
Dimensions are in inches for the entire document
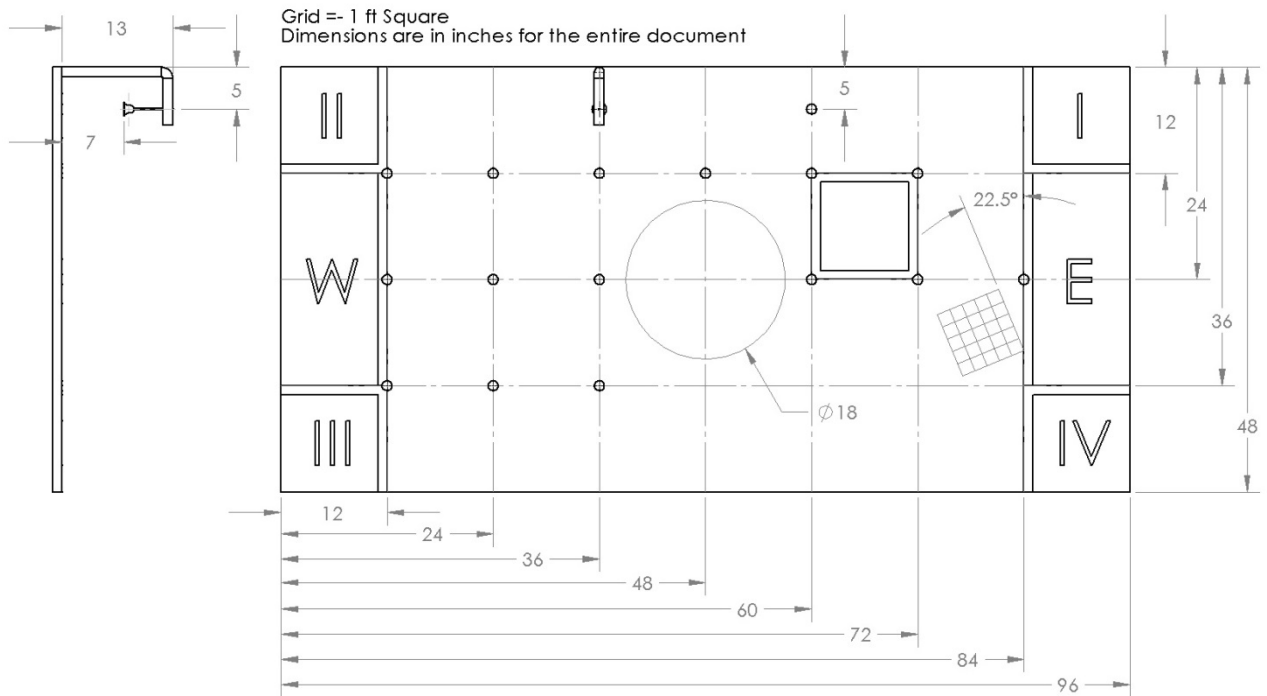
Challenge Board Dimensions

Detail dimension of the Bell location

Detail dimension of the Grid pattern.

1. Hit the Wall! (15 Points Possible)

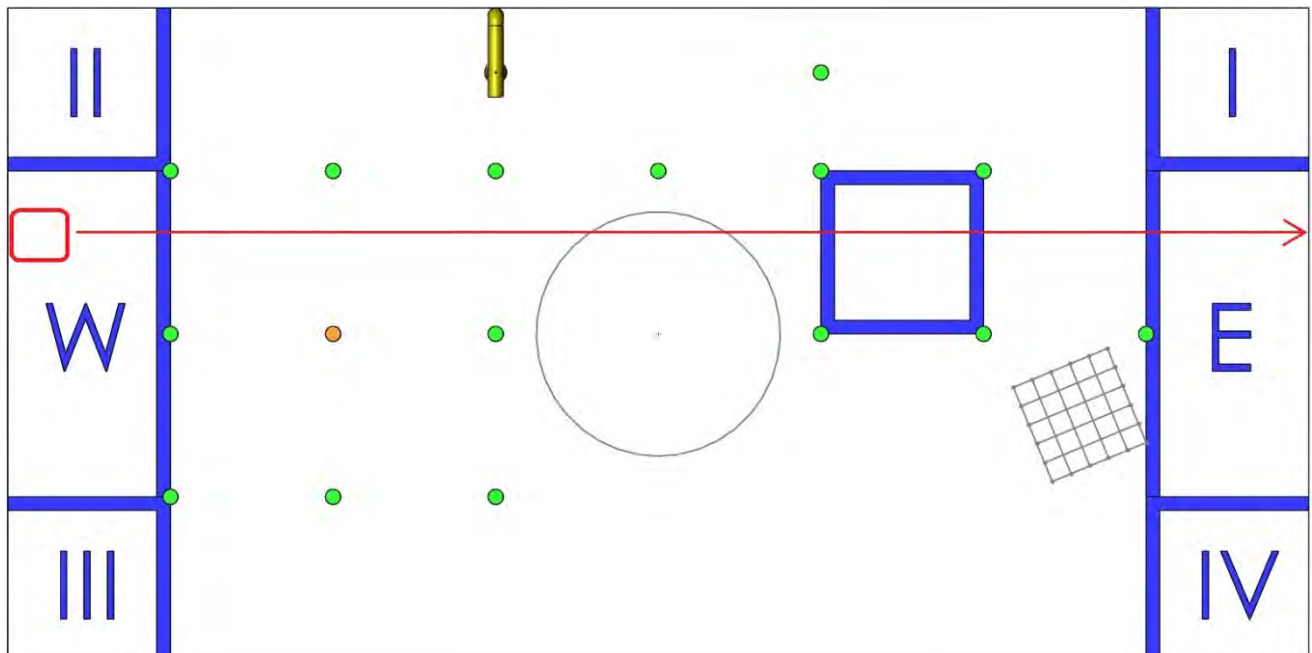### Starting Position

Bot starts anywhere within the West Zone.

Bot must start touching the West Zone wall.

Objective

Touch the East Zone wall.

Scoring

#	Description	Points
1	Touch the East Zone Wall.	15
2	Penalty for each whole inch short of the East Zone Wall.	-3

Starting Position
    Bot is placed in the Center Ring, facing the West Zone.
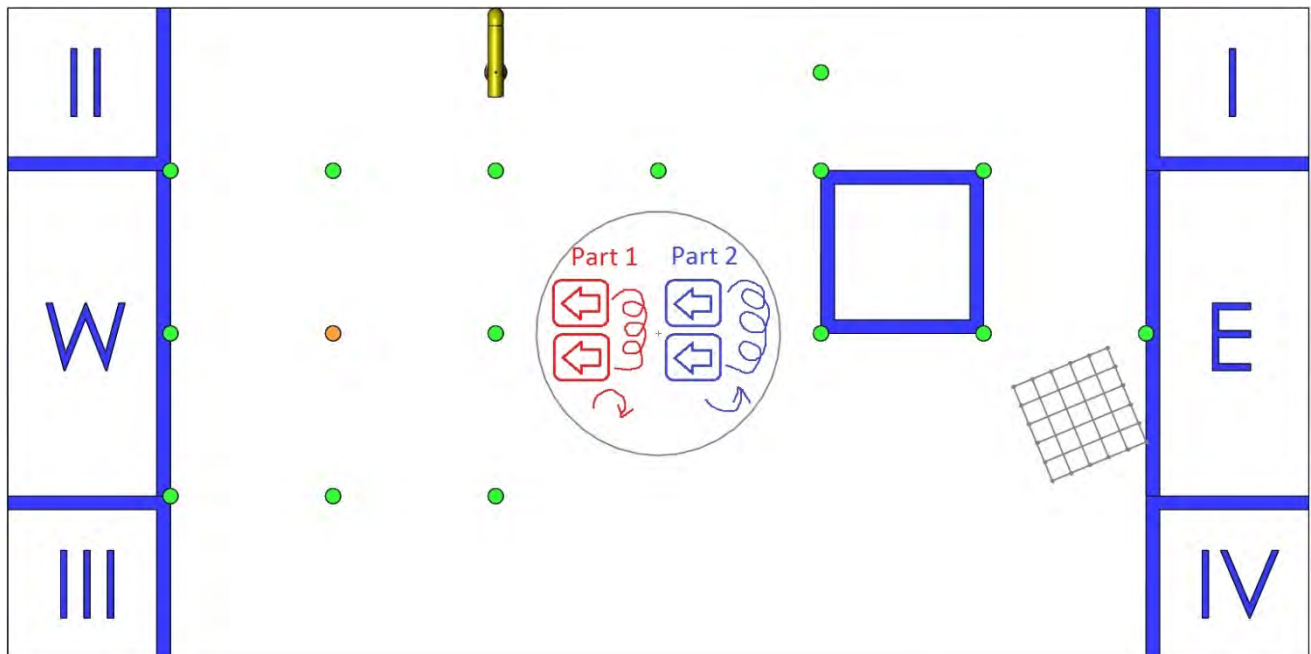
Objective
    Part 1:
        While the Bot's LED is red, spin clockwise in place, three times, and pause facing the West Zone.

    Part 2:
        The Bot's LED turns blue and spins counterclockwise in place, three times, and finishes facing West Zone.

Scoring

#	Description	Points
1	Spin Clockwise three times.	10
2	Spin Counter-Clockwise three times.	10
3	Bot displays both colors.	5
4	For changing colors in the right order.	5
5	Does not finish facing West Zone (±25°).	-5

Starting Position

Bot One is placed in the East Zone

Bot Two is placed in the West Zone, facing the other Bot

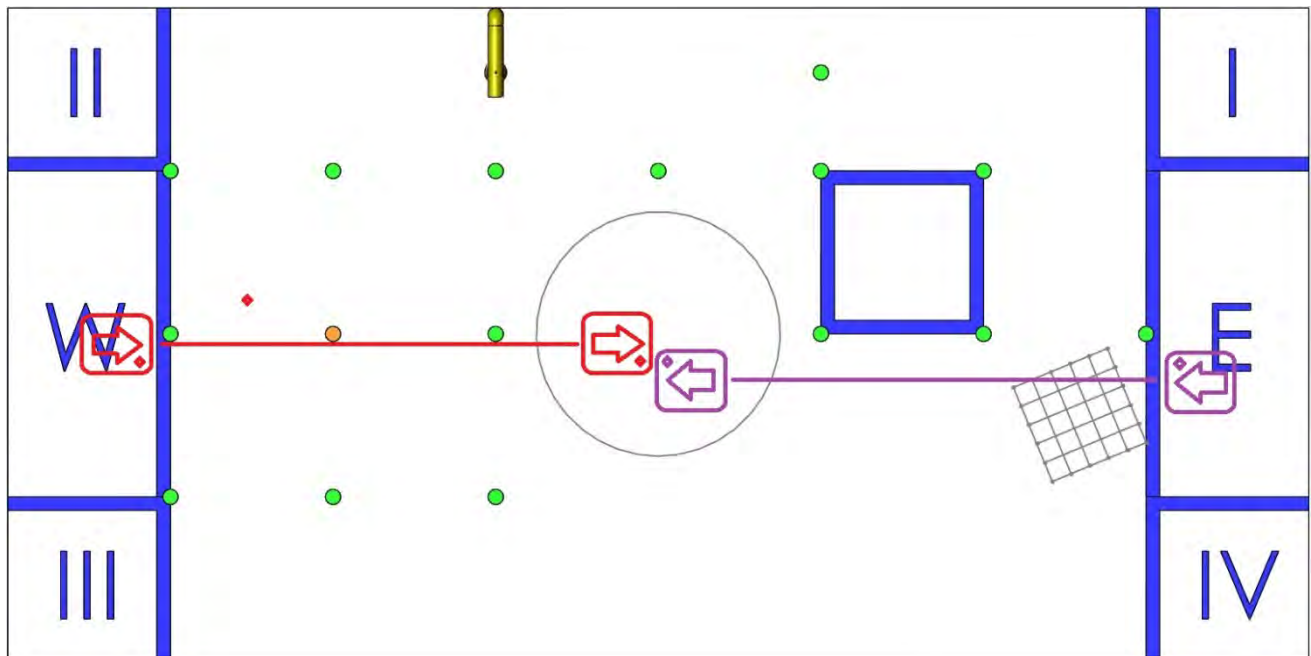The 'X' Button on each bot must be facing upwards.

Objective

Both bots move to the middle and get as close to each other without touching as possible.

Scoring

Distance is measured between the 'X's on each of the bot's labels.

#	Description	Points
1	Distance <= 4 Inches.	30
	4 inches < Distance <= 5 inches.	20
	5 inches < Distance <= 6 inches.	10
	Distance > 6 Inches.	0
2	Penalty if Bots Touch .	No Points

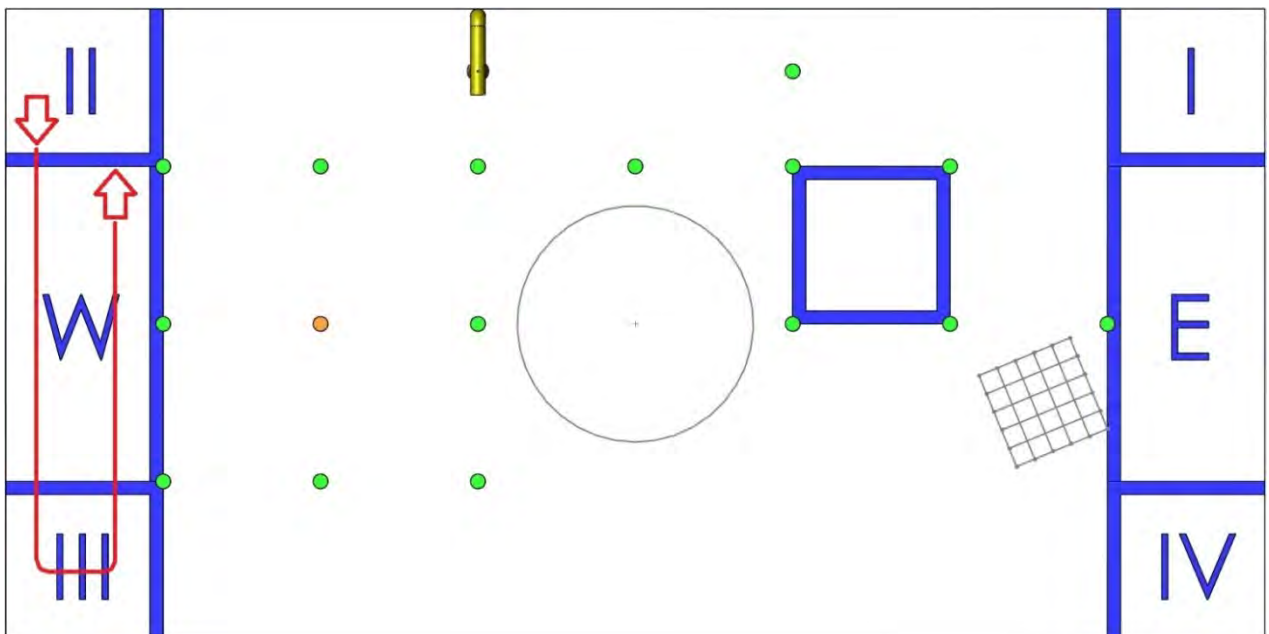## Starting Position

Bot starts in Corner II.

Objective

Bot moves completely within the Corner III boundary. Move back toward Corner II, come as close to the Corner II boundary line as possible without touching or crossing over.

Scoring

Distance is measured from the nearest point on the robot to the Corner II Boundary Line.

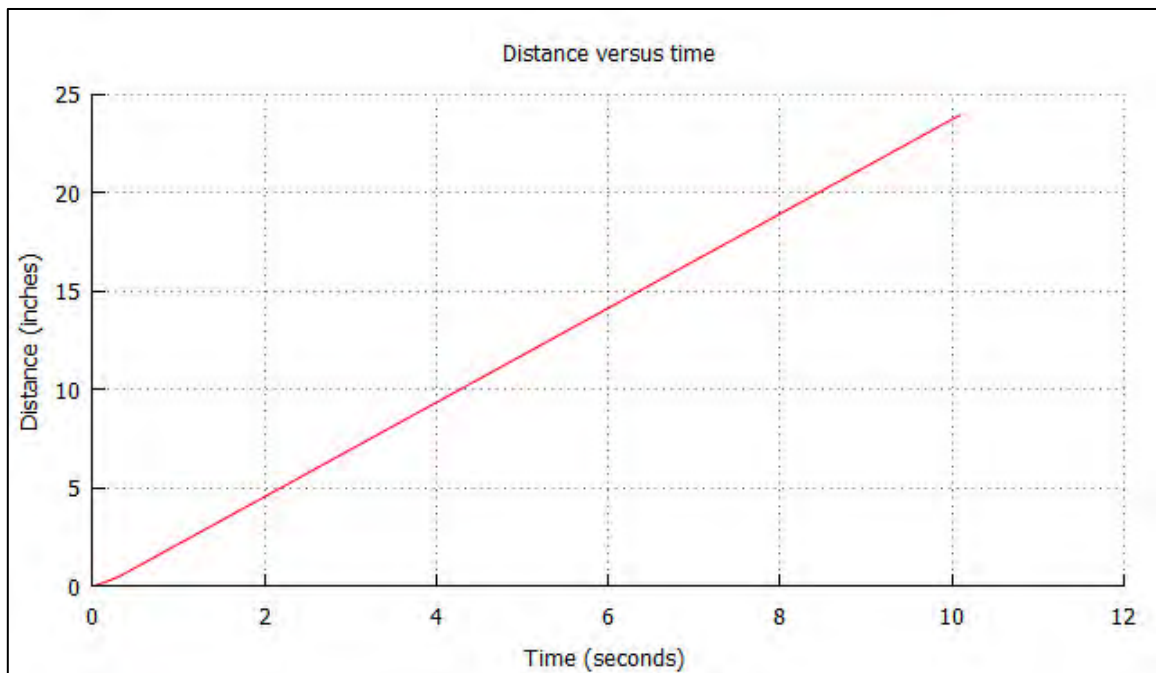| #	Description	Points
1	Distance < 1 inch.	40
	1 inch < Distance < 2 inches.	30
	2 inch < Distance < 3 inches.	20
	3 inch < Distance < 4 inches.	10
	Distance > 4 inches.	0
2	Penalty for not completely entering Corner III.	No Points
3	Penalty for touching or crossing Corner II Boundary Line.	No Points

Starting Position

Bot Starts in the West Zone.

Objective

Graph bot movement, distance over time, using the bot sensors. Bot must travel 24 inches in 10 seconds. Label graph as shown below. The bot may end in any location.

Scoring

#	Description	Points
1	Figure is plotted.	10
2	Graph shows linear relationship.	10
3	Graph starts at the origin.	10
4	X End Point is 9 < X (Time) < 11.	15
5	Y End Point is 22 < Y (Distance) < 26.	15
6	Penalty if graph not labelled as shown below.	No Points

Distance versus time

Board Setup

Pipes set up to cover dots A, B, C and D.

Starting Position

Bot starts completely within the West Zone boundary.

Objective

Bot moves to the East Zone, turns around Pipe 4 and returns to the West Zone, without moving the pipes.

Scoring

#	Description	Points
1	Turn around Pipe D in the East Zone.	30
2	Finishes completely within the West Zone boundary.	30
3	Penalty for each Pipe moved.	-10

RackTrack Setup
Pipes on Dot A, B, C and D

7. High Five Low Five (60 Points Possible)

Board Setup

Place a two pipe stack at Dot 2.

Starting Position

Bot starts in Corner II.

Objective

Create a bot that crosses board, knocks over at least one pipe at Dot 2, and "rings" the bell.

Scoring

Touching the bell counts as "ringing".

#	Description	Points
1	Knock over at least one of the pipes in the stack on Dot 2.	30
2	Ring the Bell.	30
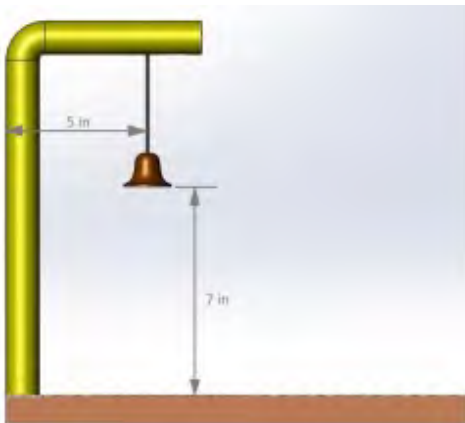
Figure 1 - Bell Tower

Figure 2 - Pipe Stack

High 5 Low 5 Setup
Two Stack Pipes on Dot 2

Board Setup

Pipes are placed on Dots 1, 2, 3, A, B, 6, 7 and 8.

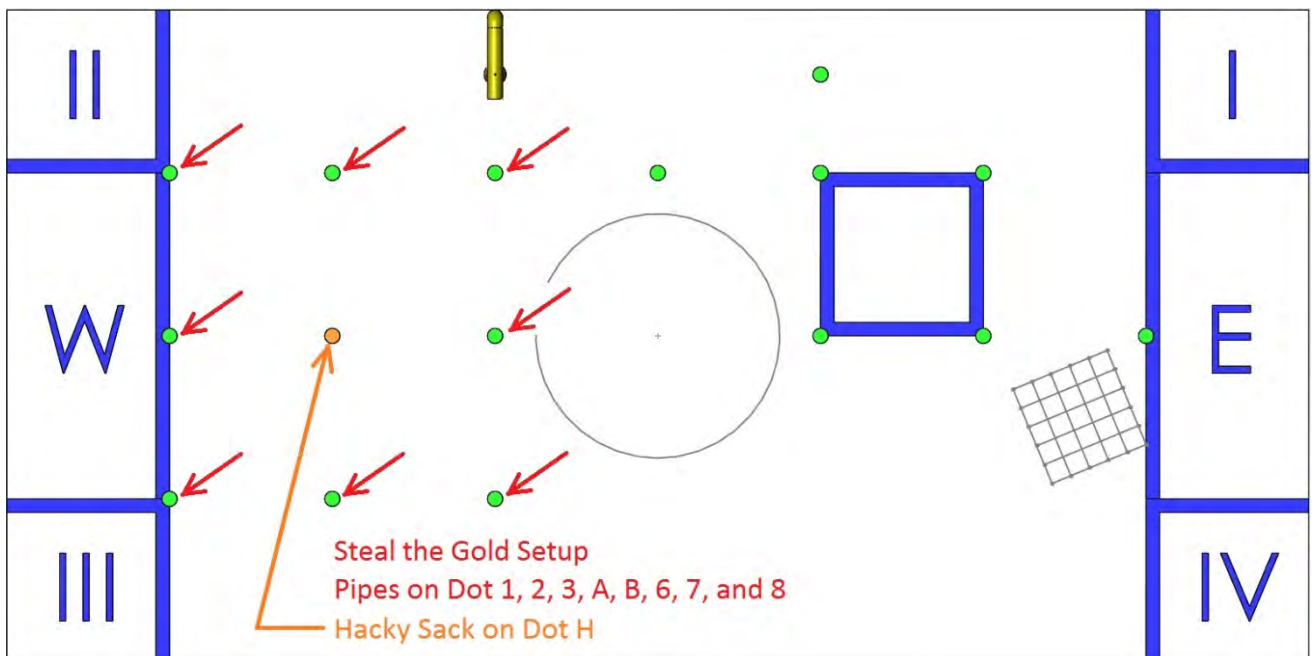The Hacky is placed on Dot H.

Starting Position

Bot is placed in Corner II.

Objective

Your bot moves the hacky from the center of the pipe array to Corner III without moving any pipes.

Scoring

#	Description	Points
1	Touching the Hacky with your bot.	20
2	Move Hacky outside the pipe array.	20
3	Move Hacky all the way inside Corner III.	20
4	Bot stops completely inside Corner III.	20
5	Penalty for each pipe moved.	-15

Steal the Gold Setup
Pipes on Dot 1, 2, 3, A, B, 6, 7, and 8
Hacky Sack on Dot H

Board Setup

A pipe is placed where the red circle is drawn in the illustration below.

Starting Position

Bot starts in Corner IV as illustrated below.

Objective

Use a bot to move the pipe to a scoring square. Then back the bot off from the pipe by at least 1 inch or run will not be scored.

Scoring

Score is taken off the diagram below.

#	Description	Points
1	The score of the highest value square the pipe is touching.	See Diagram
2	Pipe stops completely within a scoring square.	15
3	Penalty for bot ending within 1 inch of the pipe.	No Points
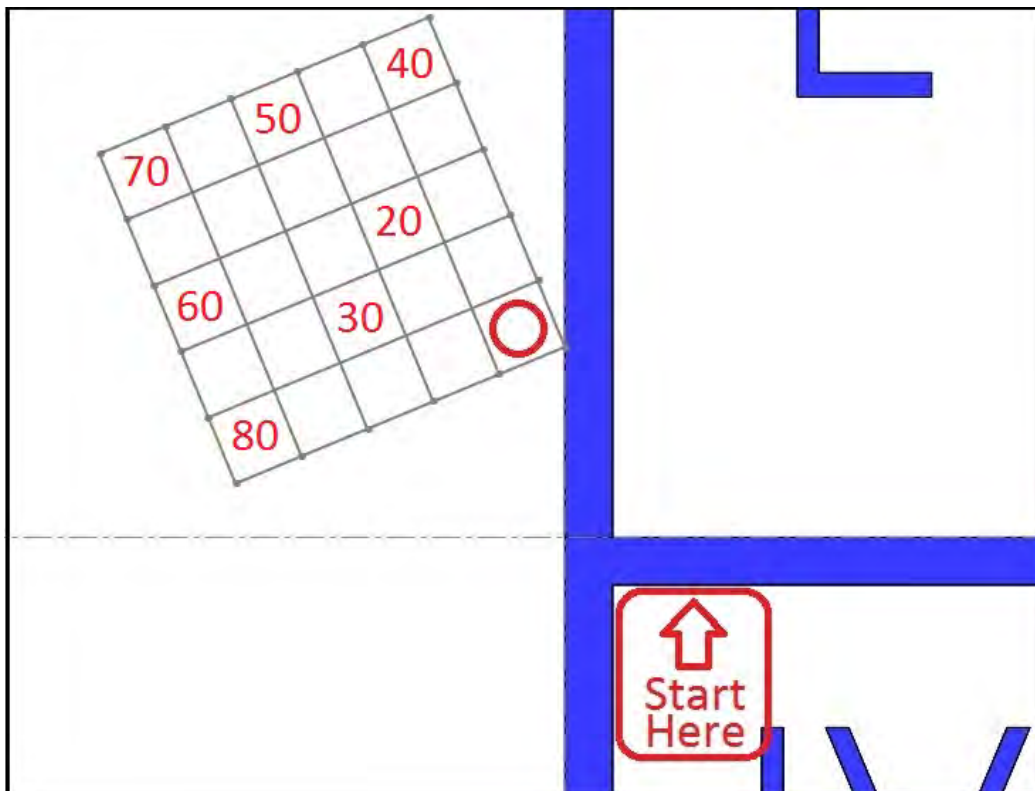
Board Setup

Place an upside down cup (Pick-up Cup) over Dot B.

Place a right side up cup (Drop Cup) on Dot C.

The hacky is placed on the Pick-up cup

Starting Position

Bot starts at any position touching the West Zone.

Objective

Have a bot pick up the hacky from the Pick-up cup, and drop it into the Drop cup.

Scoring

#	Description	Points
1	Bot picks up hacky.	25
2	Bot transports hacky within a foot of Drop Cup.	25
3	Hacky touches the Drop Cup.	25
4	Hacky is put into the Drop Cup.	40
5	Penalty for each cup moved from its starting position.	-20

Hacky Sack

Cup - Upside down

Side view
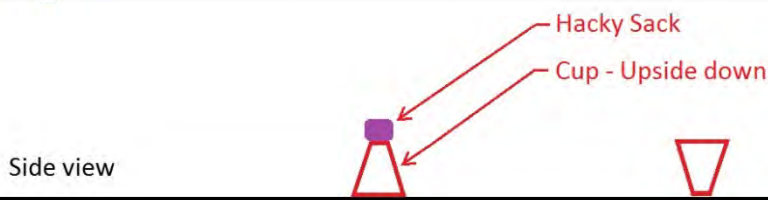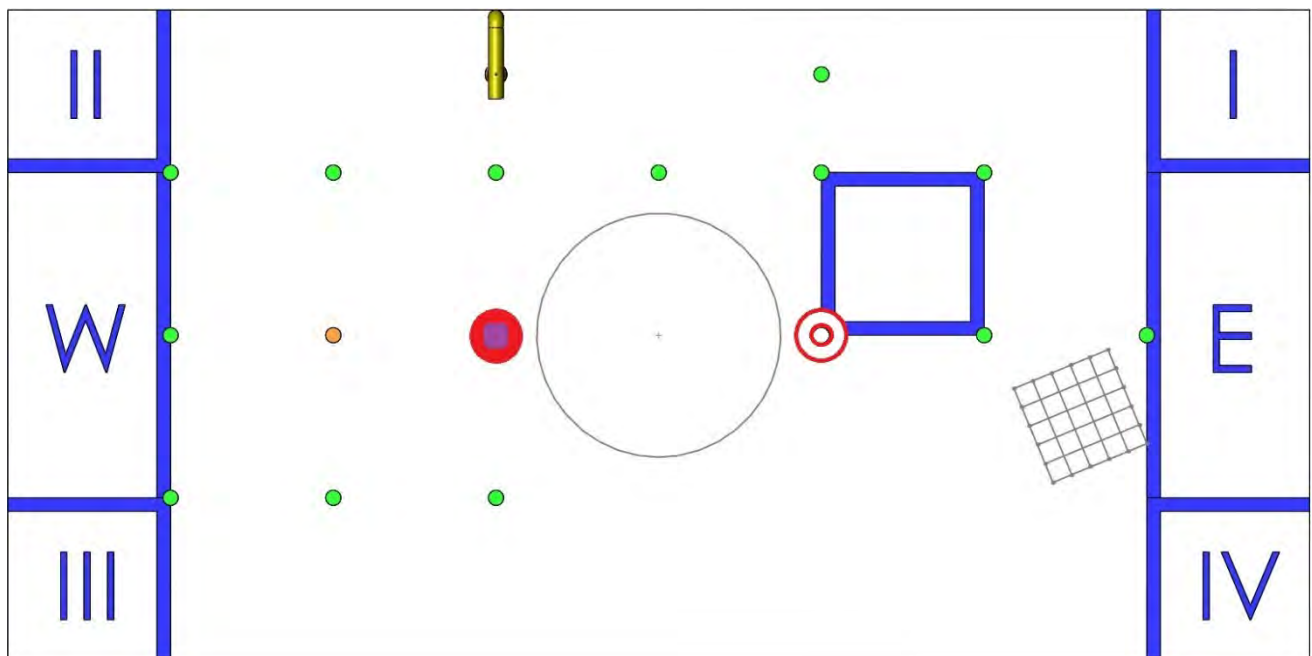
Overview of Event Locations

- 2121A Bainer Hall: Math Programming Competition
- ARC Pavilion: RoboPlay Challenge Competition
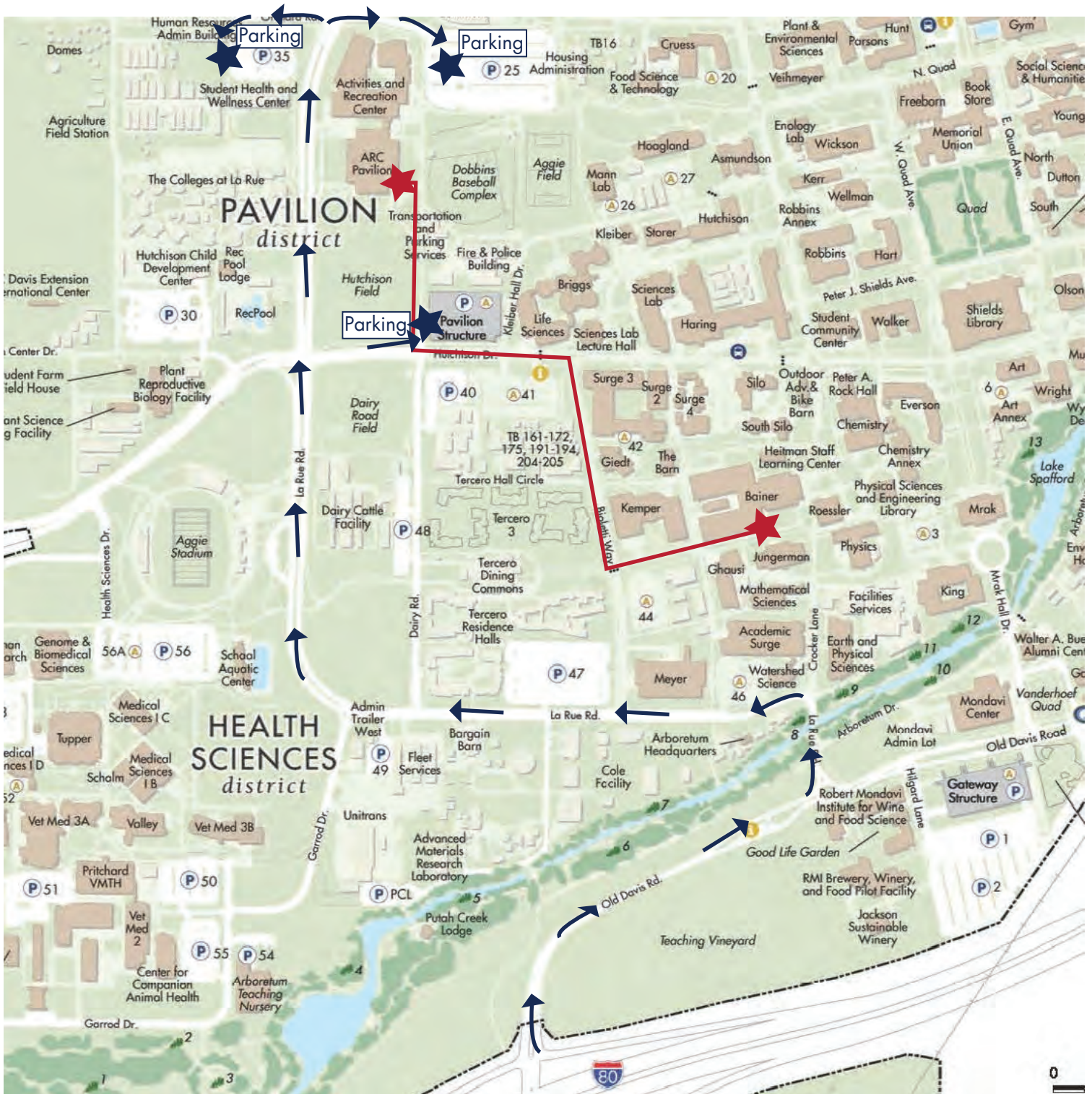
→ : driving directions   — : walking directions

UC Davis Pavillion
RoboPlay Competition
Team Assignments