RoboPlay Challenge

search and rescue

DIVISION

3

C-STEM DAY

SATURDAY MAY 20TH, 2017

UC DAVIS AND UNIVERSITY HIGH SCHOOL, IRVINE

C-STEM is a UC approved Educational Preparation Program for Undergraduate Admission to All UC Campuses

Message From the Director

Dear C-STEM Teachers and Students,

Welcome to C-STEM Day 2017!

We have planned an exciting day for our C-STEM students to show off their teamwork and problem-solving skills! As the UC Davis C-STEM Center continues to expand and grow with new team members, we continue celebrate the achievements of our teachers and their students with support from parents and volunteers on C-STEM Day with the RoboPlay Competition.

We are proud to be a UC Approved Educational Preparation Program for Undergraduate Admission to all UC campuses. The C-STEM integrated mathematics, computing and robotics curriculum is implemented in over 200 schools across California. This year, we are expanding the C-STEM program in other states in the nation.

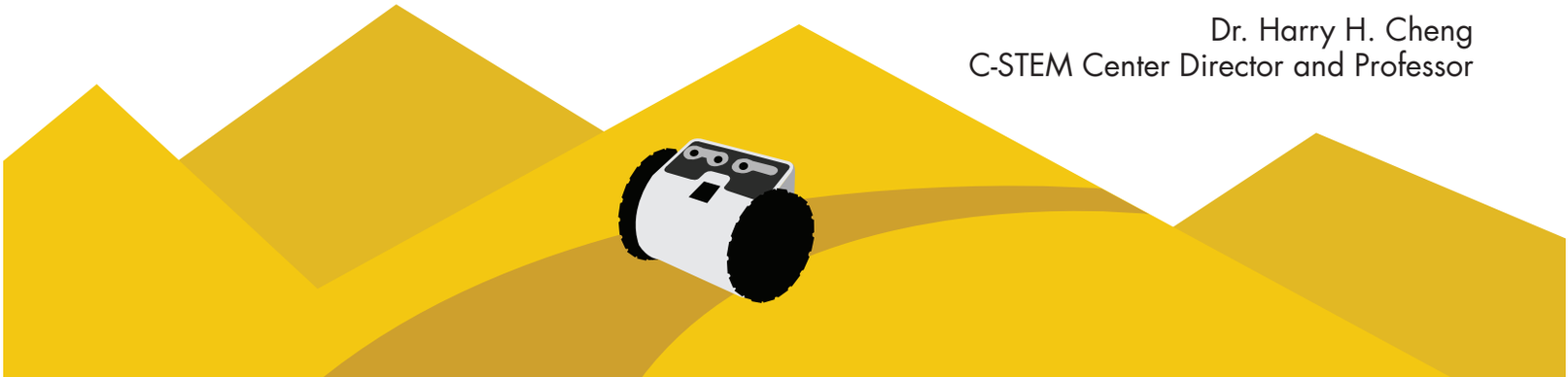
The C-STEM program is continuously striving innovate our curriculum with more resources. We believe that it is important to provide students with a C-STEM pathway of UC A-G approved courses that schools can readily and easily integrate. Our C-STEM Math-ICT Curriculum provides K-12 students with up to 12 years of computer science education through hands-on integrated learning of math and computer science, starting in the first grade.

As we continue to develop C-STEM curriculum, we also develop educational computing and robotics technologies that allow teachers and students to access our content quickly and easily. Many of you have already experienced C-STEM Studio, a freely available tool that provides teachers and students a centralized resource platform to work with. Usage of RoboBlockly, another freely available tool, that allows for web-based robotic simulation using a drag and drop puzzle-piece like interface continues to soar. We excited that all C-STEM software now can run in ultra-low-cost Raspberry Pi computers. Our professional development and curriculum provide teachers and students with the skills and knowledge necessary to be creative with physical computing and join the maker resolution.

We are so pleased to see familiar and new faces at this year's competition. Some of you have been participating in C-STEM Day since it began 7 years ago and we celebrate your commitment to academic excellence! We have 130 RoboPlay Challenge teams, 82 teams in Davis and 48 teams in Orange County. In addition, we have about 40 video competition submissions. 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 H. Cheng
C-STEM Center Director and Professor



Organized by

UCDAVIS C–STEM Center & Irvine Valley College

C-STEM Day Schedule - May 20, 2017

TIME	EVENT
7:30 - 8:30 AM	Registration and Setup for RoboPlay Challenge Competition
8:30 - 8:40 AM	Welcome and Introduction
8:40 - 9:00 AM	RoboPlay Challenge Competition Introduction
9:00 - 12:00 PM	RoboPlay Challenge Competition Problem Solving
12:00 - 12:45 PM	Lunch Break
12:45 - 3:45 PM	RoboPlay Challenge Competition
12:45 - 4:00 PM	Break
4:00 - 5:00 PM	Awards Ceremony: • 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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OVERVIEW

General Rules

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

Competition Zone Rules

Competition Information

1. 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.)
2. In between each team's run, there will be a 3 minute passing period.
3. No robots may be run on the competition board during the 3 minute passing period.
4. Any challenge that is on-going when your 17 minute period ends will be immediately stopped and points will be calculated.
5. You are allowed to attempt each challenge as many times as you like within the allotted competition time.
6. If you attempt a challenge multiple times, only the points from the highest scoring run will be kept.
7. Challenges may not be "chained together" meaning you cannot do two challenges simultaneously with the same program.
8. Teams are responsible for setting up the board for each run of each challenge.
9. Teams may not use more than 4 I-bots and 1 L-bot simultaneously. Plus a I-bot, L-bot or dongle for wireless connectivity.

Practice Information

1. All teams will be provided a designated practice area (pit) to place their practice board.
2. 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.)
3. Each 17 minute period starts and ends when specified in the schedule. You will not be given 17 minutes from when you arrive. Please be prompt.

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. Challenges may not be "chained together" meaning you cannot be scored for two challenges at the same time.
4. 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 as a tie breaker, with the lowest number of attempts winning the tie.
5. 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.
6. Any challenge that is on-going when your 17 minute period ends will be immediately stopped and points will be calculated.
7. You may abort a run at any time by touching a robot or calling "abort". Aborted runs still count as attempts, and score zero points.
8. 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".
9. 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.
10. You are encouraged to keep a record of your challenge scores in the space provided at the bottom of each challenge.
11. Once you start your program you may not interact with your computer. Interacting with your computer will count as an "abort".

Reminders for Students

General

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

Assigned Boards

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

Practice/Competition Times

- 17 minute practice/competition times will be marked by a whistle being blown.
- Arrive 5 minutes early for your allotted practice/competition time and stand in the designated waiting area.
- Refer to packet if you don't know when your practice/competition times are.
- Keep your name tag on at all times. You will need it to gain access to the board during your 17 minute period as well as to your pit area.

Random Numbers

- Many 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.
- 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 only after pressing Run. 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

Location

Point ("at/on point N"):
- Single Bot - Bot covers the dot
- Bot Configuration - Bot Configuration covers the dot

House ("at/on house X"):
- Single Bot - Bot covers the dot on the house
- Bot Configuration - Bot Configuration covers the dot on the house

Road ("on a road/street"):
- Single Bot - Wheels do not cross the centerline of the road except for turns
- Bot Configuration - Center of Bot Configuration remains inside boundary of road

Near a House:

An object or Bot is near a house if a block placed between the object and the house graphic touches the Bot and the house graphic.

Time:

Immediately/Same Time:

An action happens "immediately" after or "at the same time" as another action if their difference in finishing time is less than or equal to 1 second.

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.

Sample scanf() code

1. Read a single integer into a variable

   Example Code:

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

   Example Input:

```
10
```

2. Read two letters into two variables

   Example Code:

```
char pointA, pointB;
scanf("%c %c", &pointA, &pointB);
```

   Example Input:

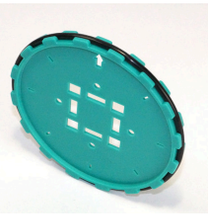
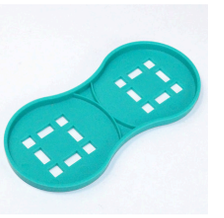
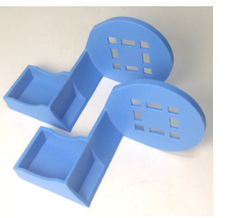
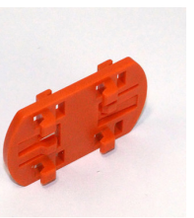
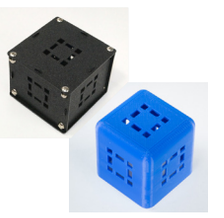
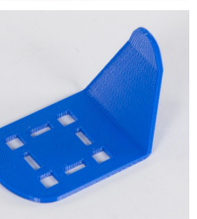
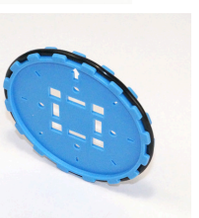
```
N R
```

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. Multiple port USB Charger (Qty: 2)
   (Skiva PowerFlow recommended)

CHALLENGE MATERIALS

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

PART	QUANTITY	QUANTITY	PART	QUANTITY	QUANTITY
Linkbot-I	4		4" Wheel	2	
Linkbot-L	1		Bridge Connector	2	
Linkbot-L or Dongle	1		Gripper	1	
Snap Connector	15		Cube Connector	1	
Caster	4		Hacky Sack	1	
			Soccer Scoop	2	
3.5" Wheel	8		PVC Coupling	1	

1. Broken Traffic Light (30 pts)

Description

A traffic light has stopped working and the cars at the intersection do not know which order they should cross the intersection in. You need to direct traffic and make sure that no accidents occur at the intersection.

Setup

BOT NAME	BOT TYPE	INITIAL POSITION	INITIAL DIRECTION	BOT TYPE
East Bot	Linkbot-I	East side of intersection	West	West side of intersection
North Bot	Linkbot-I	North side of intersection	South	South side of intersection
South Bot	Linkbot-I	South side of intersection	North	East side of intersection
Signal Bot	Linkbot-L	Point L	North	N/A

East, North, and South Bots are the Car Bots.

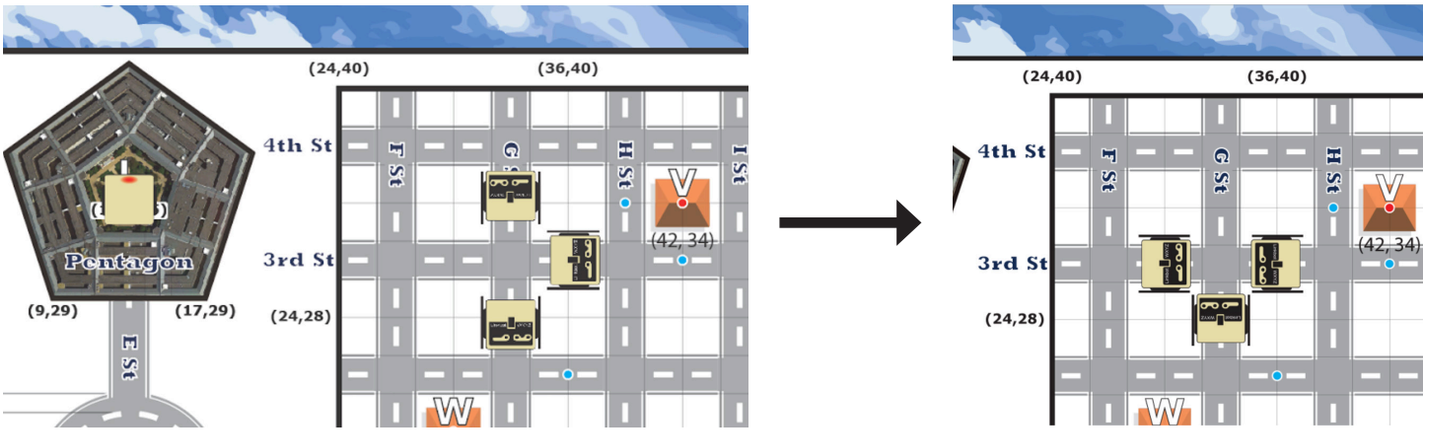
Objective

Car Bots must go to their destinations (see table above)
Anytime a Car Bot wants to move, the Signal Bot must turn its light red, turn to face the cardinal direction of the Car Bot, and turn its light green.
Car Bots must stay on roads and cannot touch each other.
Hint: The Car Bots can start and stop as far away from the intersection as you want as long as they are on the road. To prevent the Car Bots from touching, do not position them close together.

Scoring

#	DESCRIPTION OF SCORING CRITERIA	POINTS
1	Signal Bot emits a red light before emitting a green light each time a Car Bot moves	5
2	Signal Bot turns to the cardinal direction of the Bot that wants to move each time a Car Bot moves	5
3	North Bot moves to the south side of the intersection	5
4	South Bot moves to the east side of the intersection	5
5	East Bot moves to the west side of the intersection	5
6	Bots never touch	5

Figures



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

2. Quadratic Confusion (35 pts)

Description

The evacuation zone is in desperate need of supplies and its most recent shipments were delivered to the wrong location. The delivery service gives you a quadratic function whose roots are the locations of the supplies. Send Bots to the supplies.

Setup

Bot A is placed at point A facing East.
Bot B is placed at point B facing West.
Receive a, b, and c values for a quadratic equation from the judges.

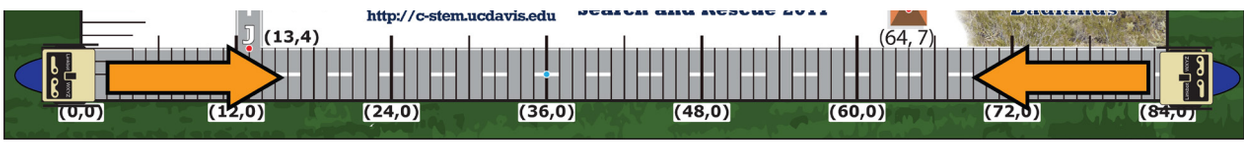
Objective

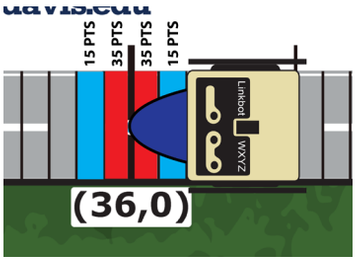
Solve for the two roots to find the two positions.
The Bots drive until the tips of their casters are on the correct positions.
Example: if the two solutions are 36 and 72, the tip of Bot A's caster should be at the 36 inch mark, and the tip of Bot B's caster should be at the 72 inch mark.
Hint 1: In the example above, Bot B wouldn't be able to go to the 36 inch mark because it would hit Bot A.
Hint 2: Refer to page 4 for help with scanf()

Scoring

#	DESCRIPTION OF SCORING CRITERIA	POINTS
1	Bots' casters stop within ±2" of the supplies	15
2	Bots' casters stop within ±1" of the supplies	20
3	Penalty: Bots touch	-35

Figures





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

3. Emergency Intercept (40 pts)

Description

Unknowingly a driver is about to drive their car off a cliff. It is up to you to send a car to intercept the driver, and prevent him/her from driving off the cliff..

Setup

Judge will give you a random corner A or B. Bot A starts at this corner.
Judge will give you a random house in {Y, W, V, Z}. Bot B starts at that house.
If Car Bot is placed on corner A, a wooden block is placed on corner B.
If Car Bot is placed on corner B, a wooden block is placed on corner A.

Objective

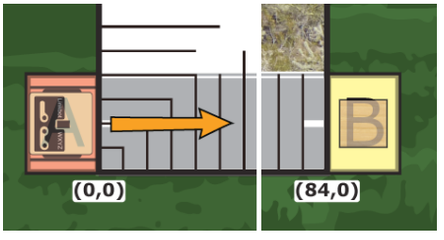
Bot A moves toward the wooden block.
Bot A and Bot B must start moving at the same time
Bot B must drive in front of Bot A before Bot A reaches the wooden block.
Bots stop within one second of Bot B driving in front of Bot A.
Bots must be no more than a block width apart when they stop.
Hint: Refer to page 4 for help with scanf()

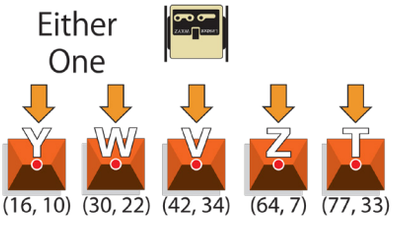
Scoring

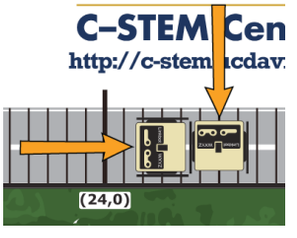
#	DESCRIPTION OF SCORING CRITERIA	POINTS
1	Bot A and Bot B start moving at the same time	5
2	Both Bots stop within one second of Bot B driving in front of Bot A	15
3	Bots stop no more than a block width apart	20
4	Penalty: Either Bot touches the wooden block	-40

Figures

Note: This is just an example set up







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

4. Message for the Pentagon (45 pts)

Description

A Spy Bot needs to maneuver around obstacles to pass an important message to the Handler Bot, so the Handler Bot can then pass the message to the Pentagon.

Setup

Spy Bot is placed in the Evacuation Zone at point M (65,34).
Handler Bot is placed at the intersection of G and 2nd Street.
A block is placed on H street between 3rd and 4th street.
A block is placed on 2nd street between G and H street.
A block is placed on G street between 2nd and 3rd street.

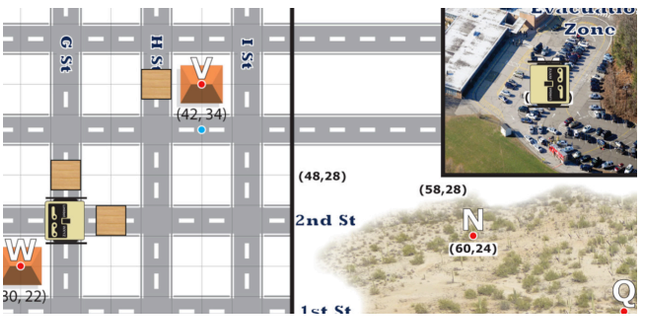
Objective

Spy Bot moves west towards Handler Bot using any path as long as it stays on the roads.
Spy Bot must tap Handler Bot to transfer the message then stop moving.
After being tapped, Handler Bot goes to the Pentagon (point L).

Scoring

#	DESCRIPTION OF SCORING CRITERIA	POINTS
1	Spy Bot touches Handler Bot then stops.	20
2	Handler Bot starts moving immediately after Spy Bot stops moving	10
3	Handler Bot ends at the Pentagon (point L)	15
4	Penalty: Spy or Handler Bot touches the block.	-15
5	Penalty: Either bot does not stay on a road at all times	-25

Figures



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

5. Ambulance Selector (50 pts)

Description

Someone has been injured and an ambulance must go to the coordinates of the injured person. This city has multiple ambulances all at different locations. Your challenge is to send the ambulance that can get to the person's coordinates the fastest.

Setup

4 bots are placed at the 4 different corners of the mat:

BOT NAME	START AT	WHEEL SIZE	SPEED
Bot A	A: (0,0)	3.5″	100°/sec
Bot B	B: (84,0)	3.5″	150°/sec
Bot C	C: (0,42)	3.5″	110°/sec
Bot D	D: (84,42)	4″	120°/sec

Receive a random pair of X and Y coordinates.
The judge will place a wooden block on the coordinate pair.

Objective

Bots move at speeds provided in the table.
Get a Bot to the given coordinate as quickly as possible.
Only move the Bot that can get there quickest.
Print the quickest time in seconds rounded to the hundredth place.
Hint: Refer to page 4 for help with scanf()

Scoring

#	DESCRIPTION OF SCORING CRITERIA	POINTS
1	The correct Bot stops immediately after touching the wooden block	40
2	The number of seconds printed is correct within ±1 second	10
3	Penalty: A Bot other than the correct Bot moves	-40

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

6. Search Party (60 pts)

Description

An injured person is lost somewhere in the city and search and rescue must find them. There are several different streets that the lost individual may be on. Your challenge is to search several of the city streets and find the injured person.

Setup

1 Bot (Search Bot) is placed at the northern end of street F facing south.
1 Bot (Search Bot) is placed at the northern end of street G facing south.
1 Bot (Search Bot) is placed at the northern end of street H facing south.
1 Bot (Injured Bot) is placed by the judge at a random location on street F, G, or H.

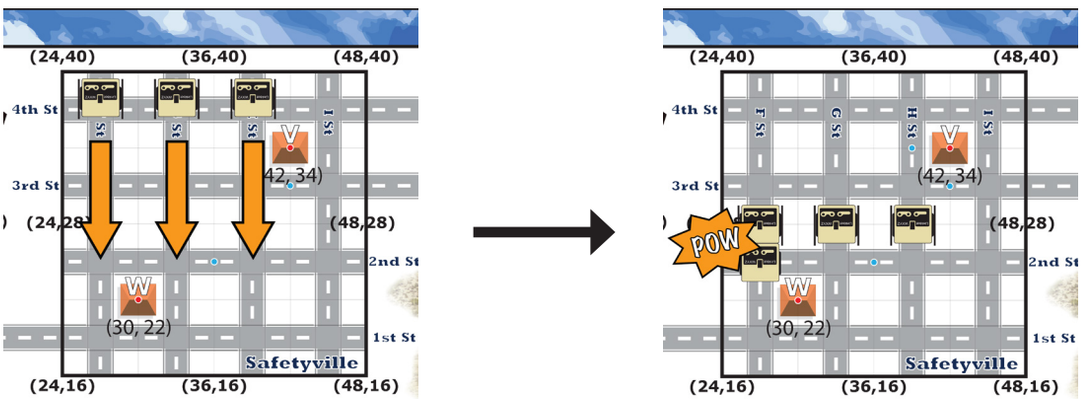
Objective

The Search Bots move south staying on their streets until one touches the Injured Bot.
Search Bots must move in unison and immediately and simultaneously stop when one touches the Injured Bot.

Scoring

#	DESCRIPTION OF SCORING CRITERIA	POINTS
1	Search Bots move in unison	20
2	Search Bots stop immediately after one touches the Injured Bot	40
3	Penalty: Any Search Bot does not stay on a road at all times	-60

Figures



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

7. Supply Transfer (70 pts)

Description

We need supplies at the Evacuation Zone! house W has extra supplies, and your robot has been tasked with getting the supplies from house W to the Evacuation Zone.

Setup

Stack two wooden blocks on house W and then place a hacky sack on top of the blocks.
Place Bot(s)/Configuration(s) anywhere as long as they are on a road and not touching the hacky.

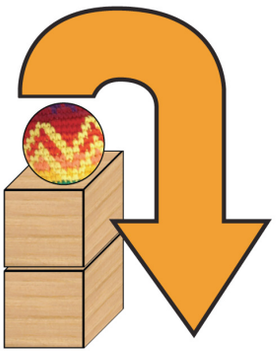
Objective

Get the hacky sack off the blocks at house W and into the Evacuation Zone without moving or knocking over the blocks.
The Bot(s)/Configuration(s) may only drive on roads.
Hint: You can (but don't have to) use multiple Bots and Bot Configurations.

Scoring

#	DESCRIPTION OF SCORING CRITERIA	POINTS
1	Bot(s) remove(s) hacky sack from top of blocks	25
2	Entire hacky sack finishes inside Evacuation Zone	45
3	Penalty: Blocks move or are knocked over	-70
4	Penalty: A Bot or Bot Configuration does not stay on roads	-35

Figures



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

8. Go Robobo 2 (80 pts)

Description

Oh no! All the fire trucks' tires have been popped and someone needs to be rescued.Your challenge is to bring the person to the Evacuation Zone without any wheels, and then go back to the fire station located at house X (6,16).

Setup

Place a Bot Configuration of two or more Bots on house X (6,16).
Place a wooden block on the blue dot on third street (42, 31).

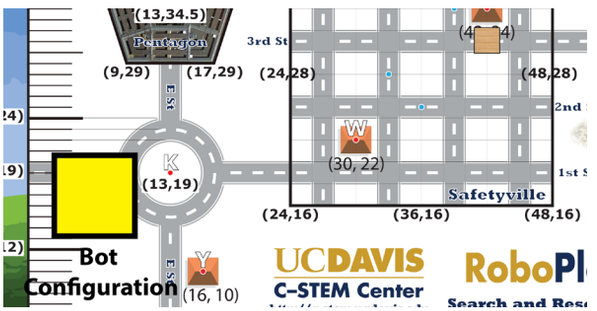
Objective

Move the wooden block into the Evacuation Zone using a configuration of two or more Linkbots and no wheels or cube connectors.
Bot Configuration finishes on house X.
Bonus: On the way back from the Evacuation Zone, the Bot Configuration goes around the roundabout at least one full loop (while staying on the road).

Scoring

#	DESCRIPTION OF SCORING CRITERIA	POINTS
1	Bot Configuration touches the wooden block	10
2	Entire wooden block enters the Evacuation Zone	20
3	Bot configuration finishes at house X and scoring elements 1 and 2 are complete	10
4	Bonus: Bot Configuration makes one full loop around the roundabout as specified in the objective	40

Figures



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

9. Helpful Friend (100 pts)

Description

Your robot has one 3.5-inch wheel and one 4-inch wheel, but it is determined to help. Your robot plans to stop at a few houses to make sure everyone is okay.

Setup

Place one Bot on any one of the points in {K, L, M, N, P, Q, R, or S} facing any direction. The Bot should have one wheel that has a 3.5-inch diameter and another wheel that has a 4-inch diameter.

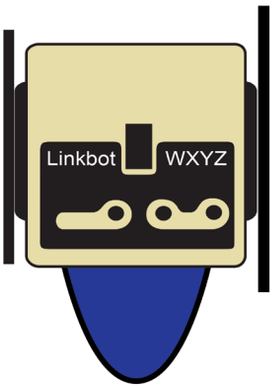
Objective

The Bot needs to "visit" all six houses T, V, W, X, Y, and Z.
Note: A "visit" is defined as any time a Bot is near the house and pauses for at least 3 seconds.
Each time the Bot reaches a house, it should stop for at least 3 seconds.
Tell the judge which houses the Bot will visit in order before you begin.
The Bot must end at the point it started on.

Scoring

#	DESCRIPTION OF SCORING CRITERIA	POINTS
1	Each house a Bot visits (up to six houses)	15 per house
2	Bot ends at the point it started at after attempting to visit all houses	10

Figures



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

10. Lost (120 pts)

Description

Some children got lost while playing hide and seek in the field and need your robot's help getting home!

Setup

Place wooden blocks on the first two letters the judge gives you.
Place one Bot on point Q.

Objective

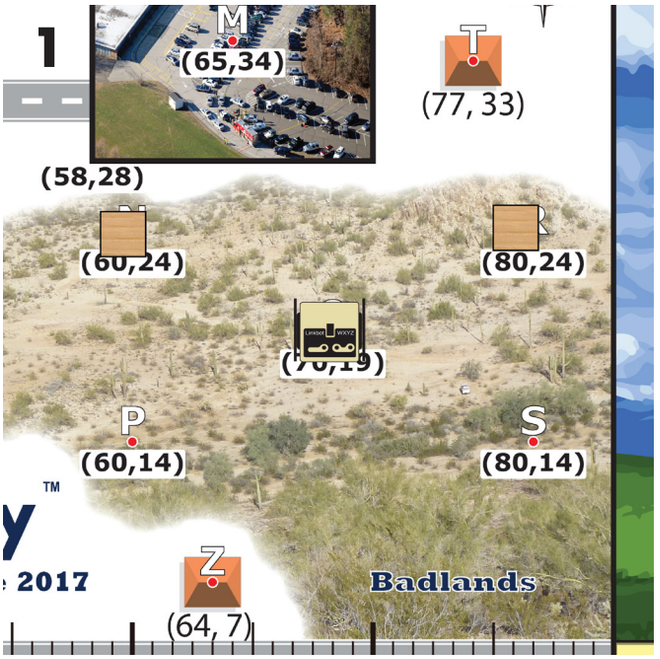
The judge will give you two letters chosen at random from the set {N, P, R, S} followed by two house letters that will be chosen at random from the set {T, Z}.
Move the block from the first point to the first house and from the second point to the second house.
Example: if the judge says "N R T Z" the robot should move the block at point N to house T and the block at point R to house Z.
The block must be near the house to count as moved.
The Bot must return to point Q when it is done.
Bonus: Use PVC connectors instead of blocks

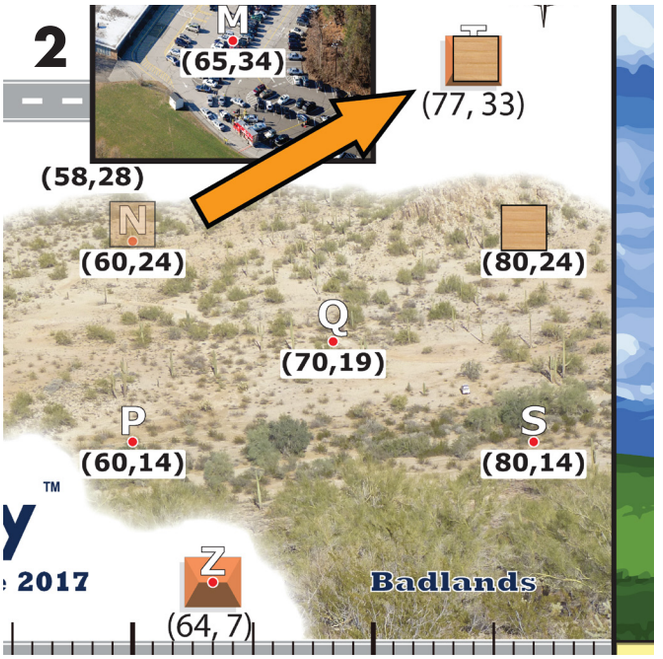
Scoring

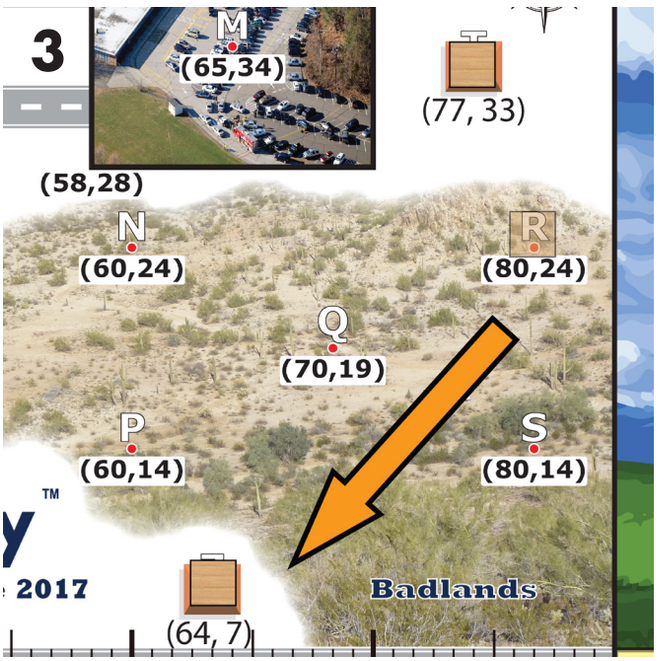
#	DESCRIPTION OF SCORING CRITERIA	POINTS
1	Bot moves both blocks entirely out of the field graphic	20
2	The first block is moved to the first house	30
3	The second block is moved to the second house	30
4	Bot ends at point Q	15
5	Bonus: Successfully use PVC connectors instead of Wooden Blocks (all other scoring elements are completed)	25

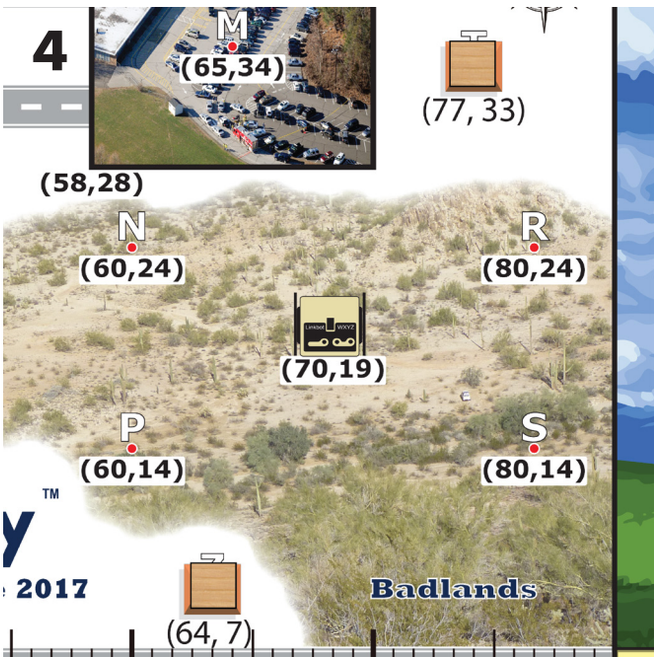
Figures

Note: This shows the example from the objective, but you will be given different letters and houses



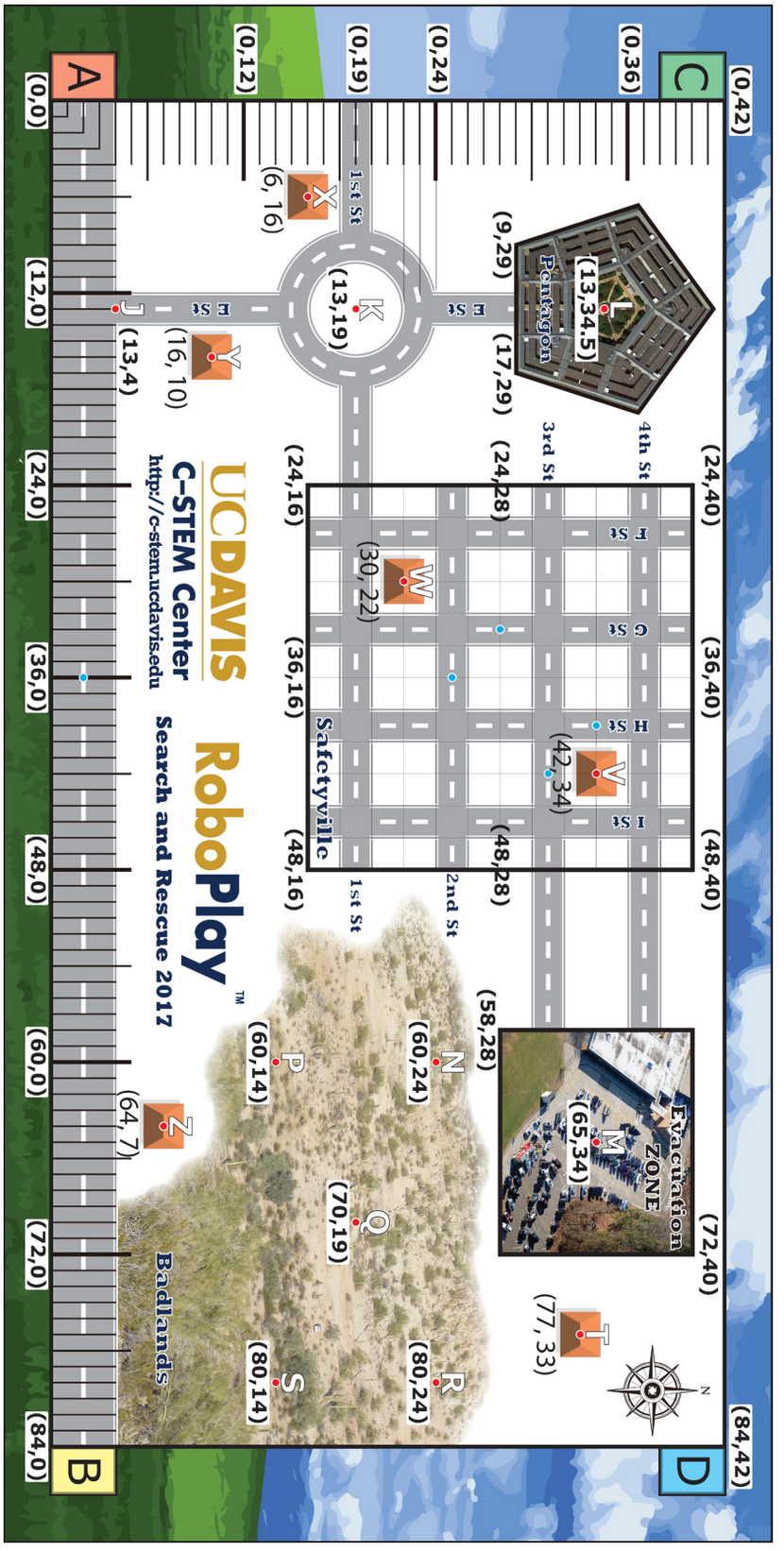






Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Score																			

CHALLENGE BOARD



SCORE TRACKER

DIVISION 3	PRACTICE 1	PRACTICE 2	RUN 1	RUN 2	RUN 3
1. Broken Traffic Light					
2. A Quadratic Confusion					
3. Emergency Intercept					
4. Message for the Pentagon					
5. Ambulance Selector					
6. Search Party					
7. Supply Transfer					
8. Go Robobo 2					
9. Helpful Friend					
10. Lost					

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