



UCDAVIS
C-STEM Center

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



RoboPlay Challenge Competition



C-STEM DAY

Saturday, May 30, 2015
UC Davis

DIVISION 2

Math Programming Competition



Message From the Director

Dear C-STEM Teachers and Students,

C-STEM (Computing, Science, Technology, Engineering, and Mathematics) is a UC Approved Educational Preparation Program for Undergraduate Admission to all UC campuses. Therefore, participation in the C-STEM program, C-STEM student individual and team awards, and extracurricular activities are recognized in the UC admissions process as achievements that have explicitly prepared students for colleges and careers. C-STEM joins a distinguished group of programs with UC A-G Program Status. High schools can readily and easily add the “A-G approved” rigorous C-STEM curriculum integrated with computing and robotics to their own school’s A-G course lists to satisfy the UC/CSU admission requirements, without submitting a complete course content description and going through the traditional approval process with the University of California Office of President.

In 2015-2016, the C-STEM Center will pilot offering a new AP Computer Science Principles course with partner schools. This new course will introduce C-STEM students to computer science principles aligned with the learning objectives described in the College Board’s CS Principles Curriculum Framework and prepare students to take the AP CS Principles exam.

The C-STEM Center aims to transform K-14 computing and STEM education in both formal and informal programs through integrated learning by integrating computing and robotics into STEM education. C-STEM Day is a culminating event of the C-STEM program. Students in the C-STEM program will showcase their accomplishments and creativity in RoboPlay and Math Programming Competitions in not only STEM topics, but also in writing, storytelling, art, music, and film production.

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 luck for your competition!

Dr. Harry Cheng
C-STEM Center Director

C-STEM is now a University of California approved Educational Preparation Program and has UC A-G approved Courses.

C-STEM Day Schedule:

May 30, 2015

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: <ul style="list-style-type: none">• C-STEM Awards of Achievement• C-STEM Awards of Excellence• C-STEM Scholarship• UC Davis Math Programming Competition Winners• RoboPlay Video Competition Winners• RoboPlay Challenge Competition Winners• GIRL's Leadership Award	Pavilion

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Computing, Science, Technology, Engineering and Math (C-STEM)

Why STEM?

The majority of future high-paying job opportunities will be clustered around the STEM disciplines (Science, Technology, Engineering and Math) on production and ingenuity in high-tech industries. STEM businesses and related knowledge-based high-tech clusters are projected to grow more rapidly than the overall economy and generate additional job creation in other sectors.

IT/ICT is a *fundamental driver of modern economic success and competitiveness* allowing automation of business processes, development of information tools for decision making, connects businesses with their customers in an increasing number of ways, and provides productivity tools to increase efficiency. *Programmers by trade are sought by a wide variety of companies* for proprietary software design, network support, or process development and have surpassed the state's 10-year employment projections in just five years.

Why computing or IT/ICT?

Information Technology (IT) or Information and Communications Technology (ICT) refer to computers and computer networks and encompasses other information distribution technologies such as television and telephones. Several industries are associated with information technology, including computer hardware, software, electronics, semiconductors, Internet, telecom equipment, e-commerce and computer services.

While the majority of IT jobs require certifications or degrees equivalent to a Bachelor's, entry-level opportunities such as Computer Support Specialists have lower education requirements. New job growth stems primarily from Software Developers, IT Security Analysts, and Market Research Analysts.

Sources: Information is directly from www.ocbc.org, www.mpict.org, and www.itif.org

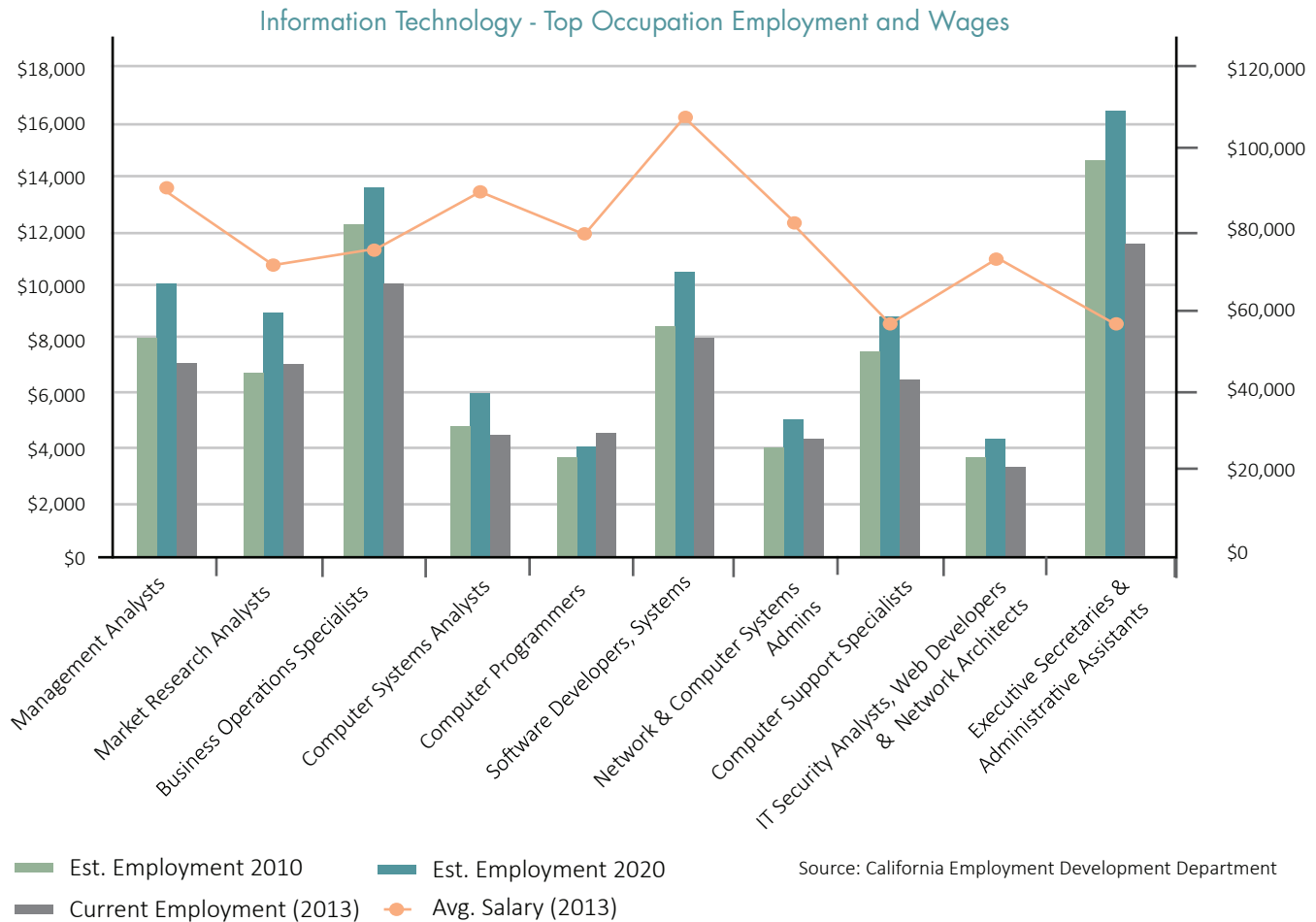
Information and Communications Technology

Creates High-Paying Jobs

- Between 2001 and 2011, over 565,000 IT-related jobs (in all industries) were created in the United States, an increase of 22.2 percent. IT jobs grew more than 95 times faster than employment as a whole, which grew by only 0.2 percent
- In 2011, IT workers earned \$78,584 a year, 74 percent more than the average worker (\$45,230). Accounting for just the growth in these high-paying IT jobs, U.S. GDP was over \$89 billion larger in 2011 than it was in 2001.

Helps Build High-Growth Companies

- In the 2011 Inc. 5000 rankings of the 5,000 fastest growing companies in the United States, almost one-quarter (1,140) were in the IT industry, with a three-year average growth rate of 302 percent and revenues totaling nearly \$54 billion.
- In Deloitte's 2011 Technology Fast 500 Ranking, a ranking of the fastest growing high-technology firms in the United States, 330 of the 500 companies were in the IT industry.



*Source: OCBC Workforce Indicators Report 2014

Did you know?

1. 2001-2011, over 565,000 IT-related jobs (in all industries) were created in the United States. IT jobs grew more than 95 times faster than employment as a whole.
2. In 2011, IT workers earned \$78,584 a year, 74 percent more than the average worker (\$45,230).
3. In the 2011 Inc. 5000 rankings of the 5,000 fastest growing companies in the US, almost 1/4 (1,140) were in the IT industry, with a 3-year average growth rate of 302% and revenues totaling nearly \$54 billion.
4. In 2012 there were 466,000 US jobs related to mobile apps, up from 0 in '07. The mobile app economy generated almost \$20 billion in revenue in 2011.

*Source: www.itif.org

Competition Details

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Schedule for RoboPlay Challenge Competition - Division 1

School	Teacher	Team #	Board	Practice Times	Competition Times	Pit #
American Cannon MS	Lee	1	A	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:05 - 2:22 3:25 - 3:42	1
American Cannon MS	Lee	2	A	10:20 - 10:37 11:40 - 11:57	1:05 - 1:22 2:25 - 2:42 2:45 - 3:02	2
Bridgeway Island	Schoellhamer	3	A	10:40 - 10:57 11:20 - 11:37	1:25 - 1:42 1:45 - 2:02 3:05 - 3:22	3
Bridgeway Island	Schoellhamer	4	B	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:05 - 2:22 3:25 - 3:42	4
Bridgeway Island	Tkachuk	5	B	10:20 - 10:37 11:40 - 11:57	1:05 - 1:22 2:25 - 2:42 2:45 - 3:02	5
California MS	Mois	6	B	10:40 - 10:57 11:20 - 11:37	1:25 - 1:42 1:45 - 2:02 3:05 - 3:22	6
California MS	Mois	7	C	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:05 - 2:22 3:25 - 3:42	7
California MS	Aguilar	8	C	10:20 - 10:37 11:40 - 11:57	1:05 - 1:22 2:25 - 2:42 2:45 - 3:02	8
California MS	Aguilar	9	C	10:40 - 10:57 11:20 - 11:37	1:25 - 1:42 1:45 - 2:02 3:05 - 3:22	9
Dixon Montessori	Purdum	10	D	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:05 - 2:22 3:25 - 3:42	10
Douglass MS	Arthofer	11	D	10:20 - 10:37 11:40 - 11:57	1:05 - 1:22 2:25 - 2:42 2:45 - 3:02	11
Douglass MS	Arthofer	12	D	10:40 - 10:57 11:20 - 11:37	1:25 - 1:42 1:45 - 2:02 3:05 - 3:22	12
Einstein MS	Stowell	13	E	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:05 - 2:22 3:25 - 3:42	13
Einstein MS	Stowell	14	E	10:20 - 10:37 11:40 - 11:57	1:05 - 1:22 2:25 - 2:42 2:45 - 3:02	14
Elkhorn Village E	Wright	15	E	10:40 - 10:57 11:20 - 11:37	1:25 - 1:42 1:45 - 2:02 3:05 - 3:22	15
Elkhorn Village E	Wright	16	F	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:05 - 2:22 3:25 - 3:42	16
Elkhorn Village E	Ogino	17	F	10:20 - 10:37 11:40 - 11:57	1:05 - 1:22 2:25 - 2:42 2:45 - 3:02	17

Schedule for RoboPlay Challenge Competition - Division 1 Continued

School	Teacher	Team #	Board	Practice Times	Competition Times	Pit #
Elkhorn Village E	Ogino	18	F	10:40 - 10:57 11:20 - 11:37	1:25 - 1:42 1:45 - 2:02 3:05 - 3:22	18
George A Buljan MS	Dosen	19	G	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:05 - 2:22 3:25 - 3:42	19
Granite Oaks MS	Waddell	20	G	10:20 - 10:37 11:40 - 11:57	1:05 - 1:22 2:25 - 2:42 2:45 - 3:02	20
Lee MS	Turner	21	G	10:40 - 10:57 11:20 - 11:37	1:25 - 1:42 1:45 - 2:02 3:05 - 3:22	21
Lee MS	Turner	22	H	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:05 - 2:22 3:25 - 3:42	22
Mountain Vista MS	Mostin	23	H	10:20 - 10:37 11:40 - 11:57	1:05 - 1:22 2:25 - 2:42 2:45 - 3:02	23
Mountain Vista MS	Mostin	24	H	10:40 - 10:57 11:20 - 11:37	1:25 - 1:42 1:45 - 2:02 3:05 - 3:22	24
Riverbank MS	Saul	25	I	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:05 - 2:22 3:25 - 3:42	25
Riverbend E	Uzelac	26	I	10:20 - 10:37 11:40 - 11:57	1:05 - 1:22 2:25 - 2:42 2:45 - 3:02	26
Riverbend E	Gonzales	27	I	10:40 - 10:57 11:20 - 11:37	1:25 - 1:42 1:45 - 2:02 3:05 - 3:22	27
Riverbend E	Gonzales	28	J	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:05 - 2:22 3:25 - 3:42	28
Roosevelt MS	Allison	29	J	10:20 - 10:37 11:40 - 11:57	1:05 - 1:22 2:25 - 2:42 2:45 - 3:02	29
School of Engineering & Sciences	Craig	30	J	10:40 - 10:57 11:20 - 11:37	1:25 - 1:42 1:45 - 2:02 3:05 - 3:22	30
School of Engineering & Sciences	Craig	31	K	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:05 - 2:22 3:25 - 3:42	31
School of Engineering & Sciences	Besk	32	K	10:20 - 10:37 11:40 - 11:57	1:05 - 1:22 2:25 - 2:42 2:45 - 3:02	32
Smedburg MS	Reinhard	34	K	10:40 - 10:57 11:20 - 11:37	1:25 - 1:42 1:45 - 2:02 3:05 - 3:22	34

Schedule for RoboPlay Challenge Competition - Division 1 Continued

School	Teacher	Team #	Board	Practice Times	Competition Times	Pit #
Valley View MS	Kugler	35	L	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:05 - 2:22 3:25 - 3:42	35
Valley View MS	Hawes	36	L	10:20 - 10:37 11:40 - 11:57	1:05 - 1:22 2:25 - 2:42 2:45 - 3:02	36
Valley View MS	Hawes	37	L	10:40 - 10:57 11:20 - 11:37	1:25 - 1:42 1:45 - 2:02 3:05 - 3:22	37

Schedule for RoboPlay Challenge Competition - Division 2

School	Teacher	Team #	Board	Practice Times	Competition Times	Pit #
American Cannon HS	Marsden	44	N	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:05 - 2:22 3:25 - 3:42	44
Luther Burbank HS	Dagler	41	N	10:20 - 10:37 11:40-11:57	1:05 - 1:22 2:25 - 2:42 2:45 - 3:02	41
Luther Burbank HS	Williams	42	O	10:20 - 10:37 11:40-11:57	1:05 - 1:22 2:25 - 2:42 2:45 - 3:02	42
River City HS	Fagout	38	O	10:40 - 10:57 11:20 - 11:37	1:25 - 1:42 1:45 - 2:02 3:05 - 3:22	38
School of Engineering & Science	Besk	33	O	10:20 - 10:37 11:40 - 11:57	1:25 - 1:42 1:45 - 2:02 3:05 - 3:22	33

Schedule for RoboPlay Challenge Competition - Division 3

School	Teacher	Team #	Board	Practice Times	Competition Times	Pit #
American Cannon HS	Marsden	45	P	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:05 - 2:22 3:25 - 3:42	45
Franklin HS	Akuna	46	P	10:20 - 10:37 11:40-11:57	1:05 - 1:22 2:25 - 2:42 2:45 - 3:02	46
Franklin HS	Shuping	47	P	10:40 -10:57 11:20 - 11:37	1:25 -1:42 1:45 - 2:02 3:05 - 3:22	47
Franklin HS	Shuping	48	Q	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:05 - 2:22 3:25 - 3:42	48
Franklin HS	Akuna	49	Q	10:20 - 10:37 11:40-11:57	1:05 - 1:22 2:25 - 2:42 2:45 - 3:02	49
Franklin HS	Akuna	50	Q	10:40 -10:57 11:20 - 11:37	1:25 -1:42 1:45 - 2:02 3:05 - 3:22	50
Heritage Peak Charter	Knapp	51	R	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:05 - 2:22 3:25 - 3:42	51
Heritage Peak Charter	Knapp	52	R	10:20 - 10:37 11:40-11:57	1:05 - 1:22 2:25 - 2:42 2:45 - 3:02	52
Livermore Valley HS	Johnston	53	R	10:40 -10:57 11:20 - 11:37	1:25 -1:42 1:45 - 2:02 3:05 - 3:22	53
Livermore Valley HS	Johnston	54	S	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:05 - 2:22 3:25 - 3:42	54
Livermore Valley HS	Johnston	55	S	10:20 - 10:37 11:40-11:57	1:05 - 1:22 2:25 - 2:42 2:45 - 3:02	55
Luther Burbank HS	Williams	43	S	10:40 -10:57 11:20 - 11:37	1:25 -1:42 1:45 - 2:02 3:05 - 3:22	43
Placer COE	Jarrett	56	T	10:00 - 10:17 11:00 - 11:17	12:45 - 1:02 2:05 - 2:22 3:25 - 3:42	56
River City HS	Fagout	39	T	10:20 - 10:37 11:40-11:57	1:05 - 1:22 2:25 - 2:42 2:45 - 3:02	39
River City HS	Tan	40	U	10:20 - 10:37 11:40-11:57	1:05 - 1:22 2:25 - 2:42 2:45 - 3:02	40
Winters HS	Challender	57	U	10:40 -10:57 11:20 - 11:37	1:25 -1:42 1:45 - 2:02 3:05 - 3:22	57

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 I-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 and scored at any given time. Multiple challenges may not be chained together nor run simultaneously.
3. 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 must stop their motion, unless specifically allowed by the challenge text.
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".

-
- 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.
 - You are encouraged to keep a record of your challenge scores in the space provided at the bottom of each challenge.
 - 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

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

Sample code:

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

- Random numbers will change at the start of every run. Your Table Judge will hold up and say the relevant numbers for each run.
- You may enter your random numbers into your program after starting it. Step away from the computer after entering your numbers.
- 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

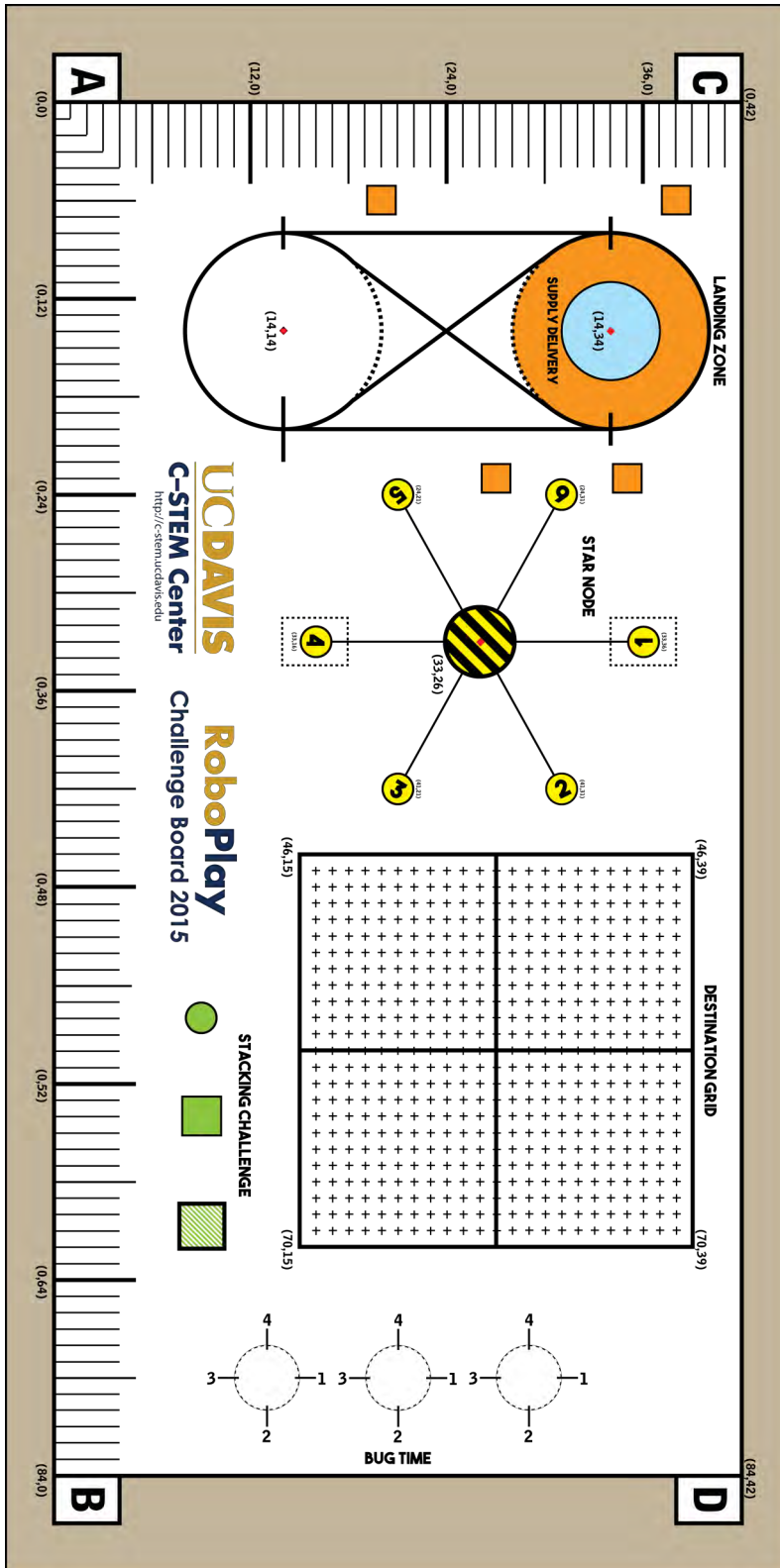
Each team will have the following parts to complete the challenges:

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
3/4" 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)

Challenge Board



1. Landing Zone

(40 Points Possible)

Basic Task Description

Have your bots surround the hacky at a radius between 4" and 8" in a cross formation.

Starting Position/Set up

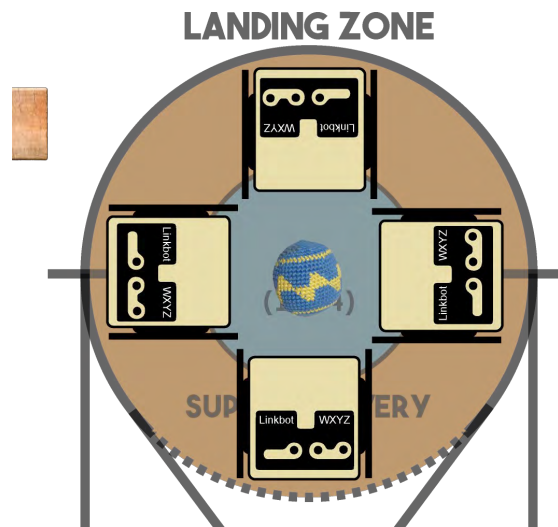
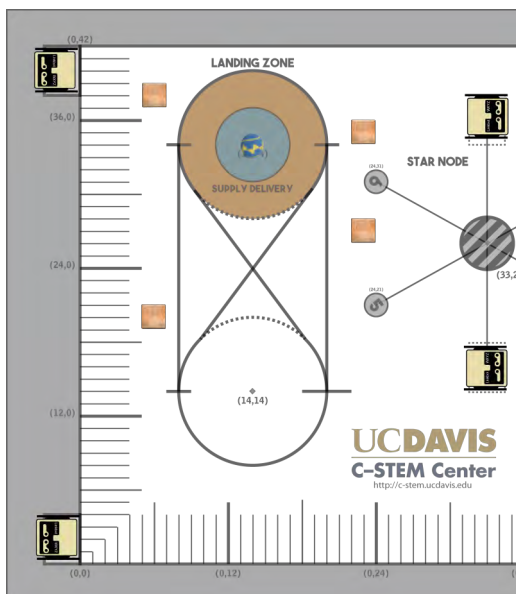
Hacky is placed in the center of the Landing Zone.
 Blocks are placed on the 4 orange squares around the Landing Zone.
 Place bots at starting positions A and C and on Star Nodes 1 and 4.

Objective

Move each bot to surround the hacky such that they are in a cross formation.
 Do not touch the hacky or move the blocks.

Scoring

#	Description	Points
1	Bots form a cross wholly within the Landing Zone.	40
2	Penalty: Hacky touched.	-20
3	Penalty: Blocks moved from starting position.	-5 per block



Team Scores

Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Score																					

2. Newton's Cradle

(55 Points Possible)

Basic Task Description

Simulate a Newton's Cradle. Use the accelerometer of one bot to detect the hit of another bot through blocks.



Starting Position/Set up

Robot A is in starting position A, facing starting position B
 3x Blocks are placed, touching one another, a random distance (12 to 24 inches) from starting position A by Judge.
 Robot B is touching blocks, facing starting position B

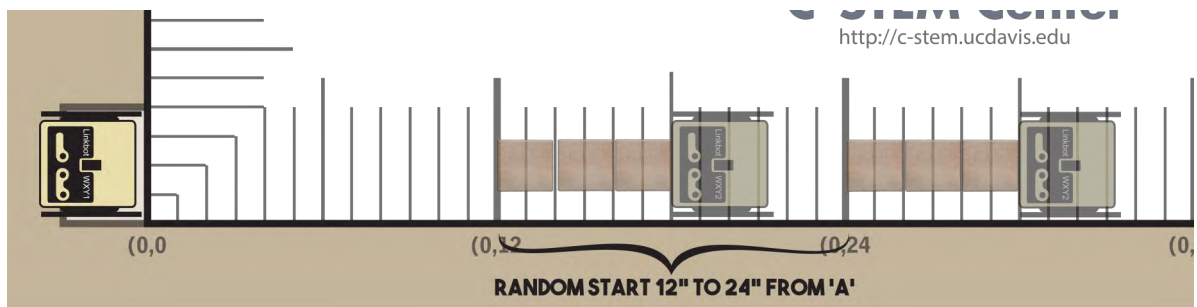
Objective

Robot A moves towards the blocks until Robot B detects a hit. Robot A Stops. Robot B moves away from target 10 inches. Robot B returns to blocks until Robot A detects a hit. Robot B Stops. Robot A moves away from blocks 10 inches.
 Robots must use accelerometers to detect hits.

Scoring

#	Description	Points
1	Robot A hits blocks and stops within 1 second.	10
2	Robot B starts after Robot A stops.	15
3	Robot B moves out 10 inches ($\pm 1''$).	5
4	Robot B hits blocks and stops within 1 second.	15
5	Robot A starts after Robot B stops and moves 10 inches ($\pm 1''$).	10

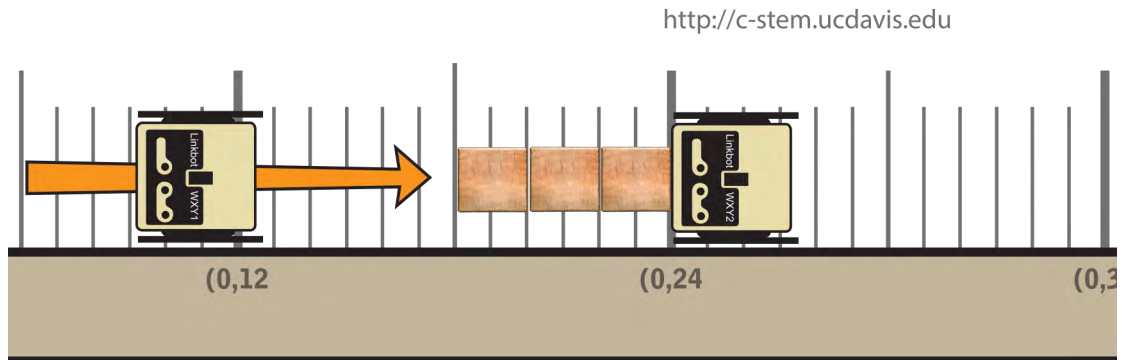
Setup:



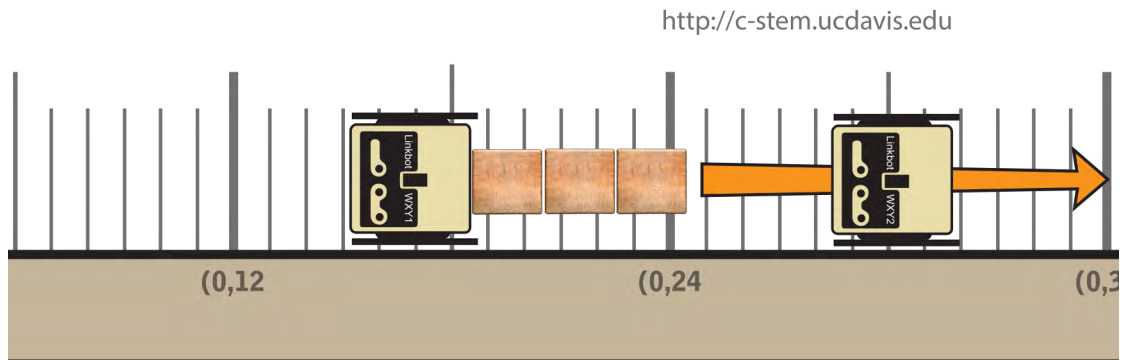
Team Scores

Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Score																				

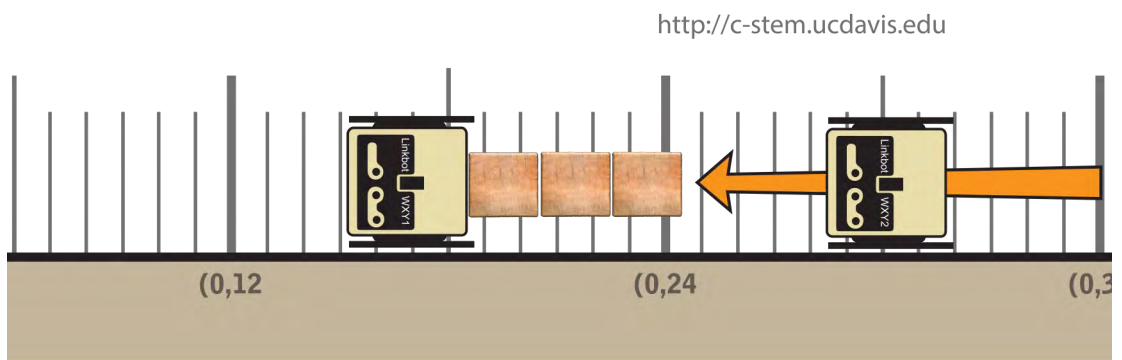
A to T:



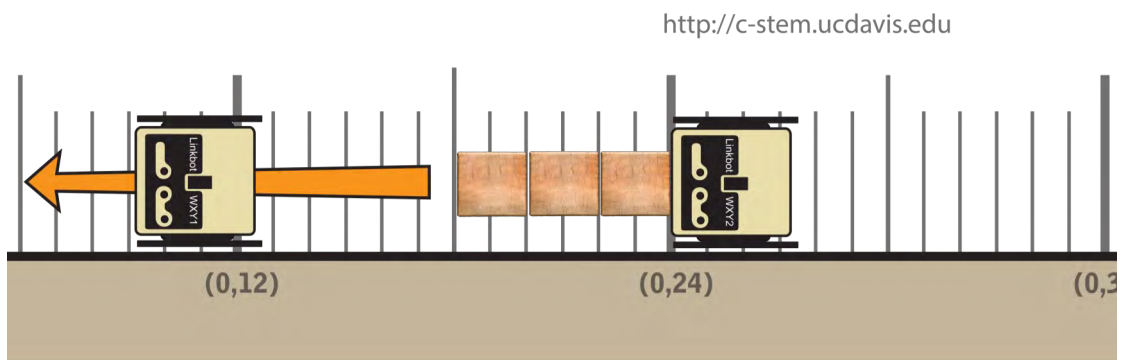
B Away:



B Return:



A Away:



3. Robo Pullups

(60 Points Possible)

Basic Task Description

Bot uses a PVC bar to lift itself off the table.

Starting Position/Set up

PVC bar is placed anywhere on the board.
Bot is placed anywhere on the board, not touching the bar.

Objective

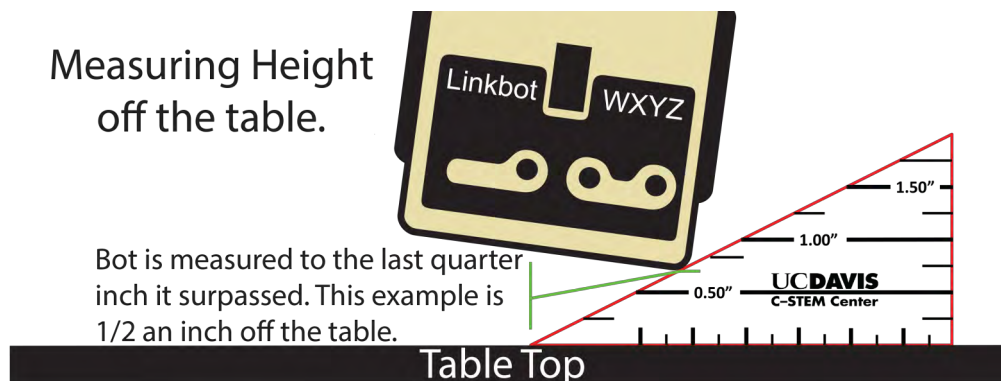
When challenge starts, the bot will activate, grab or climb the PVC bar, however the team decides to do it, and hoist itself off the ground. To score any points, every part of the bot must be at least ¼" off the table.

The bot must hold itself in the suspended position for 10 seconds so the judge may measure how high off the table it is.

Scoring

#	Description	Points
1	The bot clears the table by ¼". Measuring Triangle slides underneath bot on its side.	10
2	Each ½" above the table, rounded down. Measured via triangle to the lowest part of the bot.	10 per ½" Max of 40
3	Bonus: After judging, gentle (non-falling) dismount from bar.	10

Measuring Height off the table.



Measure the distance from the table top to lowest hanging part of the bot with the triangle.

Team Scores

Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Score																				

4. Speed Racer

(60 Points Possible)

Basic Task Description

Move bot in a straight line in a series of three successive segments with pit stops and varying speed.

Starting Position/Set up

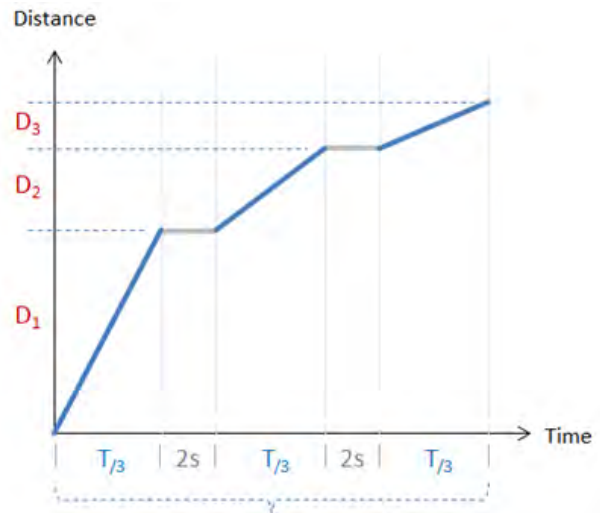
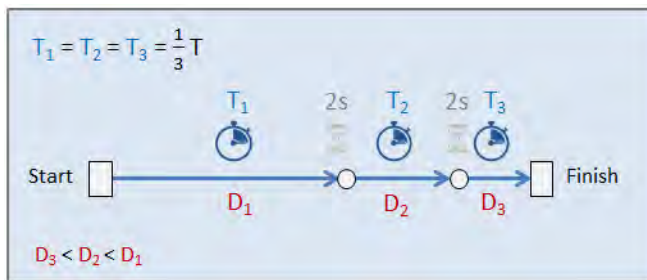
Bot is placed at starting position A, facing B.
 Receive random time T between 15 and 30 seconds.

Objective

Move 30 inches along the \overline{AB} ruler in time T. Graph the distance traveled vs. time traveled.
 Bot must travel the same amount of time ($1/3 T$) during each segment.
 Between each segment bot must stop and wait 2 seconds.
 Bot must travel slower during each subsequent segment.

Scoring

#	Description	Points
1	Bot travels 30" (± 1 ") along the \overline{AB} ruler.	5
3	Graph output of time vs. distance with labeled axis.	5
4	Graph shows each wait period is 2 seconds.	10
5	Graph shows each segment is of the same duration ($T/3$)	20
6	Graph shows the distance travelled is less for each segment.	20



Total Time = T + 4s

Team Scores

Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Score																					

5. Navigate the Oval

(60 Points Possible)

Basic Task Description

A Bot with two different sized wheels navigates the Oval Track without touching line.

Starting Position/Set up

The bot is an I-bot configured with one 4" wheel and one 3.5" wheel.

The bot starts with its wheels behind the Start Line.

Objective

The bot navigates the oval track and finishes by crossing the Start Line.

The bot's wheels straddle the oval track's line and may not touch it.

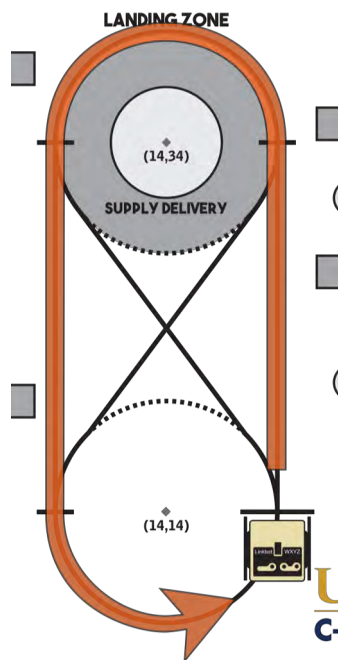
The track is divided into four segments and points are scored for each segment completed.

A segment is complete when the Bot's body is over the segment line.

If the bot fails a segment, it must start the next segment straddling the line in order to receive points for that next segment.

Scoring

#	Description	Points
1	The Bot successfully navigates a segment without touching the line.	15 per segment



Team Scores

Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Score																					

6. Meet Ya There

(75 Points Possible)

Basic Task Description

Two robots meet at a random set of coordinates.

Starting Position/Set up

Two bots start at any starting point, A, B, C, or D, with any orientation

Receive random X destination coordinate in the range 48" to 68"

Receive random Y destination coordinate in the range 17" to 37"

Place a pylon at the destination coordinates (X, Y)

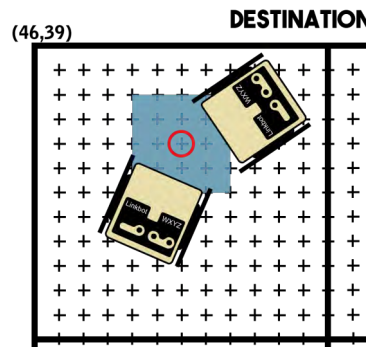
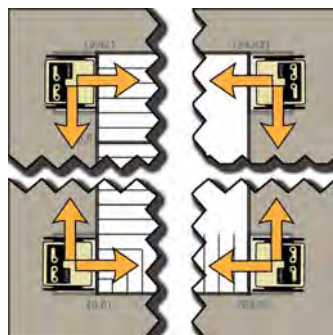
Objective

Robots leave their starting points at the same time. They travel to within a 4x4 square around the destination location defined by the X and Y coordinates. Both robots must arrive at the destination coordinates at the same time but may not touch one another. Bots may touch the pylon with no penalty.

Bonus: Complete the challenge two consecutive times with different coordinates.

Scoring

#	Description	Points
1	Both bots Depart at the same time (± 2 seconds).	5
2	Both bots enter the Destination Grid.	10
3	Both bots arrive within a 4x4 square around the target location.	20
4	Both bots arrive at the same time (± 2 seconds).	20
5	Bonus: Complete the challenge for full points two consecutive times with different coordinates.	20
6	Penalty: Robots touch one another.	-40



Team Scores

Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Score																					

7. Bug Time

(75 Points Possible)

Basic Task Description

Bugs are small critters with short lives. One could say, "time flies for a bug!" Bug Time consists of 4 seconds per minute, 4 minutes per hour, and 4 hours per day. Your task is to build a Bug Clock using three independent Bots to act as the Second, Minute, and Hour Hands.



Starting Position/Set up

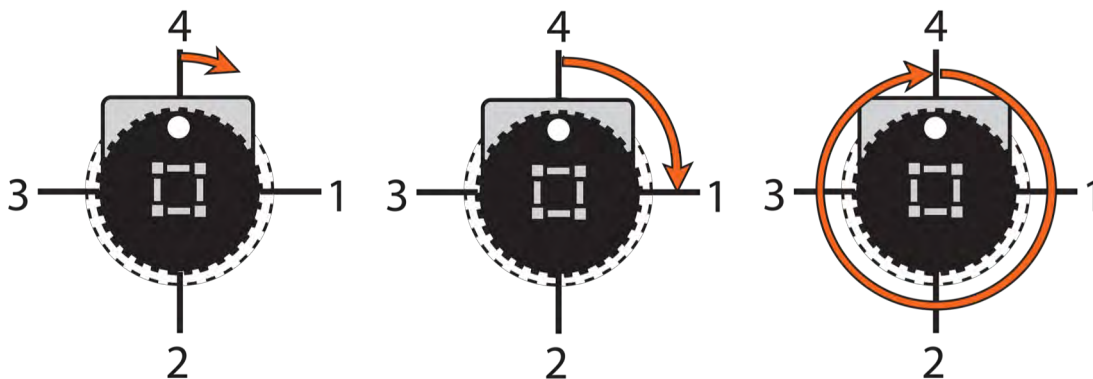
Use three independent I-Bots with wheels attached to both sides.
 Each Bot will be placed on its side on the spaces provided on the Challenge Board.
 Each Bot will have one wheel flat against the Challenge Board and the opposite wheel facing up.
 Each Wheel facing up is one of the clock's hands which will indicate Seconds, Minutes or Hours.
 Place a dot on the upward facing wheel to indicate direction of the hand.
 Each clock's hand will start pointed to 4, the top of the clock.

Objective

The Second Hand Bot completes full rotations without stopping.
 The Minute Hand Bot advances one whole number not before the Second Hand bot completes a full rotation (returns to 4) and not after the Second Hand bot reaches the number 1.
 The Hour Hand Bot advances one whole number not before the Seconds Hand Bot completes a full rotation (returns to 4) and not after the Minute Hand Bot reaches the number 1.
 Run until 2:0:0 Bug Time.
 The bots may either stop or continue running after 2:0:0 Bug Time.

Notes:

The Minute and Hour Hands may move either analog (continuous) or digital ("Ticking" and stopping). Some Bonus points can only be achieved with digital motion.



BUG TIME

Scoring

#	Description	Points
1	The Second Hand Bot completes 4 full rotations without stopping.	5
2	The Minute Hand Bot advances one whole number after a full rotation	10
3	The Hour Hand Bot advances one whole number after a full rotation of	15
4	The clock successfully runs all three hands beyond 2 o'clock Bug Time. (Hour hand facing 2, Minute hand facing 4, Second hand facing 4)	20
5	Bonus: The Minute and Hour Hands advance by "Ticking" (digital) as the other hand completes its cycle; that is, the Minute and Hour Hands	15
6	Bonus: Your clock chimes, plays a sound, when the Minutes hand	10

Team Scores

Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Score																					

8. Stacking Challenge

(90 Points Possible)

Basic Task Description

Bot moves a wooden block and stacks a hacky sack on top of it.

Starting Position/Set up

Place wooden block on the board in the solid green square.

Place hacky sack on the board in the solid green circle.

Bot may be placed anywhere on the board, but may not be touching the hacky or block.

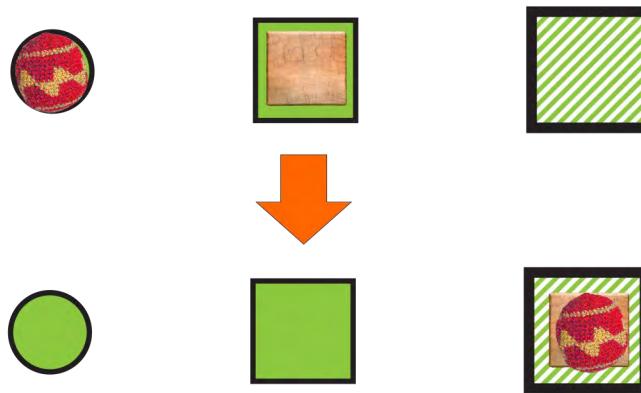
Objective

Create a stack with the wooden block on bottom and the hacky sack on top of it, fully within the green striped target square.

Scoring

#	Description	Points
1	Bot moves the wood block wholly within the green striped target square.	30
2	Bot lifts hacky off table.	30
3	Bot places hacky on wood block within the green striped target square.	30
4	Penalty for finishing with an object (block, hacky or bot) touching the target square perimeter.	-30 per object
5	Penalty for finishing with the bot in contact with either the wooden block or hacky sack.	No points awarded for challenge

STACKING CHALLENGE



Team Scores

Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Score																					

9. Retrieve Supplies

(100 Points Possible)

Basic Task Description

Bot must take hacky from a random location and deliver it to a central location.

Starting Position/Set up

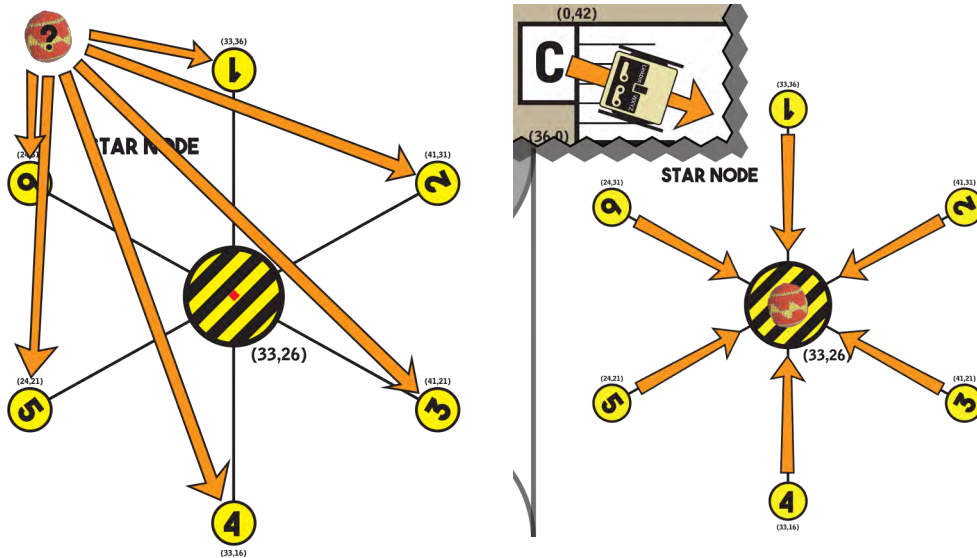
The team places the bot at starting position A, B, C, or D.
 Receive a random pickup node, PU, between 1 and 6.

Objective

Travel to the hacky pickup node indicated by the number.
 Move the hacky to the center of the Star Node.

Scoring

#	Description	Points
1	Bot moves hacky from pickup node.	30
2	Hacky is placed in the destination circle.	40
3	Bonus: Hacky is placed in destination circle, and touches no side.	10
4	Bonus: Complete two consecutive times with full score.	20
5	Penalty: Each time bot touches empty node circle, not including the one the hacky is in.	-10



Team Scores

Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Score																					

10. Synchronized Roboting**(120 Points Possible)**

Basic Task Description

Robots complete a synchronized dance.

Starting Position/Set up

Three bots placed at the 2, 4 and 6 positions on the Star Node, facing towards the center, LEDs set to purple.

Objective

The team's bots will perform "The Robotic Snowflake".

Stage 1

Step 1: The bots approach the center circle without entering it.

Step 2: Change LED color to green. Spin 300 degrees counterclockwise.

Step 3: Move forward to the next spoke of the Star Node.

Pause 5 seconds for Judge review**Stage 2**

Step 4: Change LED color to blue. Spin another 300 degrees counterclockwise.

Step 5: Move forward until bots on one of the even positions (2, 4 and 6)

Step 6: Change LED color to red. Spin 540 degrees clockwise to face the center again.

Step 7: Move back to center circle without entering it.

Pause 5 seconds for Judge review**Stage 3**

Step 8: Change LED color to orange. Turn counter clockwise 270 degrees.

Step 9: Move in a circle around the center for 2/3rds of the circle.

Step 10: Change LED color to yellow. Turn 90 degrees counter clockwise, facing outward.

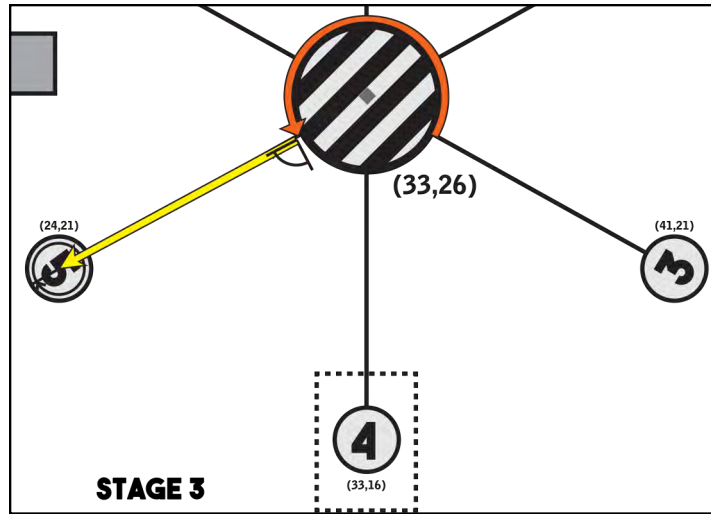
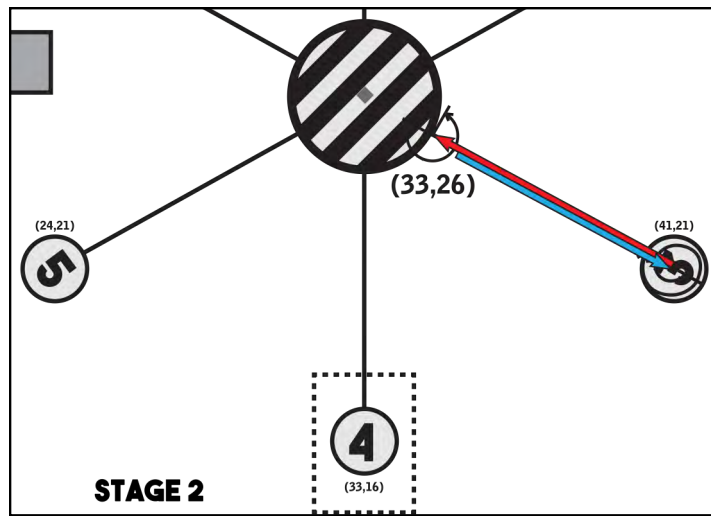
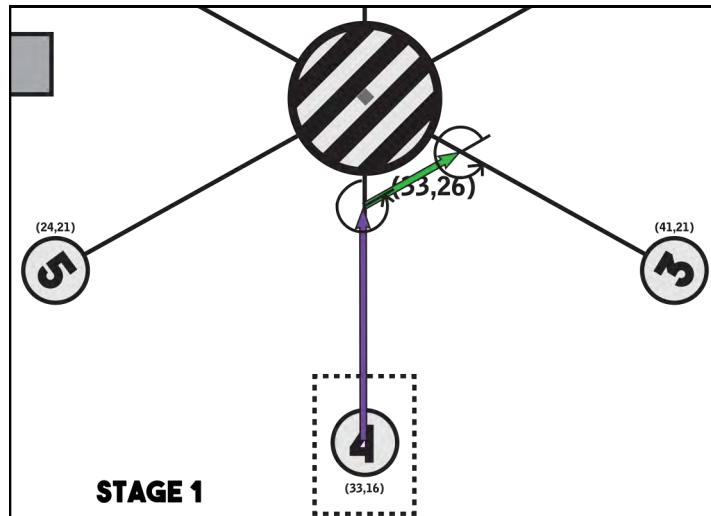
Step 11: Move forward to the numbered spot directly in front of the bot.

Step 12: Change LED color to white and spin 360 clockwise.

Note: On an abort, receive partial points up to last stage completed correctly.

Scoring

#	Description	Points
1	All bots complete Stage 1 movements	30
2	All bots complete Stage 2 movements	30
3	All bots complete Stage 3 movements	40
4	Bonus: All bots complete color changes correctly for all stages.	20
5	Penalty: Bots touch one another at any time.	No Points



Team Scores

Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Score																				

Student Notes:

Student Notes:

2015 C-STEM Day UC Davis

