



**UC DAVIS**  
**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 1**



**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"><li>• C-STEM Awards of Achievement</li><li>• C-STEM Awards of Excellence</li><li>• C-STEM Scholarship</li><li>• UC Davis Math Programming Competition Winners</li><li>• RoboPlay Video Competition Winners</li><li>• RoboPlay Challenge Competition Winners</li><li>• GIRL's Leadership Award</li></ul>	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](http://www.ocbc.org), [www.mpict.org](http://www.mpict.org), and [www.itif.org](http://www.itif.org)*

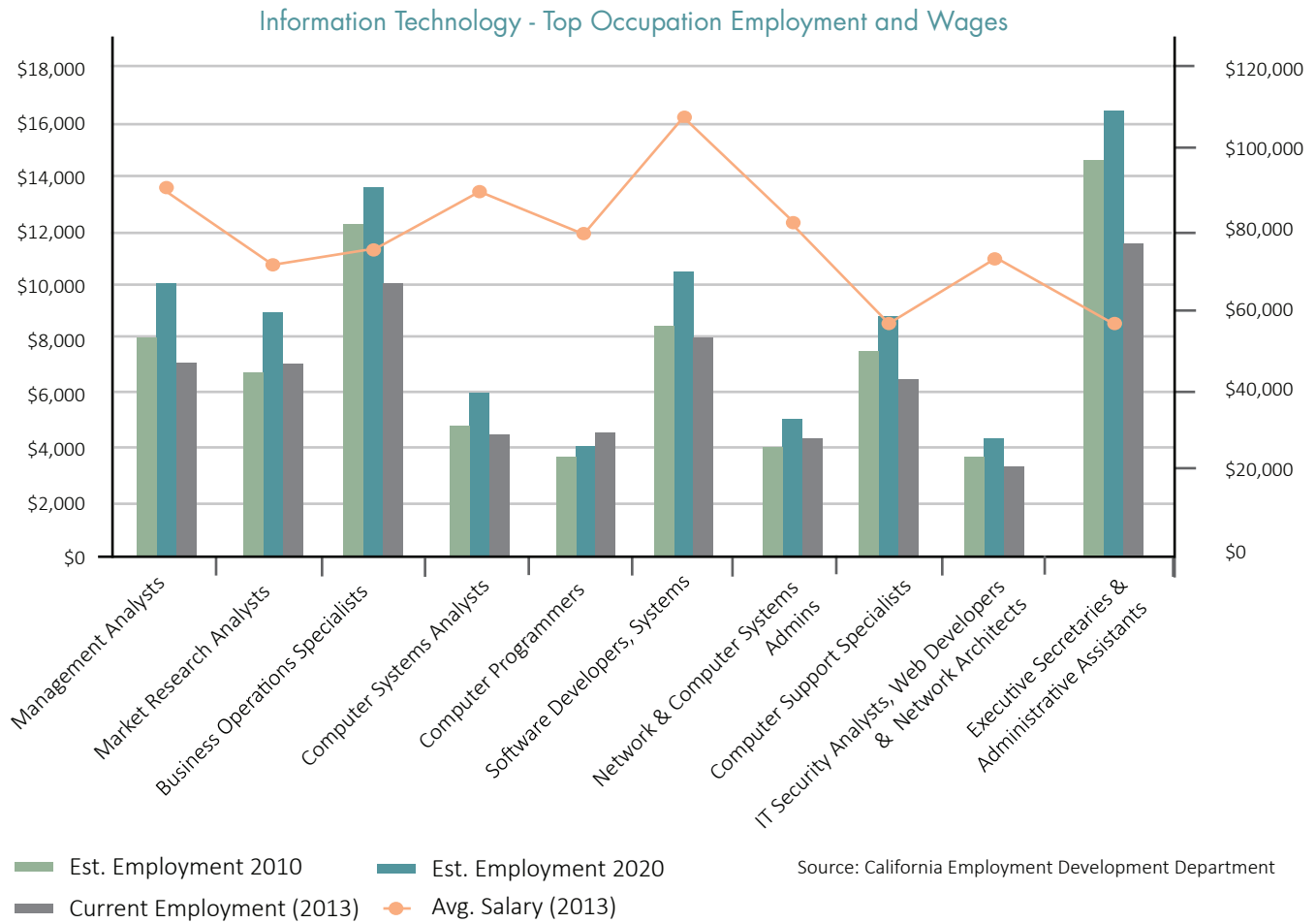
## Information and Communications Technology

### 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	Purdom	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



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## 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

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## 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

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## 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.

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## 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.

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## 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

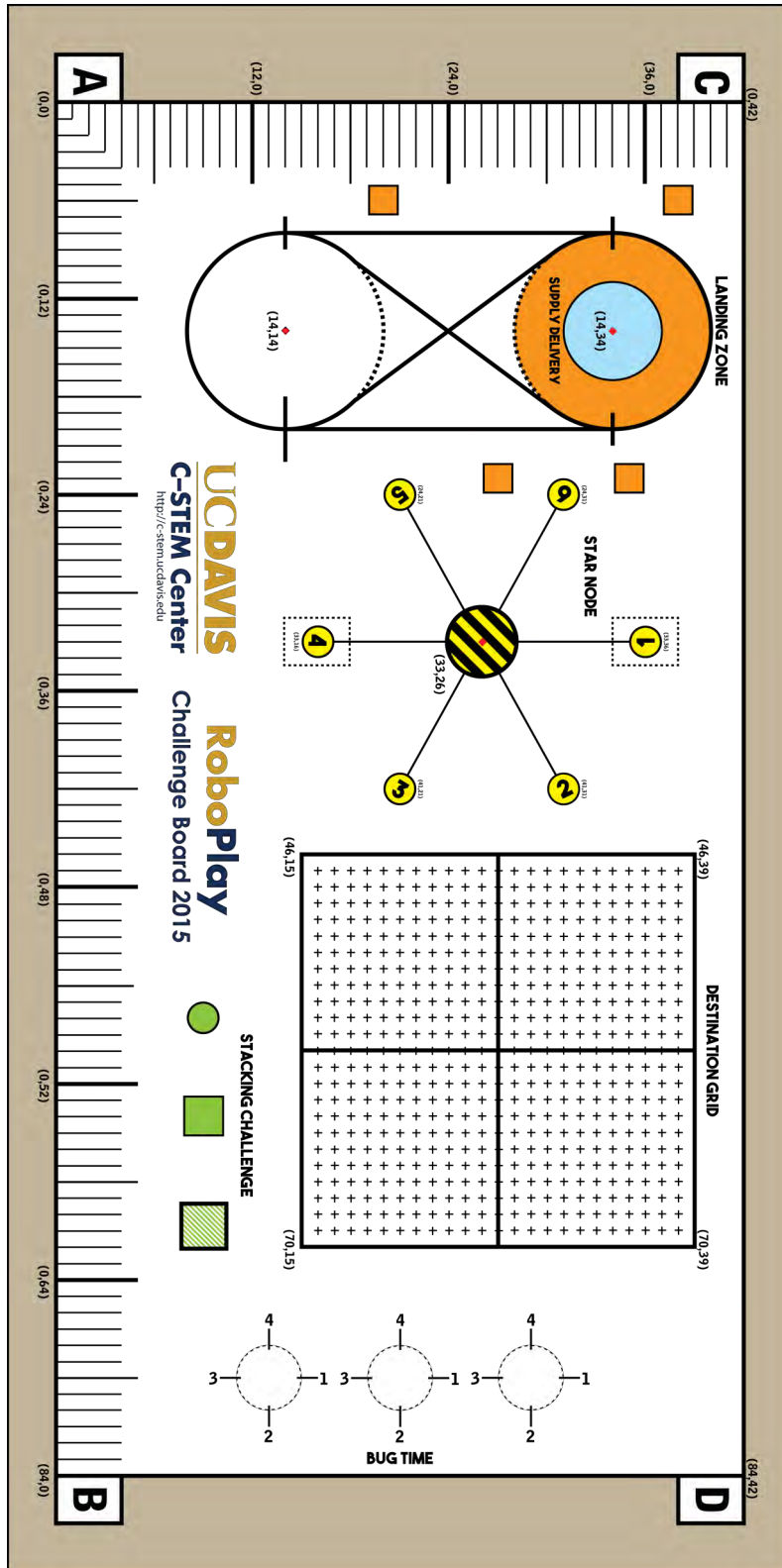
Each team will have the following parts to complete the challenges:

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. Stop on a Dime

(15 Points Possible)

#### Basic Task Description

Travel the length of the  $\overline{AB}$  line, no further.

#### Starting Position/Set up

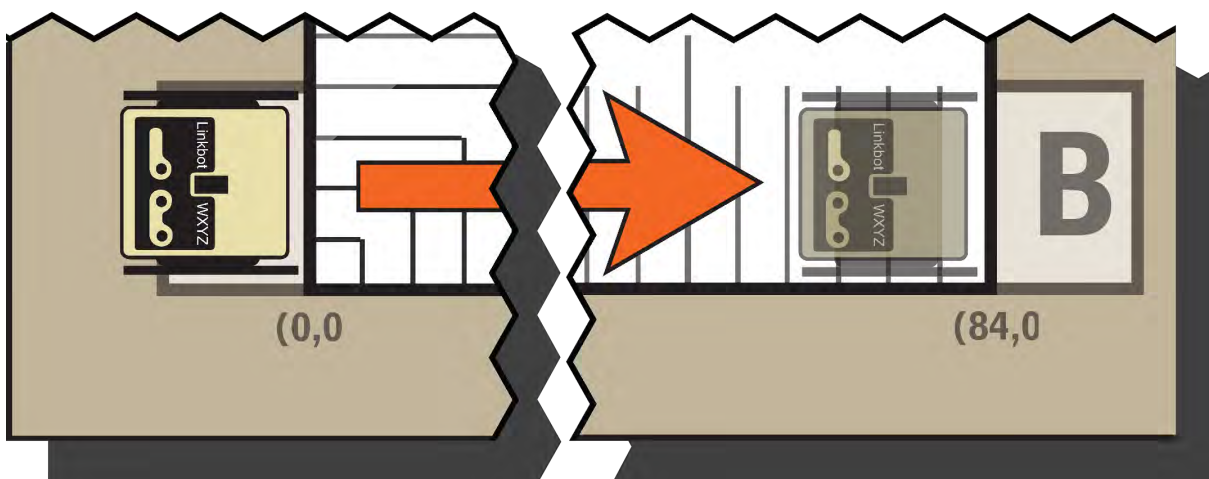
Bot starts in starting position A, Facing B.

#### Objective

Travel up to but not over the  $\overline{BD}$  line.

#### Scoring

#	Description	Points
1	Stopping before crossing the $\overline{BD}$ line.	15
2	Penalty for each whole inch short of the $\overline{BD}$ line, measured orthogonally, to the nearest point of the bot.	-3 per whole inch
3	Penalty for crossing the $\overline{BD}$ line.	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																				

## 2. Straight Forward

**(25 Points Possible)**

### Basic Task Description

A bot with two different sized wheels navigates the  $\overline{AC}$  line without touching it.

### Starting Position/Set up

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

Bot starts with its body over (0,0), next to point A, facing C

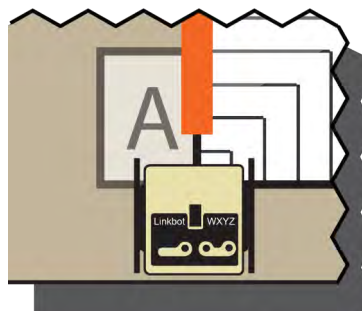
### Objective

The bot travels the  $\overline{AC}$  line and finishes with its body over (0, 42), next to point C.

The bot's wheels must straddle the  $\overline{AC}$  line without touching it

### Scoring

#	Description	Points
1	The bot successfully travels the length of the $\overline{AC}$ line and stops.	25
2	Penalty: Bot touches the $\overline{AC}$ line during movement.	-25



### Team Scores

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

### 3. Robotic Slide

**(40 Points Possible)**

#### Basic Task Description

Move the bot to complete a series of steps simulating the 'Electric Slide' dance.

#### Starting Position/Set up

Bot is placed in the center of the board facing the  $\overline{CD}$  line.

#### Objective

Note: Each 'step' is represented by moving the bot a distance equal to the bot width.

1. Bot rotates 90 degrees clockwise, takes two steps right, rotates 90 degrees counterclockwise and pauses.
2. Bot rotates 90 degrees counterclockwise, takes two steps left, rotates 90 degrees clockwise and pauses.
3. Bot moves one step back, pauses and blinks red light once.
4. Bot moves one step forward, pauses, rotates 90 degrees counterclockwise and blinks blue light once.

#### Scoring

#	Description	Points
1	Step one completed.	10
2	Step two completed.	10
3	Step three completed.	10
4	Step four completed.	10
5	Does not finish facing the $\overline{AC}$ line ( $\pm 25^\circ$ ).	-5

Move Sequence	Starting Position	Ending Position
1. 90° Clockwise Two steps right 90° Counterclockwise		
2. 90° Counterclockwise Two steps left 90° Clockwise		
3. One step back Pause Blink light Red once		
4. One step forward Pause 90° Counterclockwise Blink light Blue once		

#### 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. Robot Delivery Service

**(50 Points Possible)**

#### Basic Task Description

Move the 2 blocks to the supply delivery location, using 2 Robots.

#### Starting Position/Set up

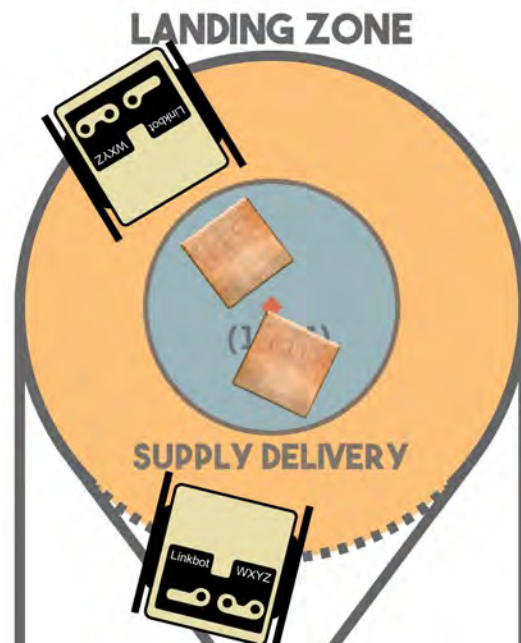
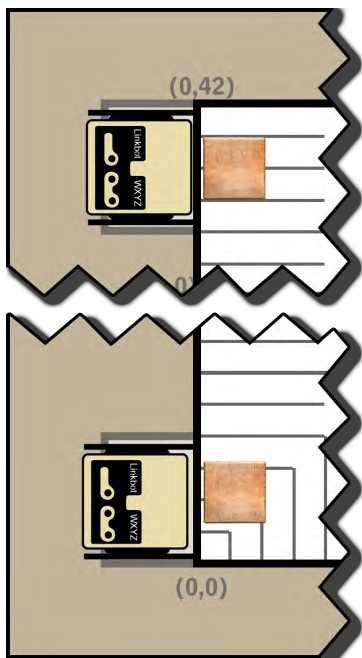
Place bots in starting positions A and C.  
Place blocks touching edges of starting positions A and C.

#### Objective

Move the blocks entirely within the Supply Delivery Circle.

#### Scoring

#	Description	Points
1	Block moved entirely within delivery circle.	15 per block
2	Blocks arrive inside circle at the same time ( $\pm 2$ seconds)	20



#### 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. Destination Unknown

(60 Points Possible)

#### Basic Task Description

Move your robot to a random set of coordinates on the board.

#### Starting Position/Set up

Robot starts 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).

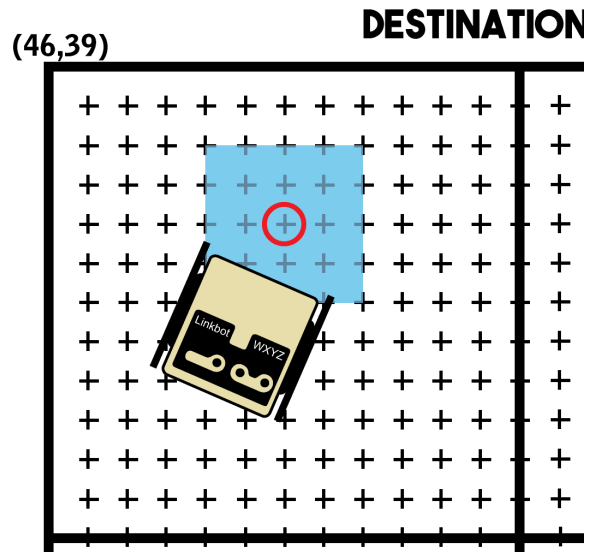
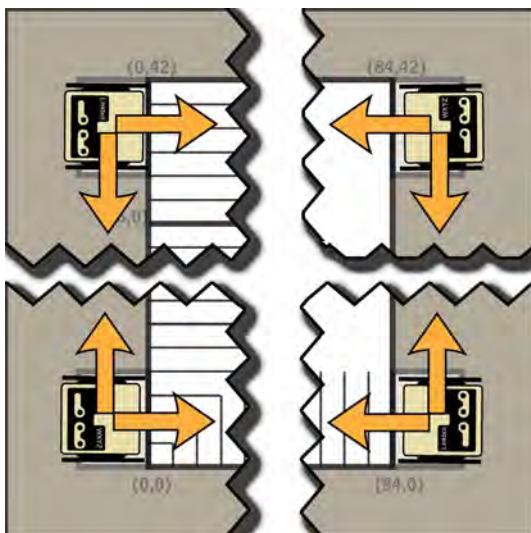
#### Objective

Move robot from the starting position to the destination coordinates (X,Y) on the Destination Grid. The bot may touch the pylon.

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

#### Scoring

#	Description	Points
1	Enter Destination Grid.	10
2	Stop within a 4x4 square around the destination coordinates.	40
3	Bonus: Complete the challenge two consecutive times with different coordinates.	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																					

## 6. 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

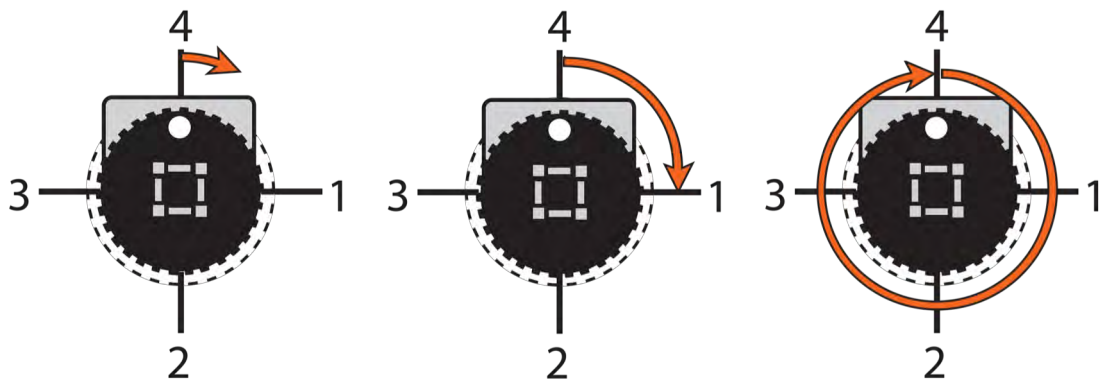
Use three independent I-Bots with wheels attached to both sides. Each Bot will be placed on its side on the spaces provided on the Challenge Board. Each Bot will have one wheel flat against the Challenge Board and the opposite wheel facing up. Each Wheel facing up is one of the clock's hands which will 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 of the Second Hand. (Scored one time only.)	10
3	The Hour Hand Bot advances one whole number after a full rotation of the Minute Hand. (Scored one time only.)	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) Clock may continue to run after these conditions are met.	20
5	Bonus: The Minute and Hour Hands advances by "Ticking" (digital) as the other hand completes its cycle; that is, the Minute and Hour Hands do not move continuously (analog).	15
6	Bonus: Your clock chimes, plays a sound, when the Minute hand reaches 4 (the top of the Hour).	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																					



## 7. Speed Racer

**(80 Points Possible)**

### Basic Task Description

Move bot in a straight line and graph movement.

### Starting Position/Set up

Bot is placed at starting position A, facing B.

Receive a random distance D, between 20 and 30 inches

Receive a random time T, between 15 and 30 seconds.

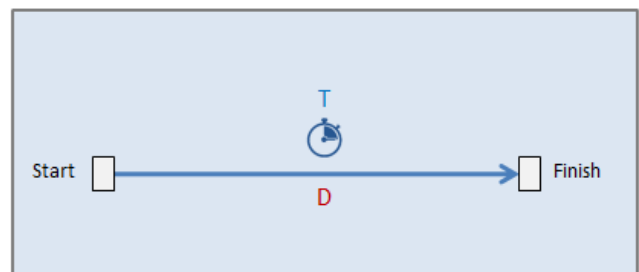
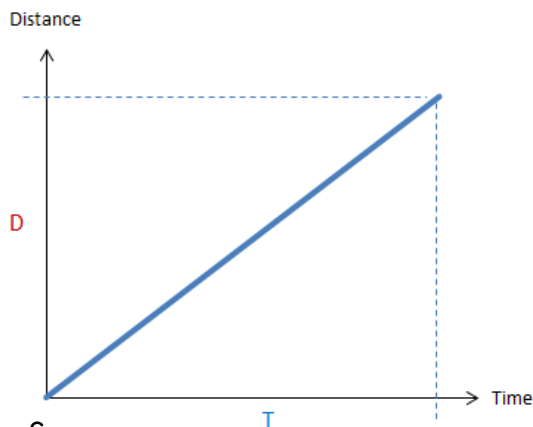
### Objective

The Bot must travel from start to finish in a straight line.

Bot must travel distance (D) in time (T).

### Scoring

#	Description	Points
1	Figure is plotted.	10
2	Graph shows linear relationship.	10
3	Graph starts at the origin.	10
4	Time end point is $T \pm 1$ seconds.	25
5	Distance traveled end point is $D \pm 1$ inch.	25
6	Penalty if graph not labelled as shown.	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																				

## 8. Tag

**(80 Points Possible)**

### Basic Task Description

Tag one robot with another. Use the accelerometer to detect the hit.

### Starting Position/Set up

Robot A is in starting position A, facing position B.

Robot B is placed a random distance along the ruler (12 to 24 inches) by Judge.

### Objective

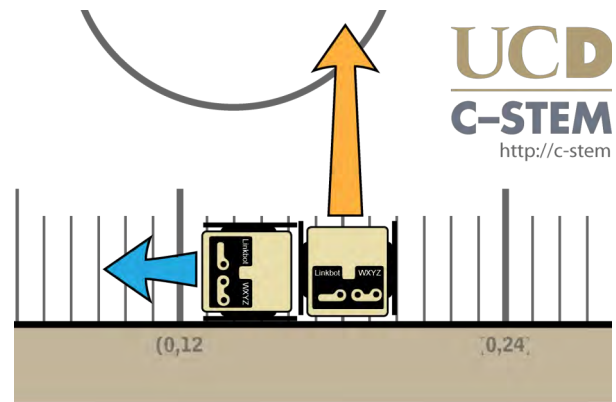
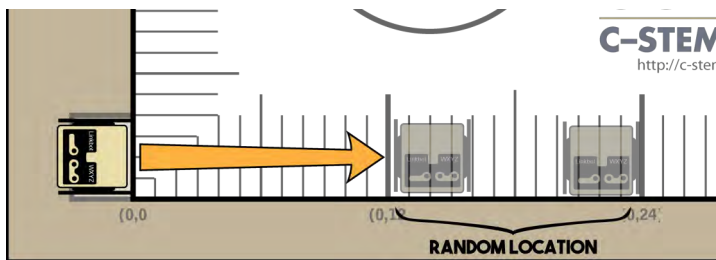
Set Robot B to detect a hit from the side via the accelerometer.

Set Robot A to move towards robot B.

When Robot B detects a hit, stop Robot A and back up slightly.

Robot B moves forward 10 inches.

#	Description	Points
1	Robot A hits Robot B and stops.	40
2	Penalty: Robot A keeps rolling more than 1 second after hitting Robot B.	-25
3	After hitting Robot B, Robot A backs up slightly and stops.	10
4	After Robot A Stops, Robot B moves forward about 10 inches.	30



### 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. Robo Pullups

(100 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.

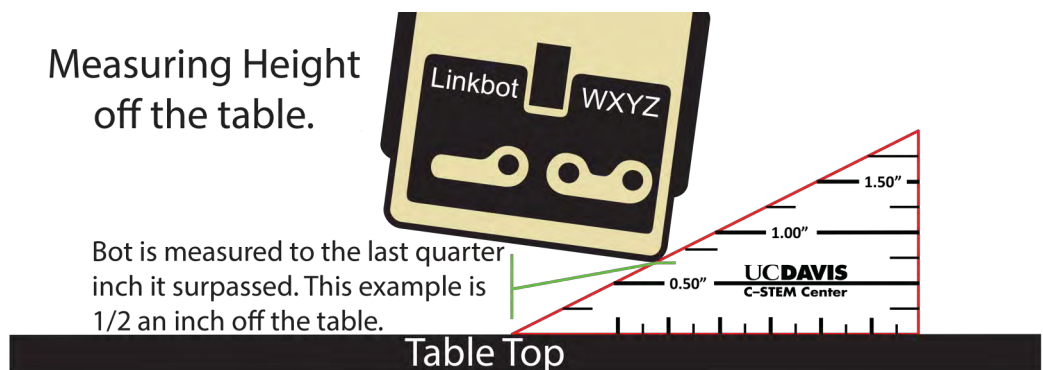
#### Objective

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 1/4" 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 1/4". Measuring Triangle slides underneath bot on its side.	40
2	Each 1/2" above the table, rounded down. Measured via triangle to the lowest part of the bot.	10 per 1/2" Max of 40
3	Bonus: After judging, gentle (non-falling) dismount from bar.	20



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																				

## 10. Stacking Challenge

(120 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.

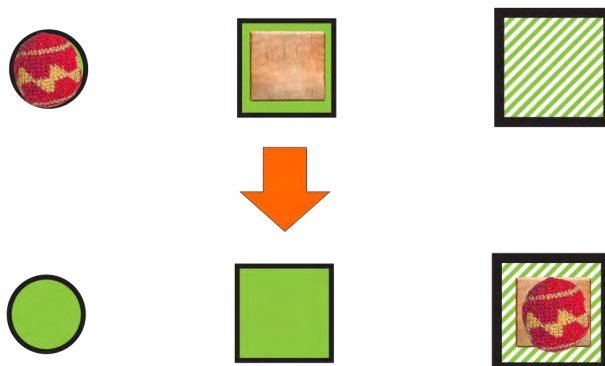
### Objective

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.	60
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																				

# 2015 C-STEM Day UC Davis

