



C-STEM DIVISION 2 DAY

2016


MAY 21, 2016
UC DAVIS | IRVINE VALLEY COLLEGE



UC DAVIS CENTER FOR INTEGRATED COMPUTING AND STEM EDUCATION
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C-STEM Center



C-STEM is a UC approved Educational Preparation Program and has UCOP A-G approved Courses.

Message From the Director

Dear C-STEM Teachers and Students,

Welcome to this year's C-STEM Day. We have an exciting day planned for you filled with competition, learning, and fun!

In addition to the distinction of being a UC Approved Educational Preparation Program for Undergraduate Admission to all UC campuses, the C-STEM program is continuously striving to add additional curriculum that meets the UC A-G approved status, so that schools can readily and easily integrate C-STEM courses into their offerings. One such effort is the C-STEM Math-ICT Pathway. This pathway provides K-12 students with 12 years of computer science education through hands-on integrated learning of math and computer science, starting in the first grade.

This is an exciting time for the C-STEM program and Center. We are at the tipping point where we have the tools and opportunity to enable schools across the nation to integrate computer science into their math and science curriculums, in order to help narrow the achievement gap in mathematics. The C-STEM program and curriculum does this in the framework of an integrated offering, emphasizing the importance of hands-on math and computer science education.

As we continue to develop C-STEM curriculum, we also continue to develop software that allows teachers and students to access content easily. As many of you have already experienced, C-STEM Studio is a key tool for teachers and students, helping teachers organize teaching resources and homework, and helping students to have a centralized platform to work with. C-STEM Studio works not only with Linkbots, but also with Lego Mindstorms NXT/EV3 robots and Arduino microcontrollers. In addition, RoboBlockly is another freely available tool that allows for web-based robotic simulation, using a drag and drop puzzle-piece like interface. The RoboBlockly curriculum includes student and teacher resources.

This year's C-STEM Day is especially exciting, because we have eclipsed 100 total teams for Challenge Competition today, here in Davis and also in Orange County. In addition, we had over 35 video competition submissions that have already been judged. I would like to thank all of our participants for their hard work, including the C-STEM teachers and students, volunteers, sponsors, and C-STEM staff.

Best of luck during the competition!

Dr. Harry Cheng
C-STEM Center Director



Supported by



C-STEM Day Schedule - May 21, 2016

Time	Event
7:30am - 8:30am	Registration and Setup for RoboPlay Challenge Competition
8:30am - 8:40am	Welcome and Introduction
8:40am - 9:00am	RoboPlay Challenge Competition Introduction
9:00am - 12:00pm	RoboPlay Challenge Competition Problem Solving
12:00pm - 12:45pm	Lunch Break
12:45pm - 3:45pm	RoboPlay Challenge Competition
3:45pm - 4:00pm	Break
4:00pm - 5:00pm	Awards Ceremony: <ul style="list-style-type: none">• C-STEM Awards of Achievement• GIRL's Leadership Award• C-STEM Awards of Excellence• C-STEM Scholarship• RoboPlay Video Competition Winners• RoboPlay Challenge Competition Winners

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Schedule for RoboPlay Challenge Competition - Division 1

School	Team Name	Board/Pit	Practice Times	Competition Times
Albert Einstein	Haunted Waffles	A/1	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
Albert Einstein	Tumblrs Black Knights	A/2	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
Albert Einstein	Cyber Chix	A/3	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
Albert Einstein	Pink Fluffy Unicorn Army	B/4	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
American Canyon Middle	ALT + F4	B/5	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
American Canyon Middle	The Wiggles	B/6	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
American Canyon Middle	Data Dames	C/7	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
American Canyon Middle	Mega Bytes	C/8	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
Bridgeway Island Element.	Brobots	C/9	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
Bridgeway Island Element.	Robot Ninjas	D/10	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
Bridgeway Island Element.	7th Grade Superstars	D/11	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
Bridgeway Island Element.	The Coding Giraffes	D/12	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
Bridgeway Island Element.	Sab-Bot-age	E/13	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
Bridgeway Island Element.	The Running Bot	E/14	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
California Middle	B-Team	E/15	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
California Middle	Ritz-Hackers	F/16	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
California Middle	Cal A	F/17	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22

Schedule for RoboPlay Challenge Competition - Division 1 cont.

School	Team Name	Board/Pit	Practice Times	Competition Times
Cambridge Elementary	Cougars	F/18	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
Cambridge Elementary	Just Do It!	G/19	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
Cambridge Elementary	The Doers	G/20	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
Center Elementary	Center Davis	G/21	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
Center Elementary	C-20 Flyers	H/22	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
Dixon Montessori	RoboDragons	H/23	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
Edwin Markham Element.	Los Robo-Lobos Poderosos de Markh	H/24	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
Edwin Markham Element.	The Mighty Markham Timber-Bots	I/25	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
Elkhorn Village Element.	Tiger Pride A	I/26	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
Elkhorn Village Element.	Tiger Pride B	I/27	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
Foothill Middle	Foothill Griffins 3	J/28	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
Foothill Middle	Foothill Griffins 1	J/29	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
Foothill Middle	Foothill Griffins 2	J/30	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
George A. Buljan Middle	Bulldog Robotics	K/31	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
George A. Buljan Middle	Buljan Robotics Club	K/32	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
Golden West Middle	The International Penguins of Mystery	K/33	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
Golden West Middle	Turtle Titans	L/34	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42

Schedule for RoboPlay Challenge Competition - Division 1 cont.

School	Team Name	Board/Pit	Practice Times	Competition Times
Golden West Middle	Computerholics	L/35	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
Golden West Middle	Gotta Go Fast	L/36	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
Golden West Middle	Automatic Falcons	M/37	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
Hogan Middle	Mecha-Spartans 1	M/38	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
Hogan Middle	Mehca-Spartans 2	M/39	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
Lee Middle	Baskin Robbins	N/40	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
Lee Middle	Gogurt 2.0	N/41	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
Mountain Vista Middle	MVMS Team 1	N/42	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
Mountain Vista Middle	MVMS Team 2	O/43	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
Pine Grove Elementary	Pine Grove STEM SCHOOL	O/44	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
Roosevelt Middle	RobOtters	O/45	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
Sutter Middle	Roosevelt Bulldogs	P/46	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
T.R Smedberg Middle	MinerBots	P/47	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
Vaca Pena Middle	Smedberg Wolverines	P/48	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
Vaca Pena Middle	Power Panthers	Q/49	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
Valley View Middle	Valley View Jags 2	Q/50	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
Valley View Middle	Valley View Jags 3	R/51	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
Valley View Middle	Valley View Jags 1	R/53	10:40 - 10:57 11:40 - 11:57	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22

Schedule for RoboPlay Challenge Competition - Division 2

School	Team	Board/Pit	Practice Times	Competition Times
American Canyon High	fnatiC	S/54	10:40 - 10:57 11:40 - 11:57	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
American Canyon High	Prod19	S/55	10:00 - 10:17 11:00 - 11:17	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
Angelo Rodriguez High	JV Team	S/58	10:20 - 10:37 11:20 - 11:37	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
Angelo Rodriguez High	Varsity Team	T/59	10:40 - 10:57 11:40 - 11:57	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
Livermore High	JANbots	T/64	10:00 - 10:17 11:00 - 11:17	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
River City High	Kill-A-Bytes	U/69	10:00 - 10:17 11:00 - 11:17	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
River City High	RC ABJ	U/70	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02

Schedule for RoboPlay Challenge Competition - Division 3

School	Team	Board/Pit	Practice Times	Competition Times
American High	Prodigy Empire	V/56	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
American High	Prodigy Rebels	V/57	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
Bradshaw Christian High	Pride Robotics	V/60	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
College Park High	EWA	W/52	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
Franklin High	Echo Squadron	W/61	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
Franklin High	Police Cops	W/62	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
Lassen High	Grizz Grammers	X/63	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
Livermore High	101 Coders	X/65	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
Luther Burbank High	One Click	X/66	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
Luther Burbank High	The Flexibles	Y/67	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
Piner High	Prospectors	Y/68	10:20 - 10:37 11:20 - 11:37	1:05 - 1:22 1:45 - 2:02 3:05 - 3:22
River City High	Tech-No-Logic	Y/71	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02
River City High	Robot Raiders	Z/72	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:25 - 2:42 3:25 - 3:42
Woodland Senior High	Robo Wolves	Z/73	10:40 - 10:57 11:40 - 11:57	1:25 - 1:42 2:05 - 2:22 2:45 - 3:02

Overview

General Rules

1. Use of other electronics during the competition, including other computers, calculators, cell phones, and other computing devices is not allowed.
2. 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.
3. Teams cannot use custom-made parts. Parts allowed are listed below under "Challenge Materials."
4. 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.
5. Once the competition has begun, the teams may speak to the Judges and volunteers for clarification on problems and technical problems, but should not talk to anyone else outside of their team.
6. Keep your name tag on at all times. You will need it to gain access to the competition zones.
7. Only the teacher and the competing students are allowed in the competitions zones. No other students or parents are allowed in the pit or competition zones.

Directions

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. Read how assignments are scored to figure out the best strategy to get points.
3. Ask questions if you are unclear about something or are having technical difficulties.

Pit Zone Rules

1. All teams will be provided a designated practice area (pit) to place their practice board. Your pit number is indicated on your name tag. Refer to the diagram in your packet to find your pit.
2. Teams may bring as many laptops as they have students to the competition and keep them in their practice area (pit).

Competition Zone Rules

General

1. You will be competing on the same competition board throughout the practice and competition sessions. Your board letter is indicated on your name tag. Refer to the diagram in your packet to find your board.
2. Arrive 5 minutes early for your allotted practice/competition time and stand in the designated waiting area.
3. Refer to packet if you don't know when your practice/competition times are.
4. Practice/competition times will be marked by a whistle being blown.

Practice Information

1. You are given two 17-minute practice periods to practice on the official board between 10am and noon. (17 minute periods can be found on the RoboPlay Competition schedule page.)
2. Each 17 minute period starts and ends when specified in the schedule. Your 17 minutes will end on schedule, so don't be late.

Competition Information

1. Only one laptop may be used at the competition table.
2. You are given three 17-minute competition periods to compete on the official board between 12:45pm and 3:45pm. (17 minute periods can be found on the RoboPlay Competition schedule page.)
3. In between each team's run, there will be a 3 minute passing period. No robots may be placed on the competition board during the 3 minute passing period.
4. Teams are responsible for setting up the board for each run of each challenge.
5. At the start of every run you must tell the judge which challenge you are running.
6. Teams may not use more than five robots simultaneously, nor more than four l-bots and one L-bot simultaneously.

Challenge Scoring

1. You are allowed to attempt each challenge as many times as you like within the allotted competition time. Only the points from the highest scoring run will be kept.
2. Only one challenge may be run on the challenge board at a given time.
3. If you attempt Challenges may not be "chained together" meaning you cannot be scored for two challenges at the same time. Each challenge attempt, regardless of outcome, counts as a run. In the case of two teams with identical scores, the number of runs will be used a tie breaker, with the lowest number of attempts winning the tie.
4. To receive points for all scoring elements completed, your program must run to completion and all bots stop their motion unless specifically allowed by the challenge. Each challenge attempt, regardless of outcome, counts as a run. In the case of two teams with identical scores, the number of runs will be used a tie breaker, with the lowest number of attempts winning the tie.
5. Any challenge that is on-going when your 17 minute period ends will be immediately stopped and points will be calculated.
6. You may abort a run at any time by touching a robot or calling "abort". Aborted runs still count as an attempt, and score zero points.
7. If your program is still executing but no penalty points are possible you may ask the judge for a "partial call" in order to abort the run and still receive partial points. The judge must agree to the "partial call" before touching any robots or the run will be scored as an "abort".

8. At the end of each run your judge will show you your run number and run score prior to submission. If you wish to contest the score for that run, you must call for a Head Judge at that time.
9. You are encouraged to keep a record of your challenge scores in the space provided at the bottom of each challenge.
10. Once you start your program you may not interact with your computer except as specified in the "Random Numbers" section below. Interacting with your computer will count as an "abort".

Random Numbers

1. Some challenges have random numbers you will need to input into your program at the start of each run.
2. Use must use the scanf() function to read random numbers into your program.

Sample code:

```
int distance;  
scanf ("%d", &distance);
```

3. Random numbers will change at the start of every run. Your Table Judge will hold up and say the relevant numbers for each run.
4. You may enter your random numbers into your program after starting it. Step away from the computer after entering your numbers.
5. You may not strategically abort your challenge to get "better" random numbers. If your judge feels that you are aborting to get better numbers you may be banned from attempting that challenge for the remainder of the current competition period.

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 with the measurement triangle resting against the nearest point.

Same Time

For the purposes of scoring, events which happen within two seconds of each other shall be considered the same time.

Tips and Tricks

- Illustrations don't necessarily show the best configuration or path for a robot to complete a challenge.
- Use accessories or create multi-bot configurations unless specifically limited by the challenge text.
- Don't be afraid to try something "crazy". If it's crazy and it works ... it's not crazy.
- If the whole challenge is too hard, go for partial points.

Challenge Materials

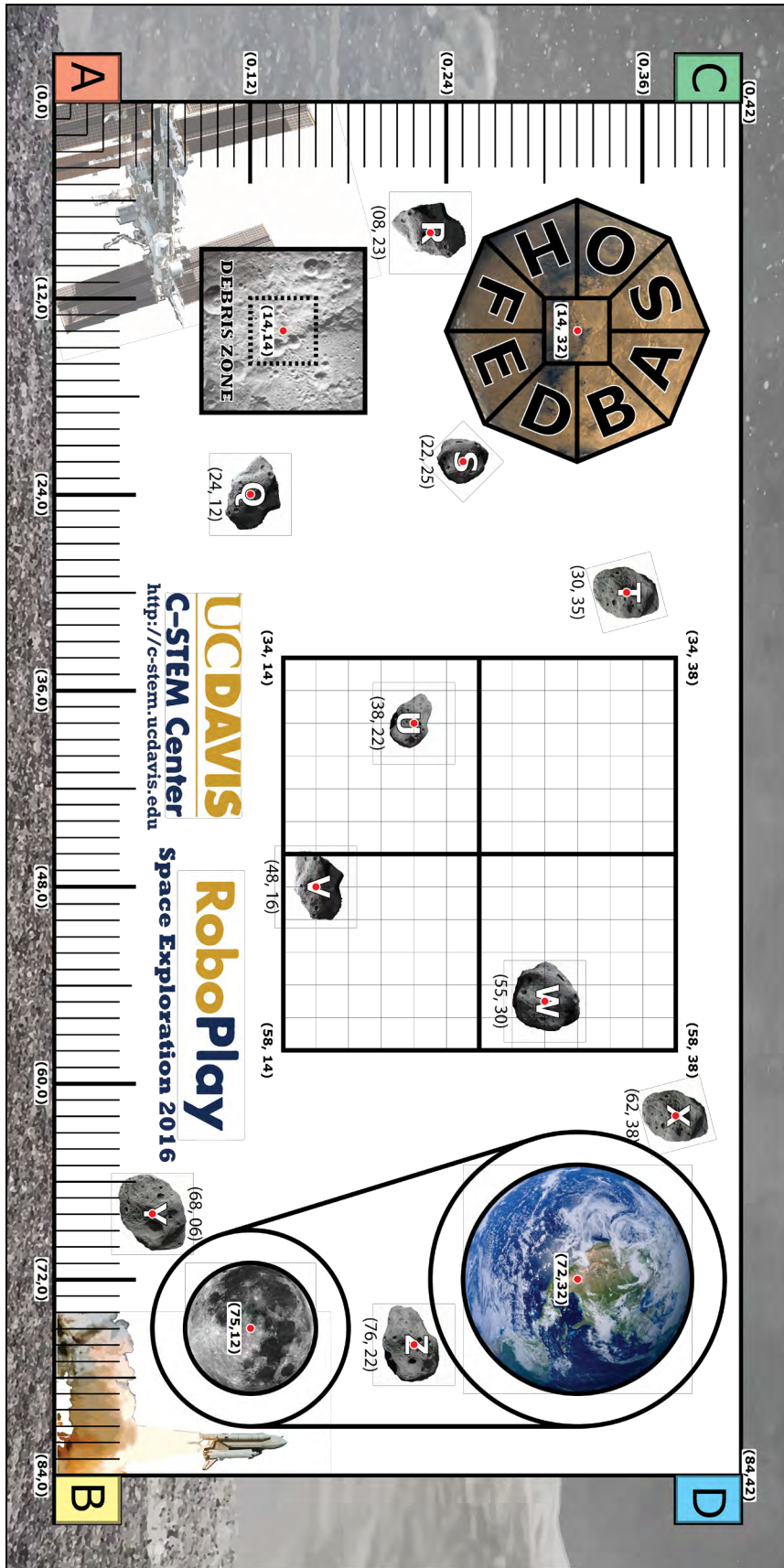
Each team will have the following parts to complete the challenges:

Part	Quantity
Linkbot-I	5
Linkbot-L	1
Snap Connector	14
Caster	2
3.5" Wheel	8
4" Wheel	8
Bridge Connector	2
Gripper	1
Cube Connector	1
Soccer Scoop	2
Hacky Sack	1
2" Wooden Block	1
1/4" Colored Stickers	3

Recommended Accessories:

1. Protractor
2. Writing Utensils
3. Compass
4. Timer/Stopwatch
5. String
6. USB flash drives
7. Ruler & Measuring Tape (min. 8 feet)
8. Extension Cord
9. Skiva PowerFlow Four Port
10. USB Charger (Qty: 2)

2016 Challenge Board



1. Supply Recovery

20 points possible

Description

Important supplies have been lost in a dust storm. The last known coordinates on the local grid have been determined. Calculate the current coordinates and send a bot to those coordinates to find the supplies.

The **global** coordinates are marked on the competition board ranging from 0" to 84" in the X direction and 0" to 42" in the Y direction. The **local** coordinate system is the grid on the mat, whose center in the **global** system lies at (48, 26). In the **local** system, however, the center of the grid is (0,0).

You will be given a random point (X,Y) in the grid's **local** system and a block will be placed on that point. Move your bot to the correct location so that it makes contact with the block.

Setup

Bot starts at any starting point: A, B, C, or D.

Receive random X local coordinate in the range -12" to 12".

Receive random Y local coordinate in the range -12" to 12".

Place a wooden block at the **local** coordinates (X,Y).

Hint: Use the scanf() function to take user input to your program.

Objective

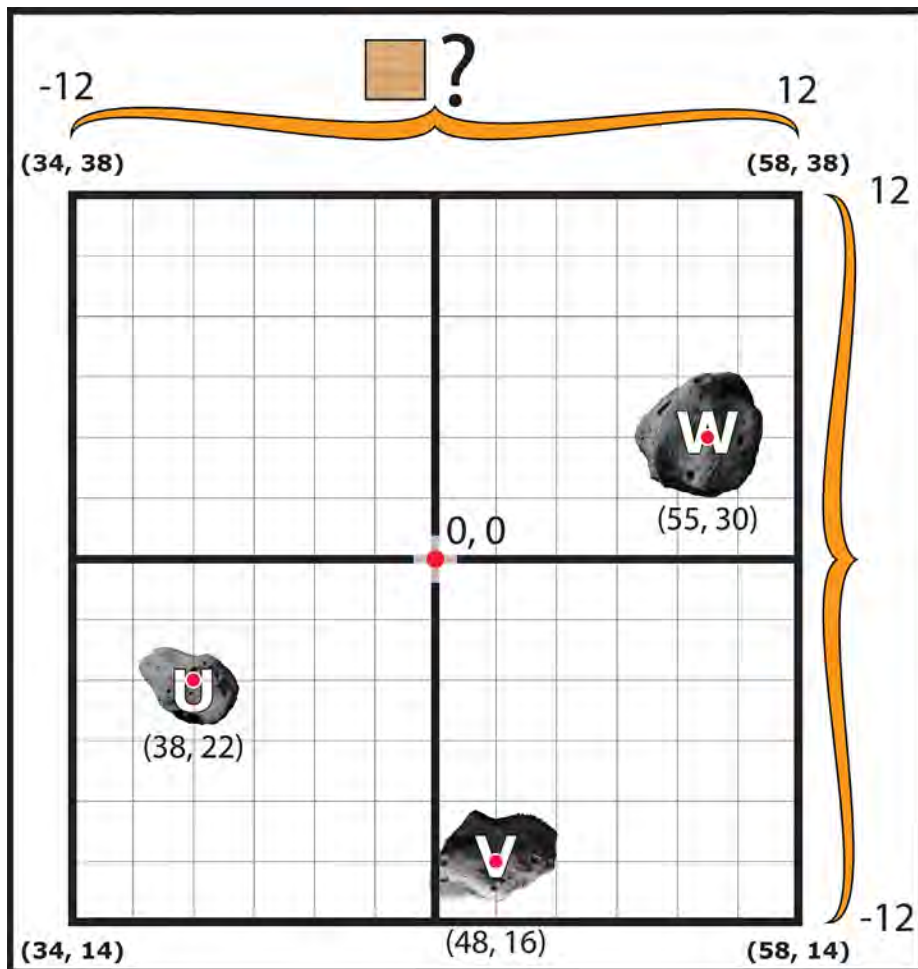
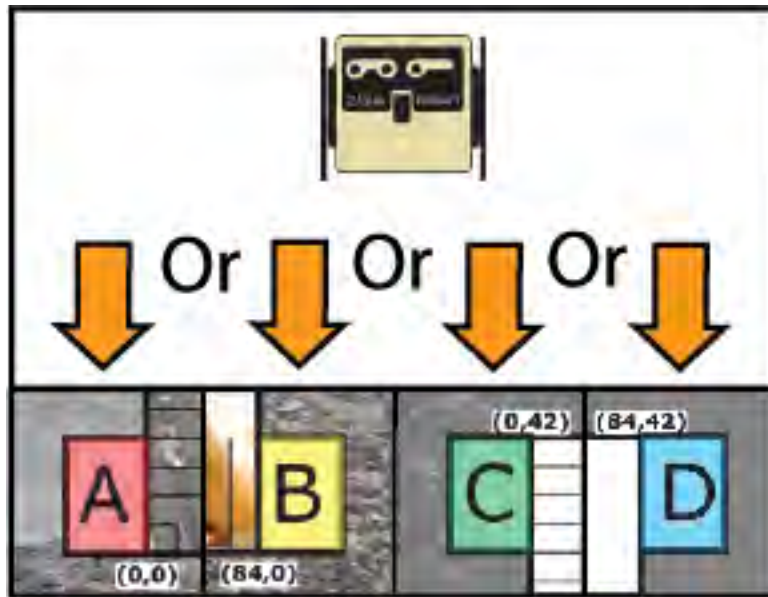
Move the bot to touch the wooden block at the local (X,Y) grid coordinates given by the judge.

Note: the coordinates are given relative to the grid, not the board. You will need to convert them to get a usable destination.

Scoring

#	Description of Scoring Criteria	Points
1	Bot makes contact with the block	10
2	Bot stops once it touches the block	10

Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Score																			



2. Newton's Cradle

25 points possible

Description

Perform momentum collision using two Bots

Setup

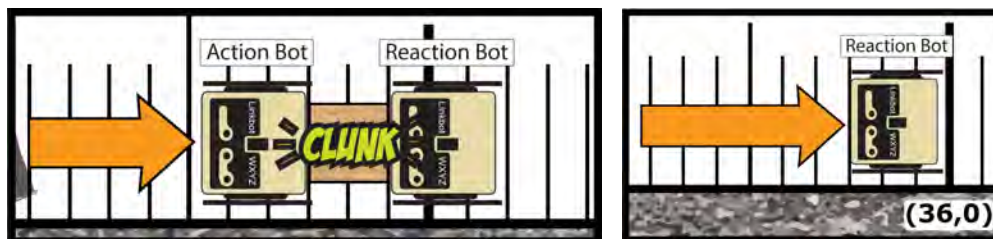
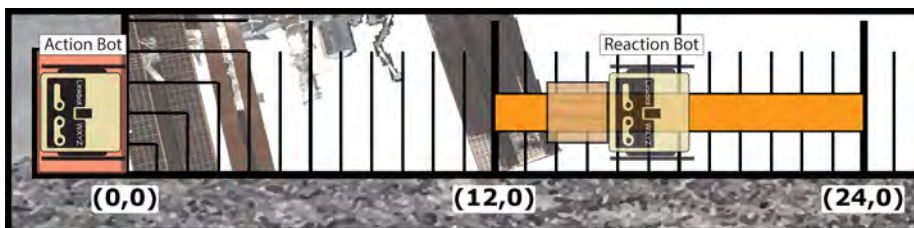
Action Bot is placed on starting position A, facing B.
 A Block may be placed between 12" and 24" along the \overline{AB} line.
 Reaction Bot is placed right of and adjacent to the block.

Objective

Action Bot travels forwards and hits the block.
 As soon as Action Bot hits the block, Reaction Bot starts to travel towards B and stops at 36"

Scoring

#	Description of Scoring Criteria	Points
1	Action Bot hits the block and stops immediately	10
2	Reaction Bot starts to move immediately after Action Bot stops	5
3	Reaction Bot stops within 2" of the 36" line	10
4	Penalty: Any part of Reaction Bot goes over the 36" line	No Points for Challenge



Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
Score																				

3. Rocket Intercept

35 points possible

Description

During a spaceflight, your craft collided with a stray asteroid, dislodging an air tank. The stray part is now tumbling on a collision course with a nearby satellite. Send a rocket to intercept and stop it. You'll also need to report to ground control with a graph of the action.

Setup

Tank Bot is placed on the right side of starting position A.
 Ship Bot is placed on starting position A.

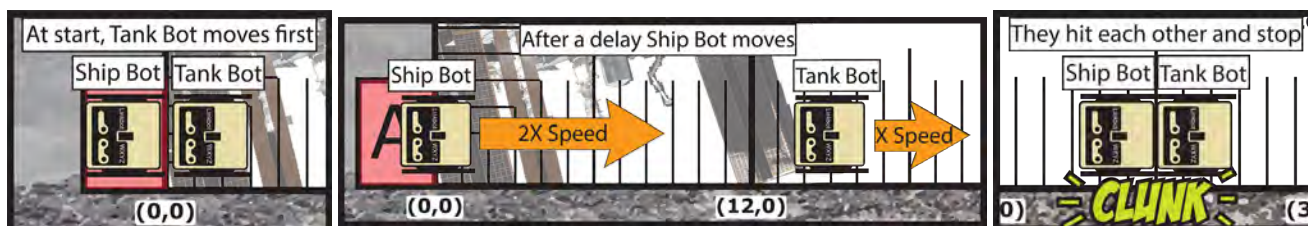
Objective

- Tank Bot leaves first, traveling along the \overline{AB} line.
- Ship Bot leaves its starting point after Tank Bot.
- Ship Bot moves at twice its speed of Tank Bot.
- Ship Bot makes contact with Tank Bot.
- Both Bots stop after making contact.
- Graph both Bots on the same chart, showing time and distance.

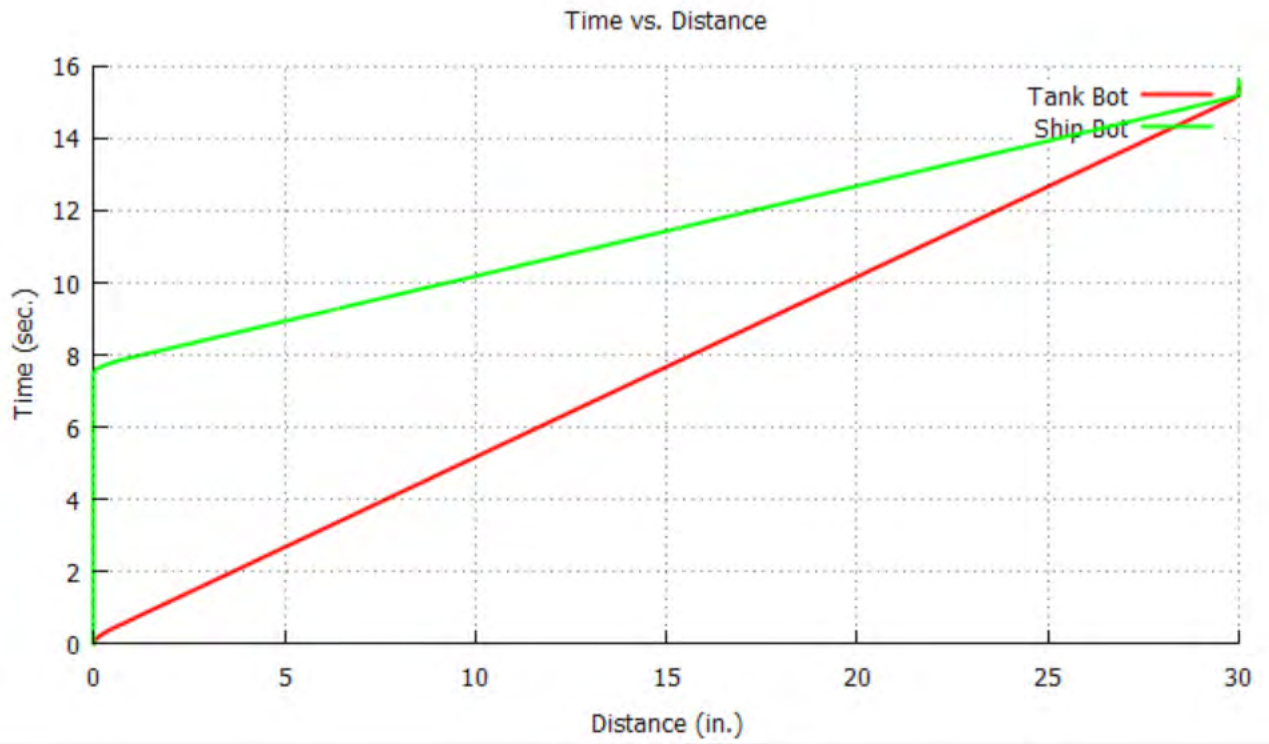
Scoring

Note: All coordinates are valid ± 2 ticks

#	Description of Scoring Criteria	Points
1	Ship Bot hits Tank Bot after traveling at least 15 inches	10
2	Both Bots stop when contact is made	5
3	The line for the Tank Bot on the graph starts at 0,0 and ends at 30, Y_2	5
4	The line for Ship Bot on the graph starts at 0, Y_1 and ends at 30, Y_2	5
5	Both Bots stop within ± 2 inches of the 30 inch mark	10



Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
Score																				



4. Collision Simulation

40 points possible

Description

Two spaceships on linear courses will collide. You need to send a camera bot out to film the event for Space-YouTube. Use the provided values to plot the intercept and move the bot to that location.

Setup

Camera Bot starts at starting Postion A.
 Recieve a random floating number **a** from 0.1 to 3.0.
 Recieve a random floating number **b** from 0.1 to 5.0.
Hint: Use the scanf() function to take user input to your program.

Objective

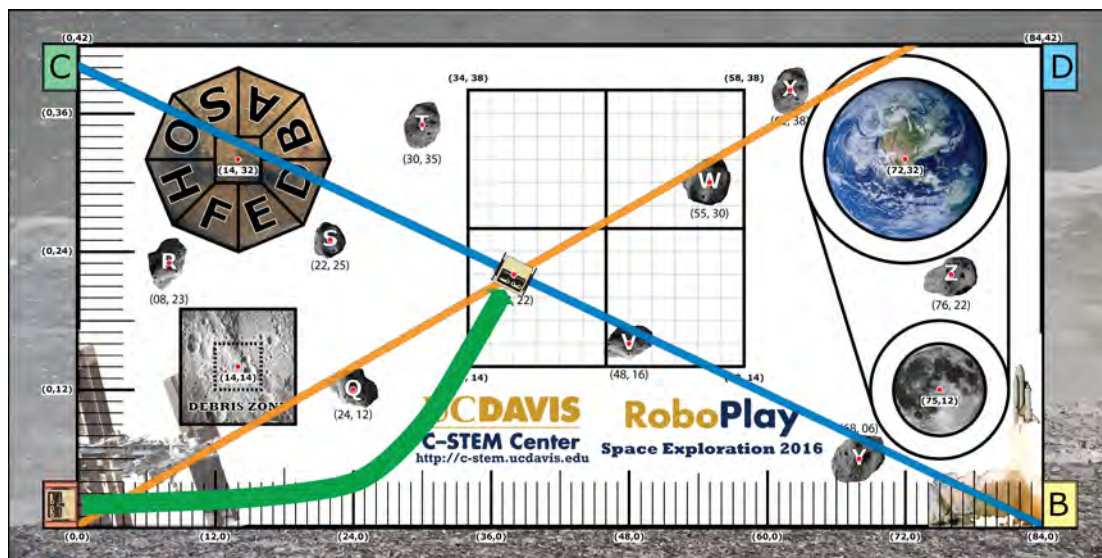
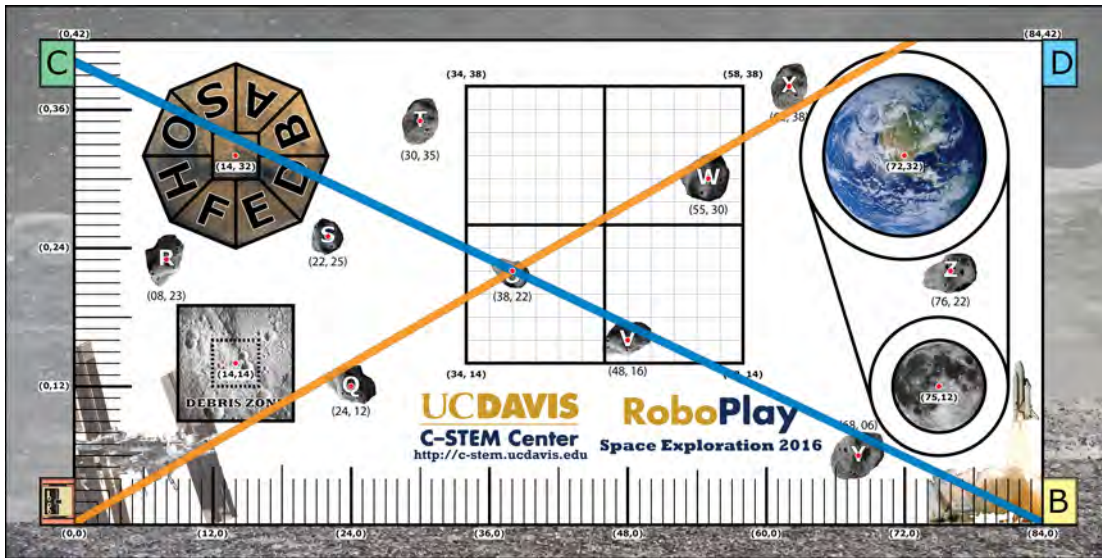
Equation 1	$y = ax$
Equation 2	$y = \frac{(84 - x)}{b}$

Solve the two equations with the provided values **a** and **b** to determine the X/Y coordinates where the two lines intercept.
 Navigate the Camera Bot to the calculated X/Y coordinates.

Scoring

#	Description of Scoring Criteria	Points
1	Camera Bot arrives within 2" of the target coordinates	30
2	Bot turns only once and proceeds directly to the target coordinates	10

Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
Score																				



5. Satellite Tracking

55 points possible

Description

In order to communicate with an orbiting satellite, a dish antenna must maintain the correct orientation as the satellite orbits the earth.

Setup

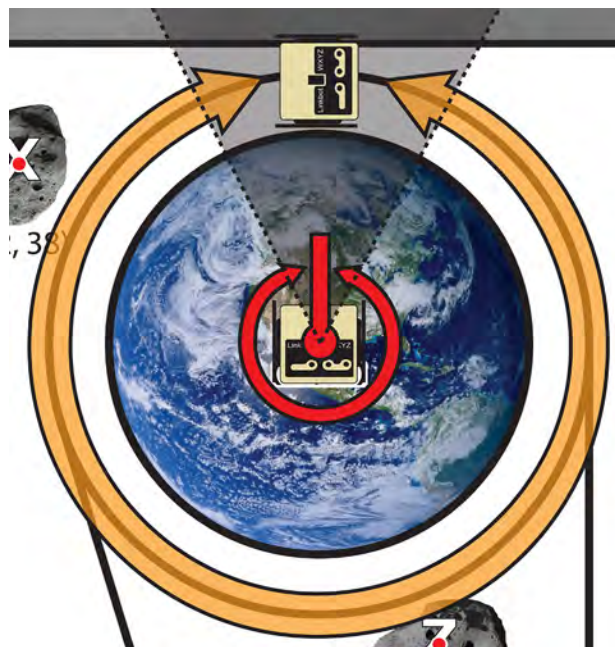
Satellite Bot is anywhere on the Earth Orbit Line.
 Antenna Bot is placed at the center of the Earth (73,32) facing the Satellite Bot.

Objective

Satellite Bot receives all the way around the Earth orbit, straddling the black line.
 Antenna Bot rotates to always face the Satellite Bot as it orbits.
 The two Bots must complete a cycle at the same time.

Scoring

#	Description of Scoring Criteria	Points
1	Antenna Bot rotates for 360 degrees	5
2	Satellite revolves around the Earth, 360 degrees	10 points per 1/4 orbit
3	Antenna Bot faces Satellite Bot for the entire orbit (± 45 degrees)	10



Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
Score																				

6. Empty Tank Disposal

60 points possible

Description

Highly volatile fuel tanks need to be disposed of safely. Your bots must transport the tanks to the debris zone without moving other debris in the area.

Setup

Bots are placed on any two separate starting positions: A, B, C, or D.
 One wooden block is placed adjacent to each of the two starting locations.
 3 PVC pipes are placed on their ends, centered on the outside edges of the inner debris zone, one per side, at the player's discretion.

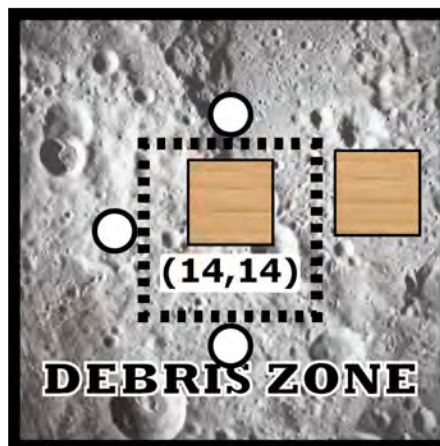
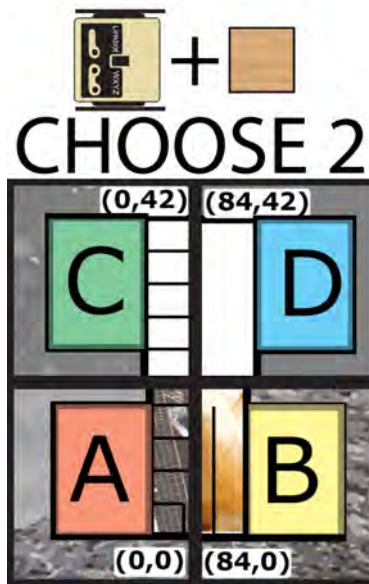
Objective

Move the blocks so that they end up mostly within the inner debris zone. More than half of the block must be inside the dotted square.
 The Bots must end up completely outside the outer debris zone.
 The PVC pipes should not be moved once the experiment begins.

Scoring

#	Description of Scoring Criteria	Points
1	Blocks are mostly inside the inner debris zone	30 per block
2	Penalty: PVC pipe is moved, but remains entirely within the outside debris zone	-10 per pipe
3	Penalty: Any PVC pipe has any part outside of the outer debris zone	-50
4	Penalty: Any Bot finishes with any part still within the debris zone	-10

Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
Score																				



7. Habitat Construction

70 points possible

Description

Inhabiting a new planet will require the surface to be excavated for before structures can be erected. Large rocks will need to be corrected and relocated. Create an Excavator Bot to collect a rock from the Debris Zone and relocate it without touching the existing structures.

Setup

Place PVC pipes along the \overline{CD} side of the Debris Zone (See Figure 1).
 Place hacky sack at the center of the Debris Zone (14,14).
 At least one Bot of the Excavator Bot must start inside starting position A.

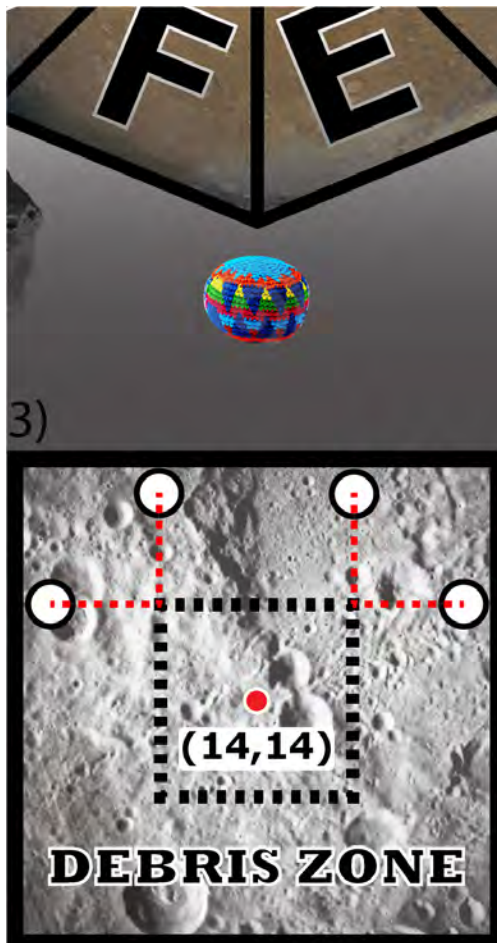
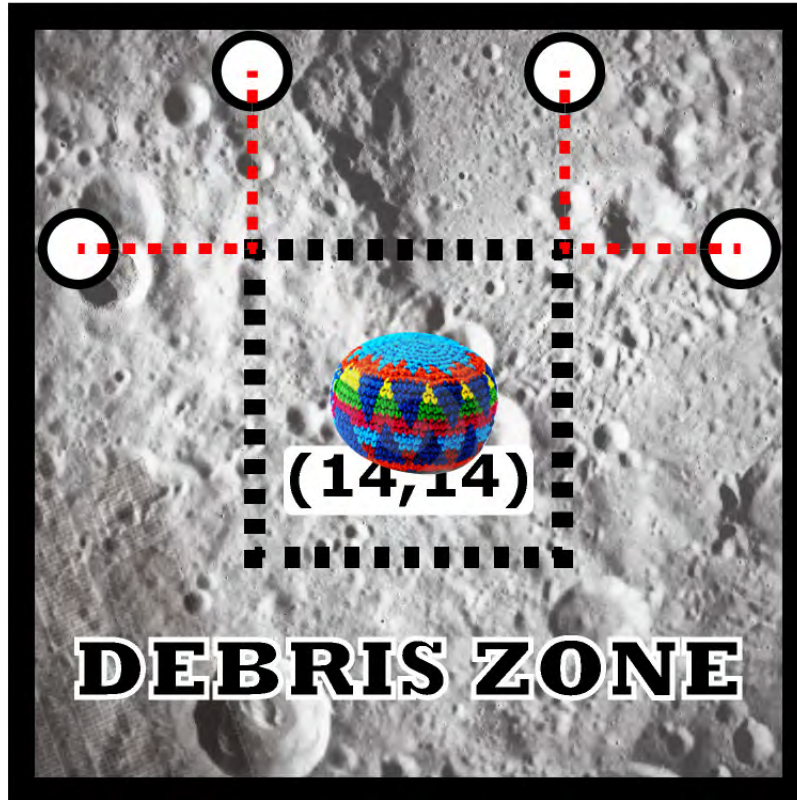
Objective

The Excavator Bot is to remove the hacky sack from the Debris Zone and then relocate it to the zones defined by the coordinates $(9 \leq x \leq 19, y > 19)$, the area "above" the Debris Zone.
 The Excavator must exit the debris zone and come to a stop for the challenge to end.

Scoring

#	Description of Scoring Criteria	Points
1	Excavator Bot moves hacky sack	15
2	Hacky sack is entirely outside the Debris Zone	20
3	Hacky sack is "above" the Debris Zone	35
4	Penalty: PVC pipes are removed	-20 per pipe
5	Penalty: Excavator Bot finishes not clear of the Debris Zone	-50

Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Score																			



8. Asteroid Orbital

80 points possible

Description

Your bot is on an inspection mission to investigate the composition of a slow moving asteroid. You'll need to move your bot around the asteroid as it moves in a straight line.

Setup

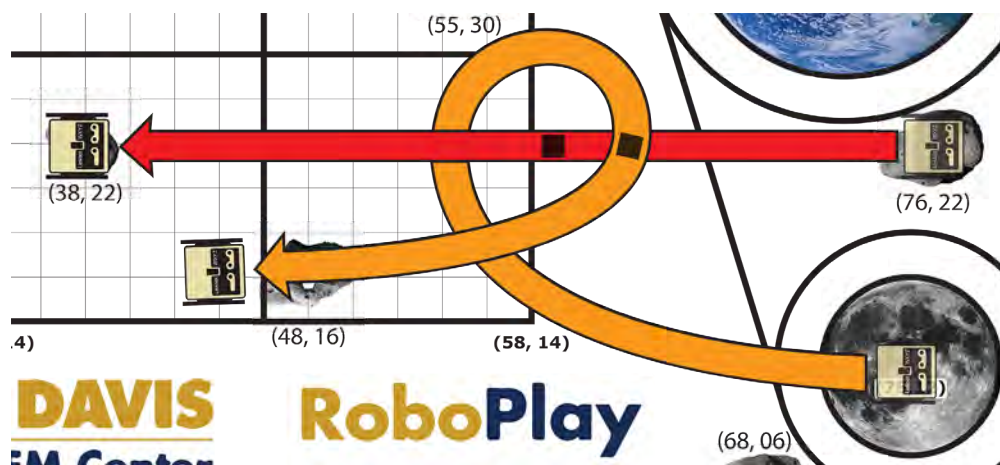
Asteroid Bot is placed on asteroid Z (76,22).
Spacecraft Bot is placed either on the center of the Earth (73,32) or the Moon (75,12).

Objective

Asteroid must travel to asteroid U in a straight line with a constant velocity.
Spacecraft Bot must circle around the Asteroid Bot while it's moving along a straight path.
The path of a loop as illustrated is optional.

Scoring

#	Description of Scoring Criteria	Points
1	Spacecraft Bot gets within 6" of Asteroid Bot	10
2	Spacecraft Bot moves all the way around Asteroid Bot	30 per orbit, max 60
3	Asteroid Bot stops at U	10
4	Penalty: Spacecraft Bot comes in contact with Asteroid Bot	-80



Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Score																			

9. Supply Run

90 points possible

Description

The first mission to Mars has been scheduled, but there is much work to be done to get ready for people. Many supply runs will be made before humans can launch. Carry the supplies from Earth to Mars, but watch out for Asteroids!

Description

Bot(s) are placed on startingn position D.
Wooden block is placed on center of Earth (72,32).

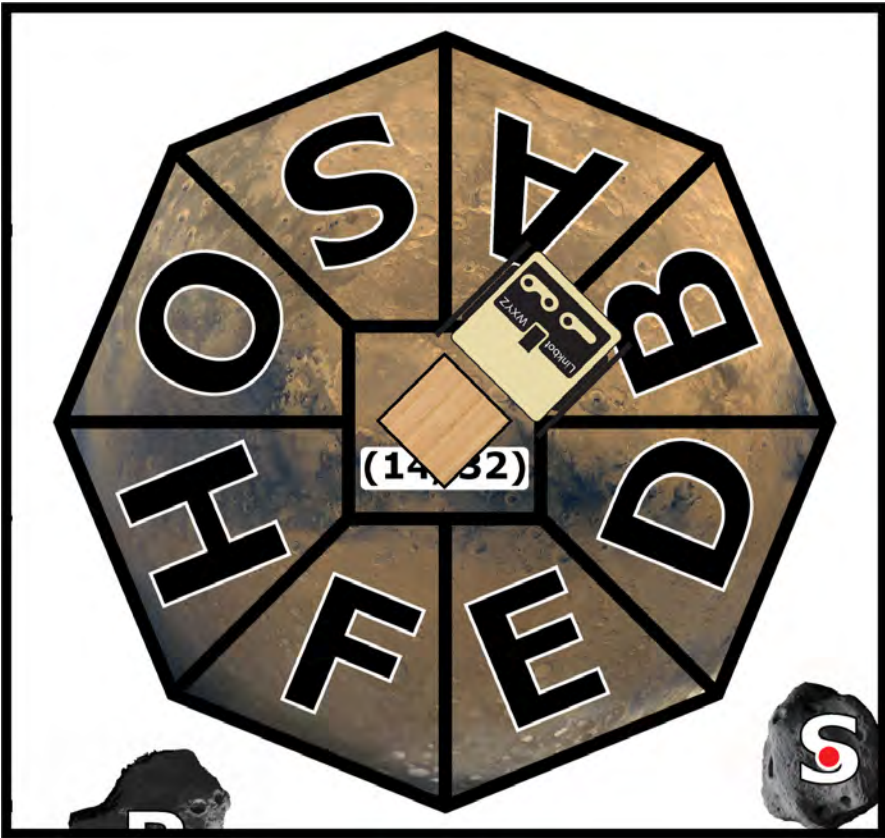
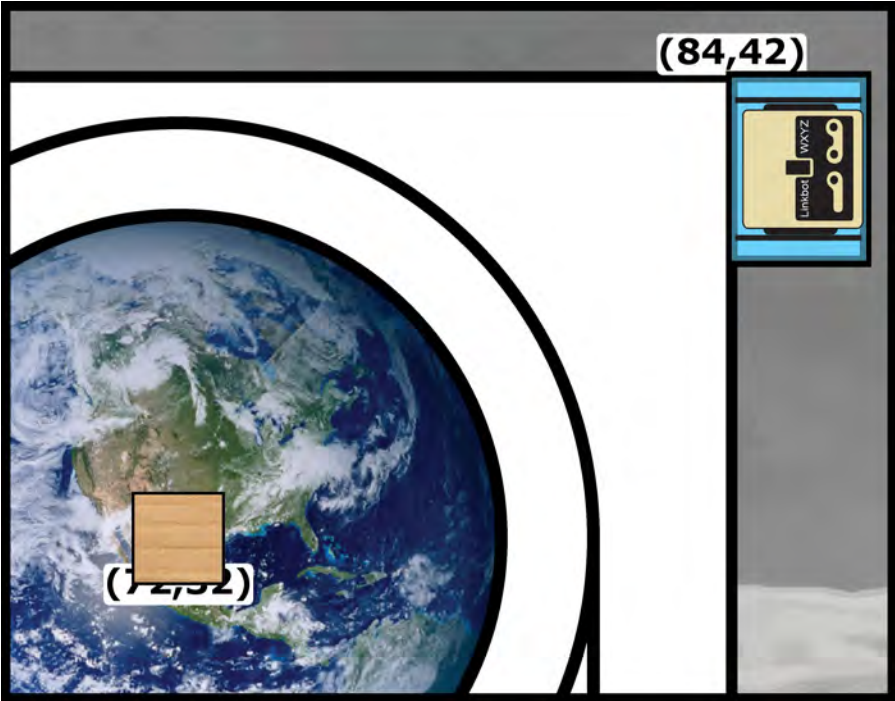
Objective

Wooden Block is pushed from center of the Earth to the center of Mars (14,32).
Both wooden block and Bot(s) may not touch any asteroids (Q - Z) on the way.

Scoring

#	Description of Scoring Criteria	Points
1	Wooden block is entirely inside the outline of Mars	20
2	Wooden block is entirely inside the center box of Mars	70
3	Penalty: Block or Bot touches the asteroid	- 30 per asteroid hit

Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Score																			



10. Exhaust Port Targeting

120 points possible

Description

A large space station (not a small moon) has an exposed exhaust port. You need to make a "delivery" to that exhaust port to "deactivate" the station.

Setup

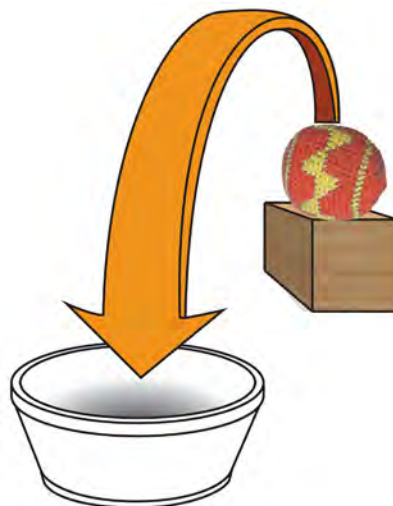
Place the cube connector, open end up, centered on the Moon at (75,12).
Place a hacky sack on one (or more) wooden block(s), at least 6" away from the bowl.
Bot(s) must start at least 6" from the hacky sack.

Objective

Place the hacky sack in the bowl.

Scoring

#	Description of Scoring Criteria	Points
1	Pick up the hacky sack	10
2	Move the hacky sack to within 3" of the bowl	10
3	Place the hacky sack in the bowl	100
4	Penalty: Move the wooden block(s)	- 50
5	Penalty: Move the bowl	- 70



Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
Score																				

Score Tracker

Division 2	Practice 1	Practice 2	Run 1	Run 2	Run 3
1. Supply Recovery (20)					
2. Newton's Cradle (25)					
3. Rocket Intercept (35)					
4. Collision Simulation (40)					
5. Satellite Tracking (55)					
6. Empty Tank Disposal (60)					
7. Habitat Construction (70)					
8. Asteroid Orbital (80)					
9. Supply Run (90)					
10. Exhaust Port Targeting (120)					
Total					

Notes:

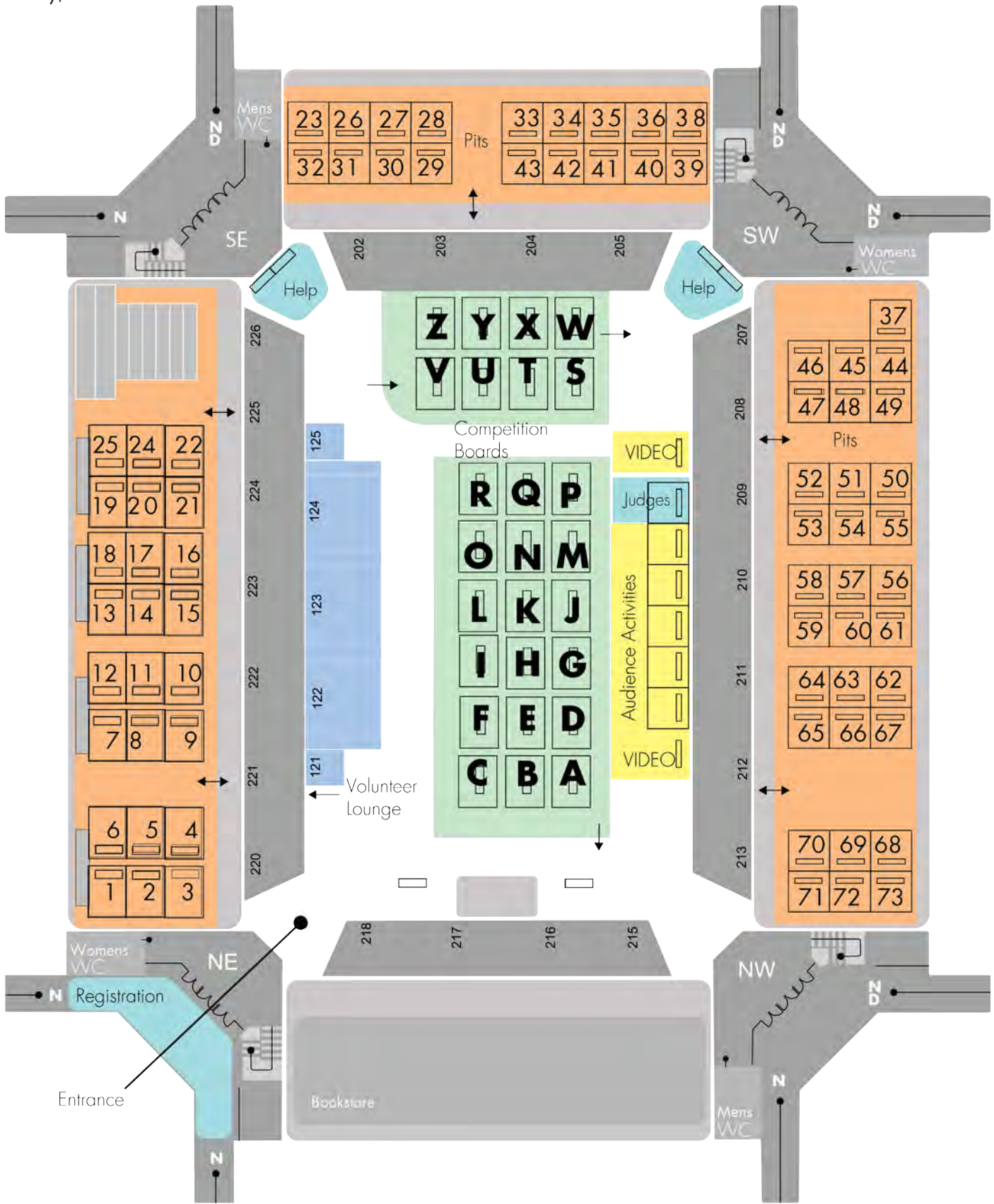
Notes:

Notes:

Pavilion - Upper Level

C-STEM Day

May, 2016



Division 1 - Challenge 2. **X Marks the Spot**

# X Value	Destination	Coordinates
14	Inner Debris Zone	14,14
22	Asteroid S	22,25
30	Asteroid T	30,35

Division 2 - Challenge 4. **Collision Simulation**

Orbital Simulation (Linear vs. Linear)							
https://www.desmos.com/calculator/cinl0nzjpn							
	X	Y	A	B	Actual A	Actual B	Max Delta (Inch)
Q	24	12	0.5	5	0.5	5	0.00
R	8	23	2.9	3.3	2.875	3.304347826	0.20
S	22	25	1.14	2.48	1.136363636	2.48	0.08
T	30	35	1.17	1.54	1.166666667	1.542857143	0.10
U	38	22	0.58	2.1	0.5789473684	2.090909091	0.17
V	48	16	0.33	2.25	0.3333333333	2.25	0.00
W	55	30	0.55	0.97	0.5454545455	0.9666666667	0.46
X	62	38	0.61	0.58	0.6129032258	0.5789473684	0.11
Y	68	6	0.09	2.67	0.08823529412	2.666666667	1.36
Z	76	22	0.29	0.36	0.2894736842	0.3636363636	0.14

a	b	lert	x	y
0.5	5	Q	24	12
2.9	3.3	R	8	23
1.14	2.48	S	22	25
1.17	1.54	T	30	35
0.58	2.1	U	38	22
0.33	2.25	V	48	16
0.55	0.97	W	55	30
0.61	0.58	X	62	38
0.09	2.67	Y	68	6
0.29	0.36	Z	76	22

$$y = ax$$

$$y = (84 - x) / b$$

Division 3 - Challenge 8. **Asteroid Defense**

Orbital Simulation (Linear vs. Linear)							
https://www.desmos.com/calculator/cinl0nzjpn							
	X	Y	A	B	Actual A	Actual B	Max Delta (Inch)
Q	24	12	2.1	5	2.083	5	0.19
R	8	23	36	3.3	35.938	3.304347826	0.04
S	22	25	5.2	2.48	5.165	2.48	0.17
T	30	35	3.9	1.54	3.889	1.542857143	0.10
U	38	22	1.5	2.1	1.524	2.090909091	0.17
V	48	16	0.7	2.25	0.694	2.25	0.38
W	55	30	0.99	0.97	0.992	0.9666666667	0.19
X	62	38	0.98	0.58	0.989	0.5789473684	0.11
Y	68	6	0.13	2.67	0.130	2.666666667	0.13
Z	76	22	0.38	0.36	0.381	0.3636363636	-0.18

a	b	Letter	X	Y
d1	d2	d3	d4	d5
2.1	5	Q	24	12
36	3.3	R	8	23
5.2	2.48	S	22	25
3.9	1.54	T	30	35
1.5	2.1	U	38	22
0.7	2.25	V	48	16
0.99	0.97	W	55	30
0.98	0.58	X	62	38
0.13	2.67	Y	68	6
0.38	0.36	Z	76	22

$$y = a(x^2/100)$$

$$y = (84 - x) / b$$

Division 3 - Challenge 7. **Contacting the Martian**

Word List				
FADE	BASH	HEAD	HOSE	SHED
BASE	DOSE	BADE	SHOE	DEAF
SAFE	BEAD	ABED	SODA	SOFA