LAWRENCE TECHNOLOGICAL UNIVERSITY
ROBOFEST 2024

GAME 010 1010

Autonomous Taxi

Judge Training

This file can be found on the **Game** page on the website

www.robofest.net **robofest@ltu.edu** 248-204-3568

Room J233 Taubman Complex, LTU

21000 West 10 Mile Road, Southfield, MI 48075, USA

Agenda

- Judging Opportunities
- Game Scenario, Synopsis, and Definitions
- Judge Roles and Responsibilities
- Game Details / Bar Code
- Playing Field Set Up
- Robot Impounding Process
- Violations, Full Reset, End of Run / Stop Line Violations
- Procedure / Rules to Play 2 Rounds
- Unveiling UTF
- Team Scoring / Tie Breakers

ROBOFEST Lawrence Technological University

Michigan Game Qualifiers

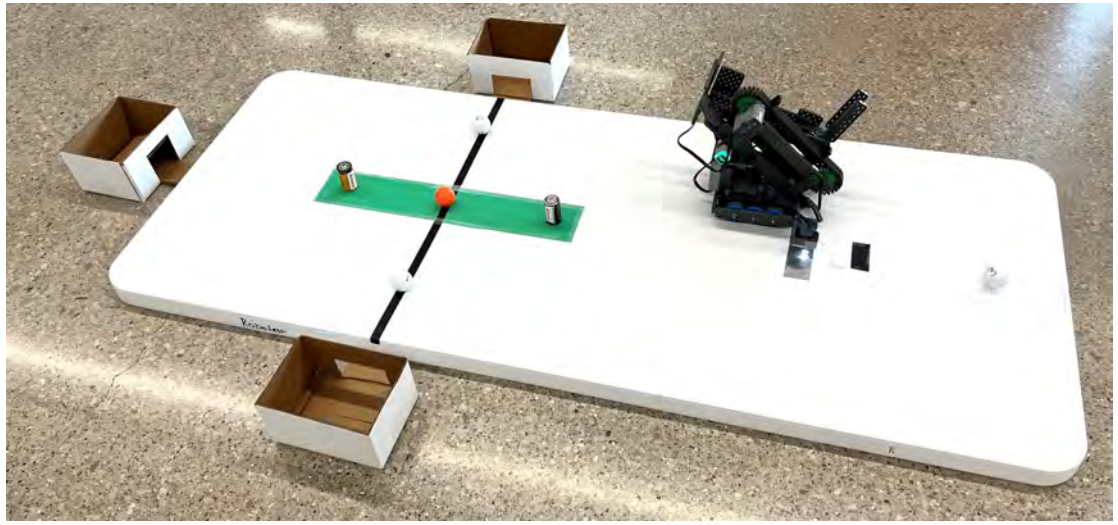
ClintonTwp_MISD_MI	Macomb Intermediate School District 44001 Garfield Ave Clinton Township, MI 48038	Saturday	2/24/2024	9:00 am - 2:00 pm
Napoleon_NCS_MI	Napoleon Community Schools 201 West Napoleon, MI 49261	Saturday	3/9/2024	10:00 am - 2:00 pm
Canton_Gallimore_MI	Gallimore Elementary School 8375 N Sheldon Rd Canton, MI 48187	Saturday	3/16/2024	9:00 am - 12:30 pm
Southfield_LTU_MI_AM (Jr Game)	LTU CS Robotics Lab	Saturday	3/23/2024	9:00 am - 1:00 pm
Southfield_LTU_MI (Sr Game)	LTU CS Robotics Lab	Saturday	3/23/2024	2:00 pm - 6:00 pm
Novi_AccelerateKID_MI	AccelerateKID 24404 Catherine Industrial Road Ste 316 Novi Michigan 48375	Friday	4/12/2024	5:00 pm - 8:30 pm

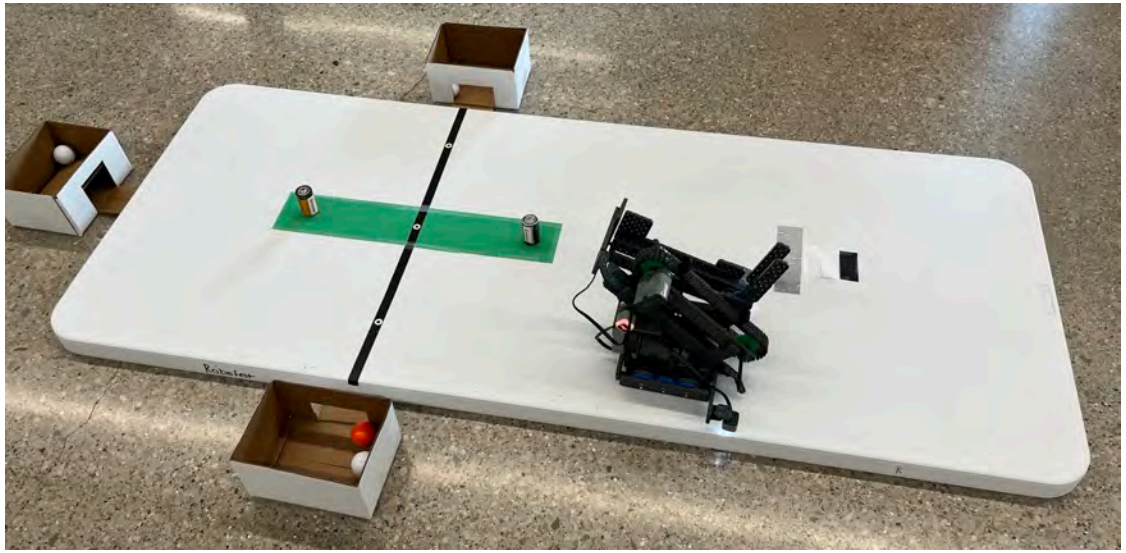
Game Invitationals and World Championship

MI_Invitational_GroupA	LTU CS Robotics Lab	Friday	4/19/24	5:00 pm - 9:00 pm
MI_Invitational_GroupB	LTU CS Robotics Lab	Saturday	4/20/24	9:00 am - 1:00 pm
MI_Invitational_GroupC	LTU CS Robotics Lab	Saturday	4/20/24	2:00: pm - 6:00 pm

World Championship Game Finals	LTU Field House	Saturday	5/11/24	9:00 am - 4:30 pm

Game Synopsis





- Autonomous vehicle has to take three passengers and a food delivery to their desired destinations while obeying traffic laws and avoiding collisions
- For a game run, max 2 minutes are given and one full-reset is allowed
- All the tasks must be done autonomously without any external help
- UTF (Unknown Tasks and Factors) will be unveiled just before the 30 minute work-time:
  - Passenger destinations (except passenger 3 for Sr Division)
  - Game-Ending Task
  - Items/landmarks may be added for the Game-Ending Task
- STEM Learning Goals
  - Geometry/degrees/logic/computational thinking
  - Localization and navigation
  - Object detection and manipulation

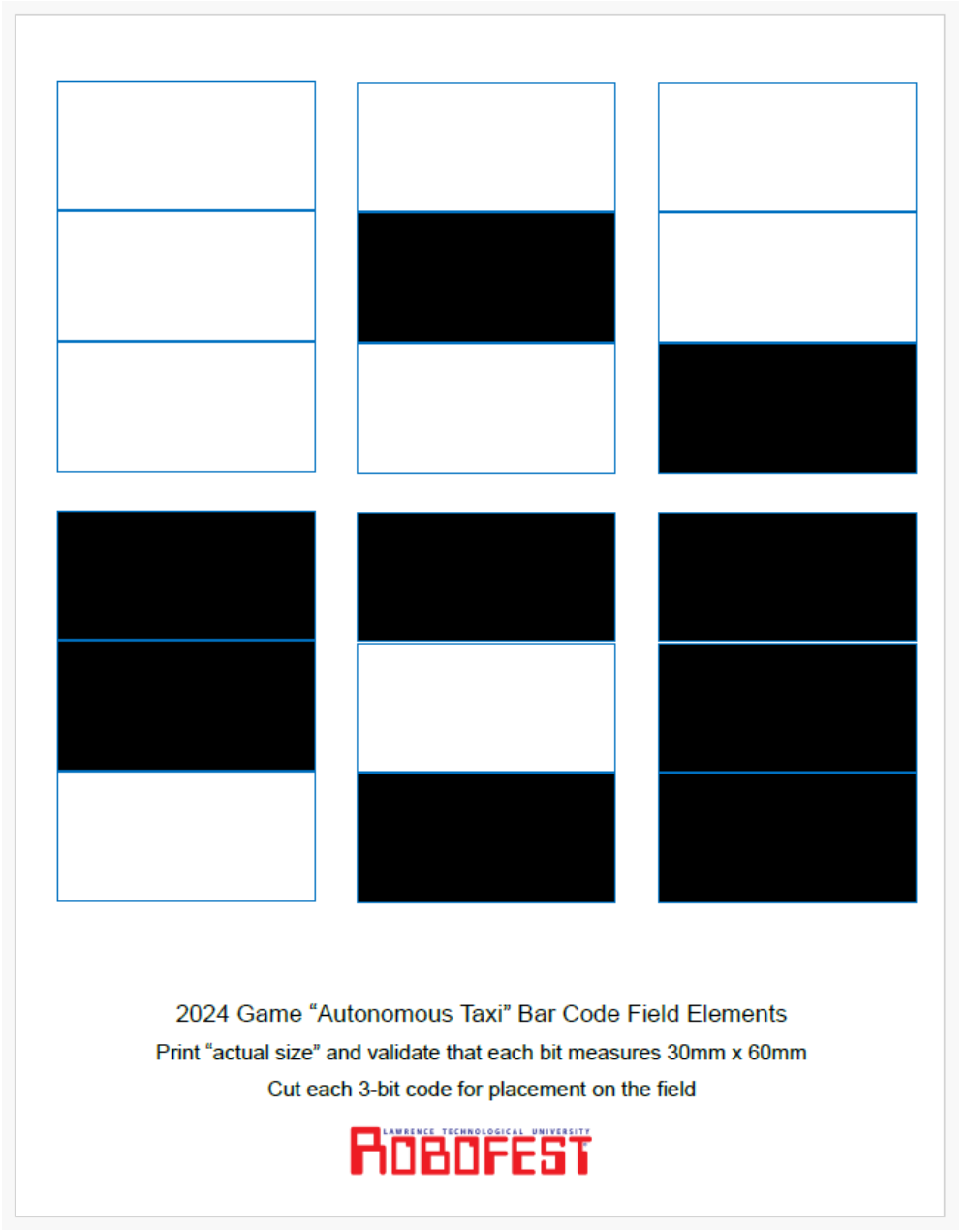
Game Field Definitions

- **Field:** All materials including 6-foot table, Buildings and Objects
- **Passenger object:** (3) standard white golf balls, numbered
- **Food object:** (1) orange golf ball
- **Pedestrian object:** (2) D sized batteries, or object of similar size
- **Buildings:** (3) cardboard boxes, sitting on the floor, taped to the table
- **Start line:** Foil tape taped to the table
- **Stop line:** Black electrical or painters tape
- **Median:** Green paper taped to the table
- **Bar code:** Black and/or White paper taped to the table
- **Score Card:** Used by Judges to calculate all points for a run – Verified by team

Bar Codes

File available on the Game Page:

https://www.robofest.net/images/2324/BarCodes.pdf



Score Card

File available on the Game Page:

https://www.robofest.net/images/2324/Game24Scorecard.pdf

Judging Items (all but item #7 to be checked at the end of the run)			Count	Actual Count	Point Value	Score Earned/Lost	max value
#1	Passenger 1	Building C Second Floor	0 (no) 1 (yes)		20		20
		Building C First Floor	0 (no) 1 (yes)		12		
		Building A or B	0 (no) 1 (yes)		10		
		Moved	0 (no) 1 (yes)		5		
#2	Passenger 2	Correct Building	0 (no) 1 (yes)		15		15
		Incorrect Building	0 (no) 1 (yes)		10		
		Moved	0 (no) 1 (yes)		5		
#3	Passenger 3	Correct Building	0 (no) 1 (yes)		15		15
		Incorrect Building	0 (no) 1 (yes)		10		
		Moved	0 (no) 1 (yes)		5		
#4	Food (orange)	In Building B	0 (no) 1 (yes)		15		15
		Moved	0 (no) 1 (yes)		5		
#5	Pedestrians	In green median (any part touching green)	0, 1, 2		5		10
		On table completely outside green median	0, 1, 2		2		
		Off table	0, 1, 2		-1		
#6	Game Ending Mission achieved		0 (no) 1 (yes)		15		15
#7	Stop Line violations - Tally below for round (restart tally if reset is requested)		no maximum		-2		0
#8	Robot remained intact throughout the run		0 (no) 1 (yes)		10		10
#9	Reset was requested (reset penalty)		0 (no) 1 (yes)		-3		0
Stop Line violation tally:			**TOTAL SCORE** Total maximum score = 100				100
Stop Line violation tally restarted if reset is requested:			**Time Left in Seconds** Record only if score is 100				

Game Definitions

- **UTF:** Unknown Tasks and Factors announced prior the 30-minute work time for each round – Includes Robot Start Orientation, location of some objects, and Game Ending Task – Not printed to scale
- **Work time:** 30-minute period before each round where teams adjust their programs and practice
- **Pit:** Area of team tables – only team members are allowed in this area for the duration of the competition
- **Impound:** The process of inspecting each team's robot for compliance (size, labeling, controller limit, etc.) and placing it in the impound area
- **Impound area:** A table where all the robots are placed after inspection and remain until the team is instructed to remove it for a run. Robots are returned to the impound table after the run until round is over
- **Run:** 2-minute period where Robot completes the mission on the field
- **Round:** One run completed by all teams, also called R1 & R2

Judge Roles and Responsibilities (1/2)

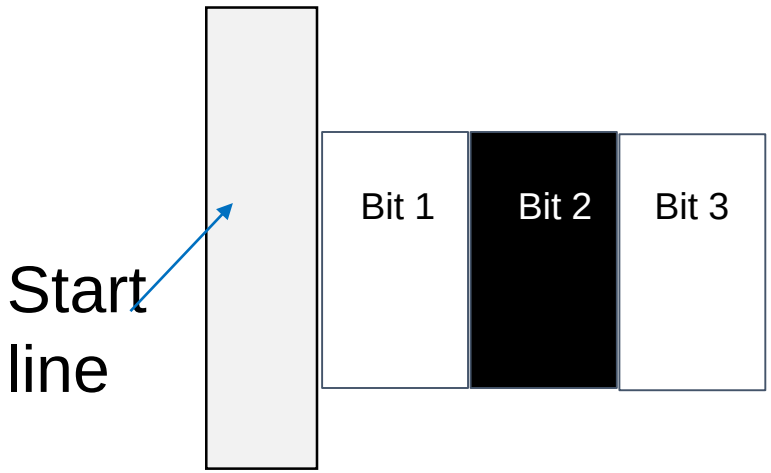
- Review all Game Judge Training
- Prepare / Verify initial placement of field elements and markers for known objects on official tables and practice tables
- Prepare placement of Start Line and Bar Code on official tables after impound using correct Host UTF instructions for each round
- Proctor the teams:
  - No adults in the pit during the competition
  - No contact with adults during the work time
  - Teams must share official and practice tables
- Impound robots

Judge Roles and Responsibilities (2/2)

- Review UTF Sheet for each Round to determine
  - Correct Bar Code
  - Bar Code and Start Line location
  - Passenger delivery locations
  - Game Ending Task
- Work with partner Judge to guide the team at the start the run, watch for violations, reset the field if the team requests a reset, Record Time (if needed) Score the run on the Score Card
- Review the score card with the team for agreement, then Judge and team sign it and turn in to the scorekeeper

Bar Code for End Task - Jr Division

- Bar code may be used for the end task
- Code unveiled after impound

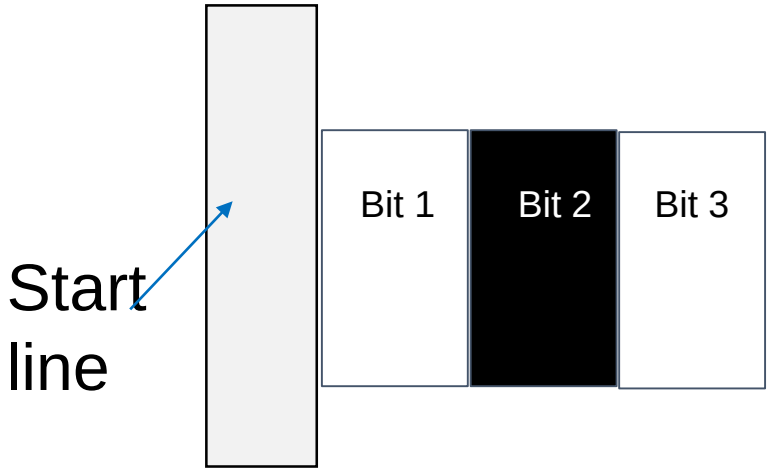


Examples:

- Display the color of Bit 2 at the end of the round
- Stop in front of Building A if Bit 1 is black, stop in front of Building B if Bit 1 is white

Bar Code for End Task - Sr Division

- As with Jr Division, bar code may be used for the end task for Sr Division
- Code unveiled after impound

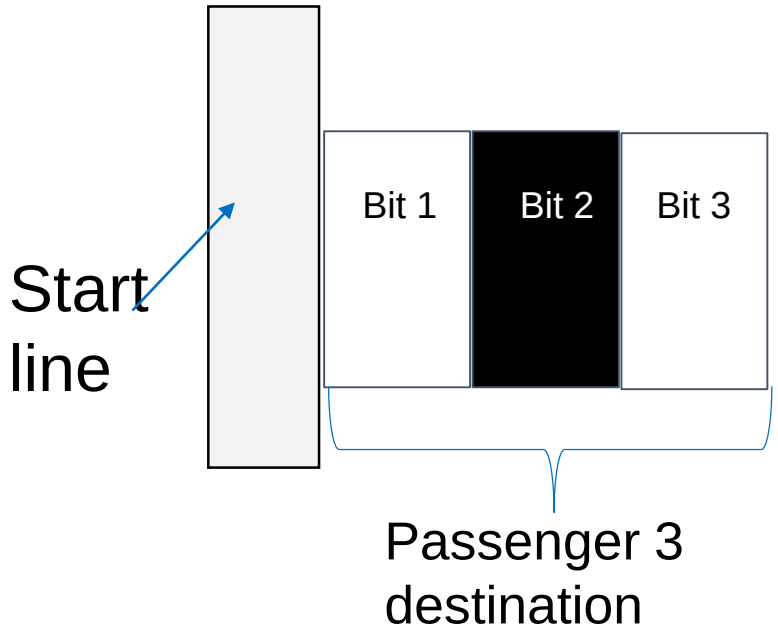


Examples:

- Display the colors of Bit 1, Bit 2 and Bit 3 at the end of the round
- Stop in front of Building A if Bit 1 is black, stop in front of Building B if Bit 1 is white
- Display the sum of Bit 1 + Bit 2+ Bit 3 (assume white 0, black =1)

Bar Code for Destination - Sr Division Only

- 3 bit sequence used for destination of Passenger 3
- Each segment is a binary digit representing a destination
- White= 0, Black =1



Bit 1	Bit 2	Bit 3	Destination
0	0	0	A
0	0	1	A
0	1	0	A
0	1	1	B
1	0	0	B
1	0	1	B
1	1	0	C
1	1	1	C

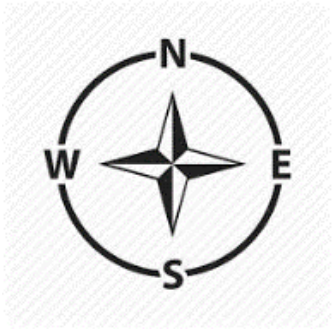
THIS EXAMPLE: Passenger 3 to Building A

Playing Field Setup for Each Round

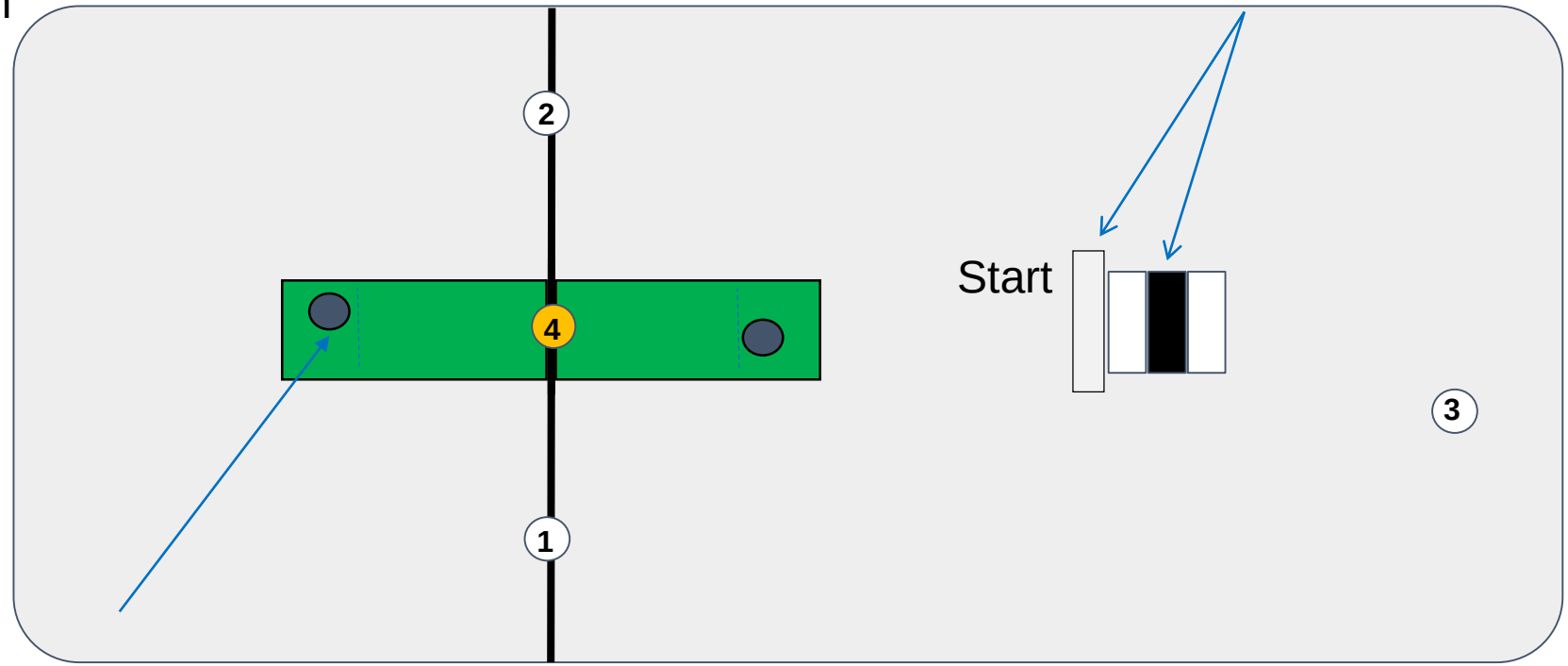
Official and practice tables should be pre-set with all elements prior to team check-in

A

Actual bar code and exact location of start line/bar code will be unveiled after impound and have to be reset on official tables from the practice configuration



C



Start line, bar code: Measured from Stop line and centered North/South

Each Pedestrian is placed randomly within a 10cm zone from the end of the median

B

Buildings and ball locations are the same round to round

Robot Impounding Process

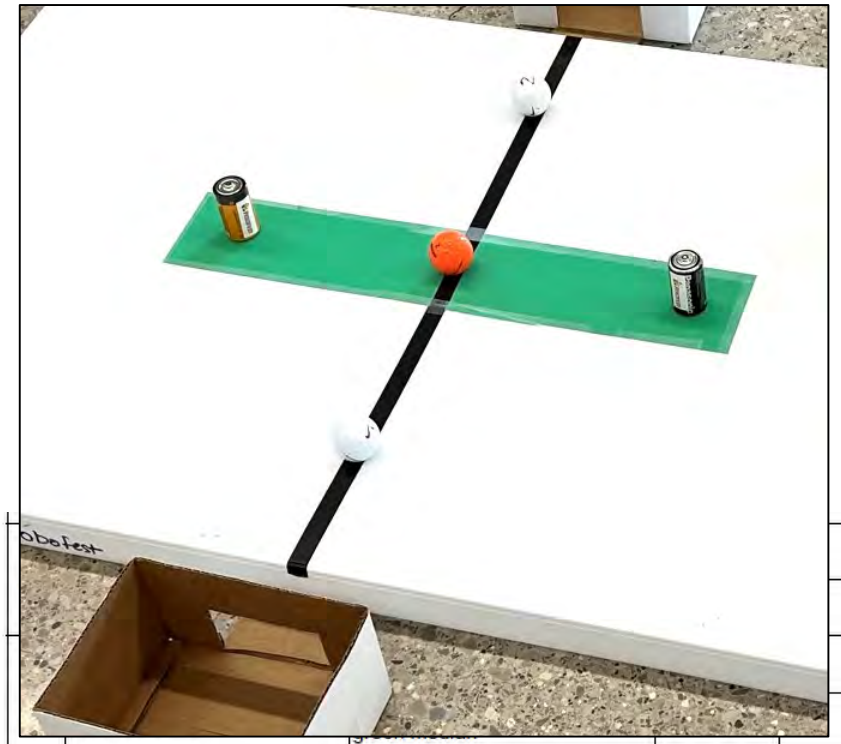
- Only one team member should approach the impound table to minimize traffic and reduce the chances for accidental damage
- Judges will be provided with 35cm x 35 cm measure board to measure the robot
- Judges should handle the robot as little as possible. Ask team members to place the robots on the measure board
- Judges will check the robot for the following:
  - **Maximum length and width: 35cm x 35cm *including expansion***
    - Ask if robot expands and team must show
    - Wires may extend beyond 35cm
  - All the wheels for driving touch the table surface
  - Robot is labeled with Robofest Team ID (on any visible surface - Team Name optional)
  - Robot front has a “Front” indicator
- Robots may not be charged at the impound. Robots should be turned off to save battery
- After inspection/approval, the ask the team member to place the robot on their team placemat on the impound table

Violations, Full-Reset, End of Run Declaration

- When any of the following violations occur, Judges shall stop the game play (and robot if still moving) immediately to avoid further disruption of the field:
  - Human touches the robot or field materials. Once the robot starts moving, the player cannot touch it
  - Robot falls off the table (any part of the robot touches the floor)
  - Any other illegal activities that a Judge determines
- The team can request a one-time full-reset (with penalty points) at any time. If reset is selected, time continues to run while Judges reset the table
- Team may declare the end of the run at any time. Players should not move the robot until instructed by the Judge
- If the robot is still moving when team calls “end of run” (or at the time limit) no points will be awarded for the Game-Ending Task which requires the robot to stop

Stop Line Violations

- Violation if the entire robot goes past the line without stopping
- Judges should keep a tally of the number of violations during the round, then put final number on scorecard
- Tally starts over if a reset is requested



				15		
				5		15
				5		
				2		
		Off table	0, 1, 2	-1		10
#6	Game Ending Mission achieved		0 (no) 1 (yes)	15		15
#7	Stop Line violations - Tally below for round (restart tally if reset is requested)		no maximum	-2		0
#8	Robot remained intact throughout the run		0 (no) 1 (yes)	10		10
#9	Reset was requested (reset penalty)		0 (no) 1 (yes)	-3		0
Stop Line violation tally: Stop Line violation tally restarted if reset is requested:				TOTAL SCORE Total maximum score = 100		100
				Time Left in Seconds Record only if score is 100		

Procedure/Rules to Play 2 Rounds (1/3)

- Only contestants are allowed to access the pit area, team tables, practice fields, and official game fields throughout the competition, including during the setup time before the opening ceremony, during work time, and breaks
- When Unknown Tasks and Factors (UTF) are unveiled, teams will be provided a hard-copy of the UTF and/or it will be projected/displayed on a screen
- Teams will be given a 30 minute work-time after UTFs are unveiled to work on their robots. Prior to the start of the work time, all people, except contestants and authorized staff/volunteers, will be **dismissed** from the competition area(s)
- During the practice time, teams must share the fields. Judges/proctors should watch for teams adjusting code at the field or taking more than one practice run if another team is waiting

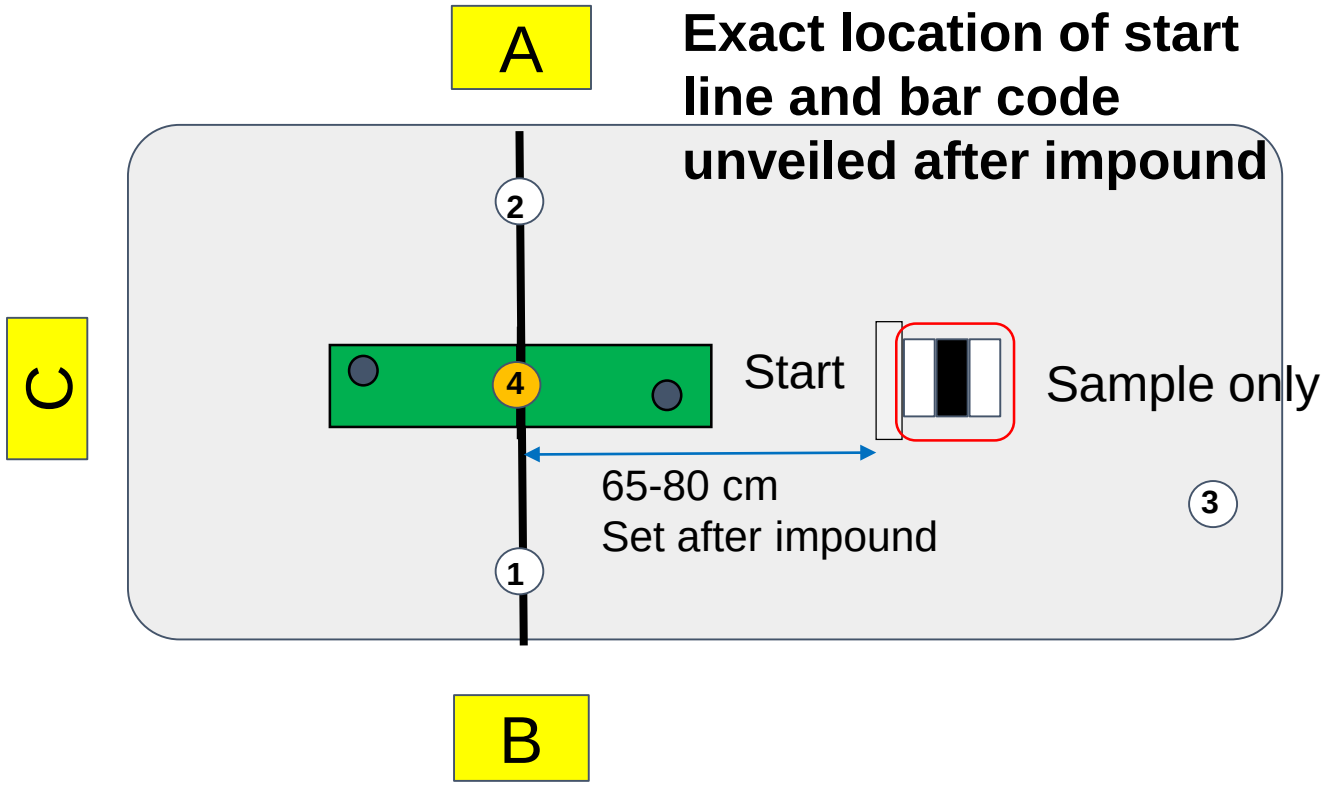
Procedure/Rules to Play 2 Rounds (2/3)

- All teams must submit their robot to the impound area when the 30 minute work-time has expired. Robots may be taken to be impounded early. Only one team member should deliver the robot to the impound table. Penalty may be applied if not impounded in time
- During the impounding process, Judges will inspect the robots. (Size of the robot, Team ID, “Front” label, number of computer controllers, etc.)
- No power will be supplied at the impound table and the entire robot must be impounded, including rechargeable batteries
- Teams will compete in a pre-determined order decided by the site host
- During the Game Rounds, all team members must remain in the team spectator area – no pit access allowed

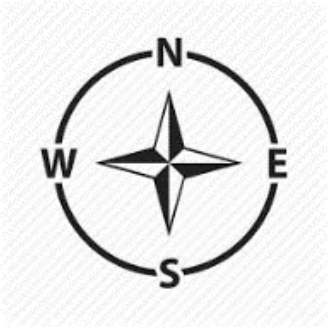
Procedure/Rules to Play 2 Rounds (3/3)

- When a team is called to compete, a maximum of two contestants per team are allowed to retrieve the robot from the impound area and to be present at the playing field during the run
- Judge (or Emcee) will check if (1) timer is ready (2) Judges' are ready (3) teams are ready. Then count down "3-2-1 - Go" to start a Game Run
- Contestants must stay near the Start Zone. They should not follow the robot. They can approach the robot only to end the run, request a reset, or when Judge tells them
- Final scoring is done after the run is over except for Stop Line Violations
- A team member must sign the score card to confirm the team's score
- Teams will play two rounds, each round will have a different set of UTF's (Unknown Tasks and Factors)

Jr Division UTF R1

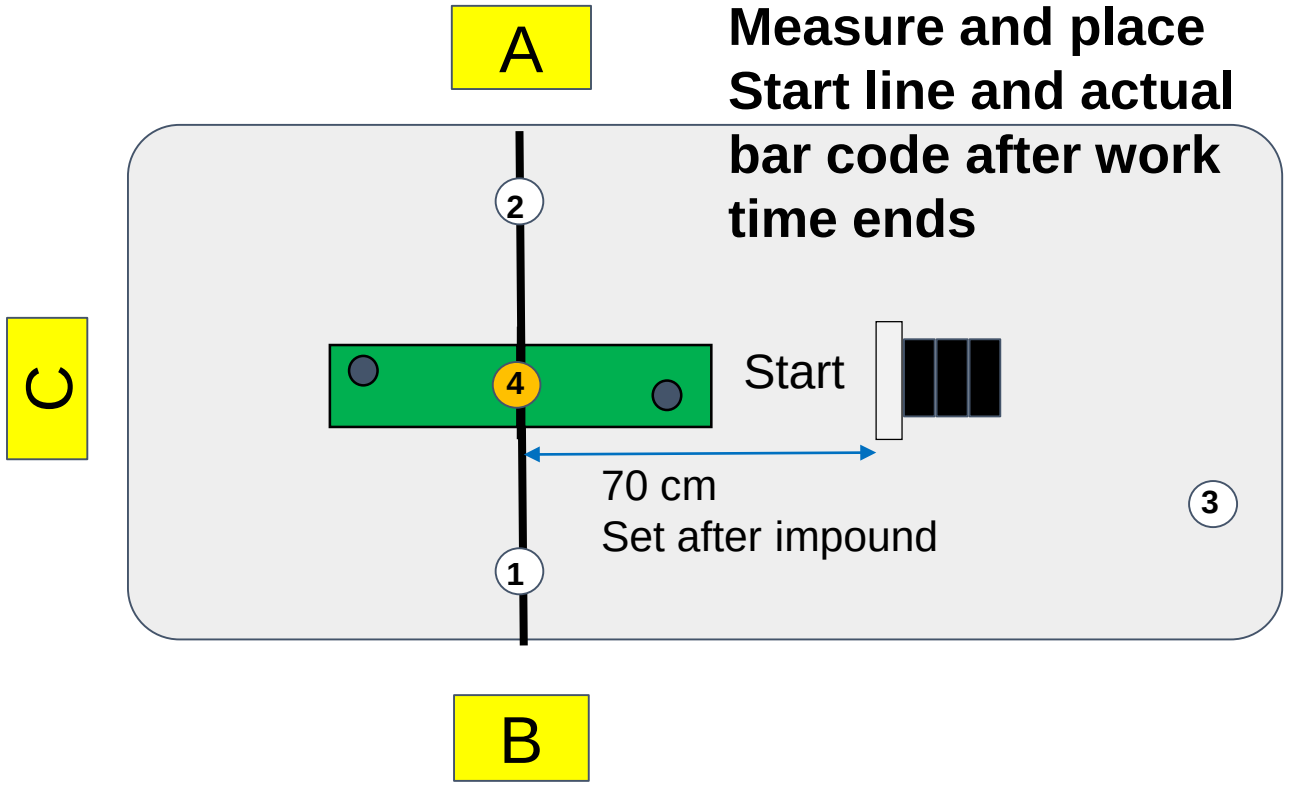


Passenger	Destination
1	C
2	B
3	A

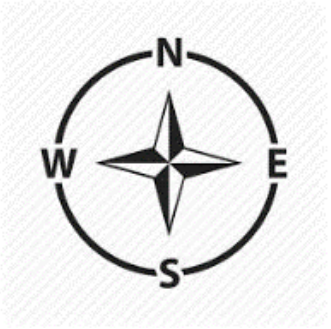


Game-Ending Task: the robot must be stopped and displaying the number of black bits in the bar code

HOST: Jr Division UTF R1

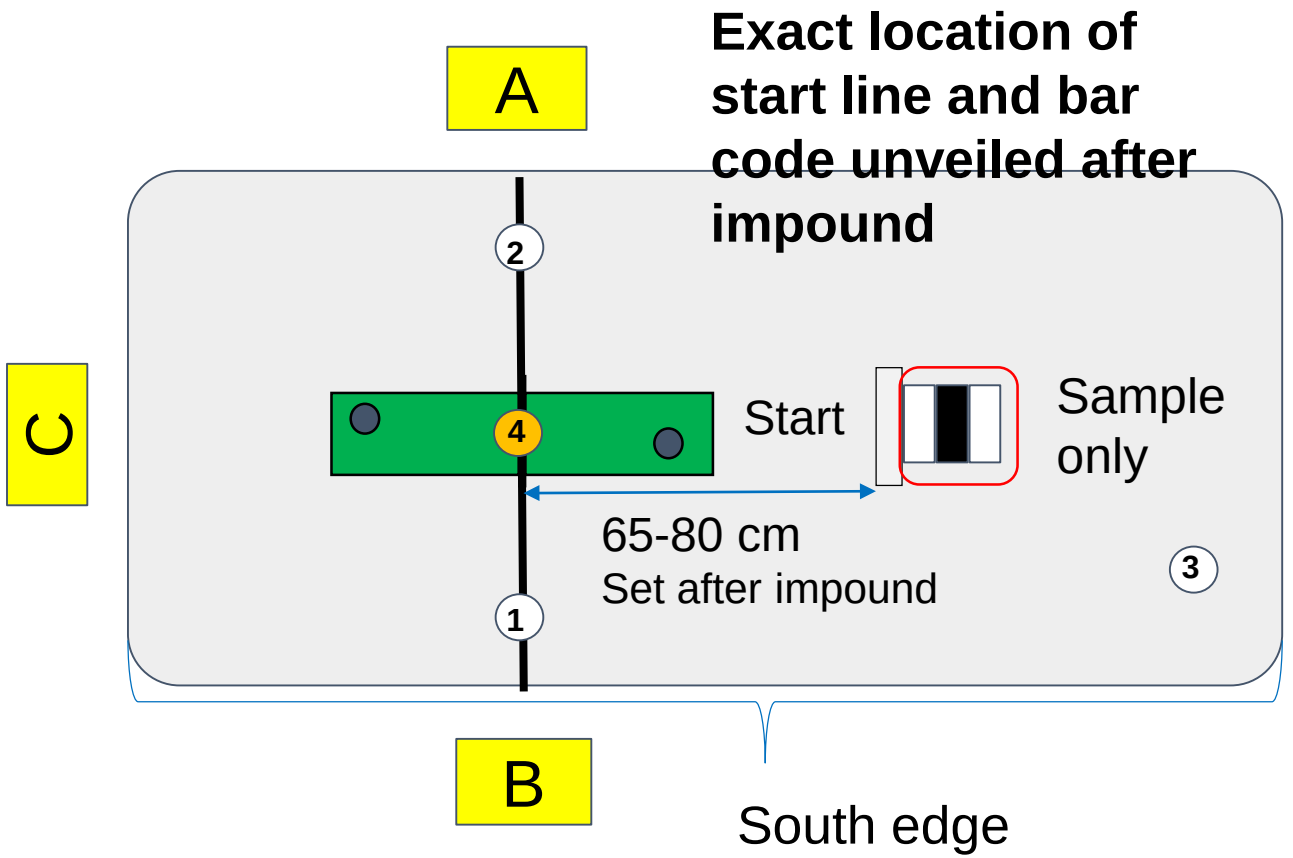


Passenger	Destination
1	C
2	B
3	A

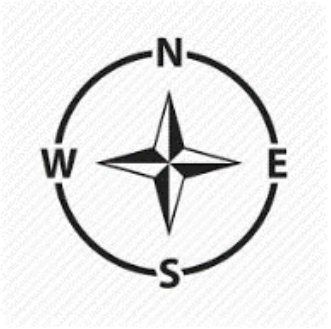


Game-Ending Task: the robot must be stopped and displaying the number of black bits in the bar code **ANSWER: 3**

Sr Division UTF R1



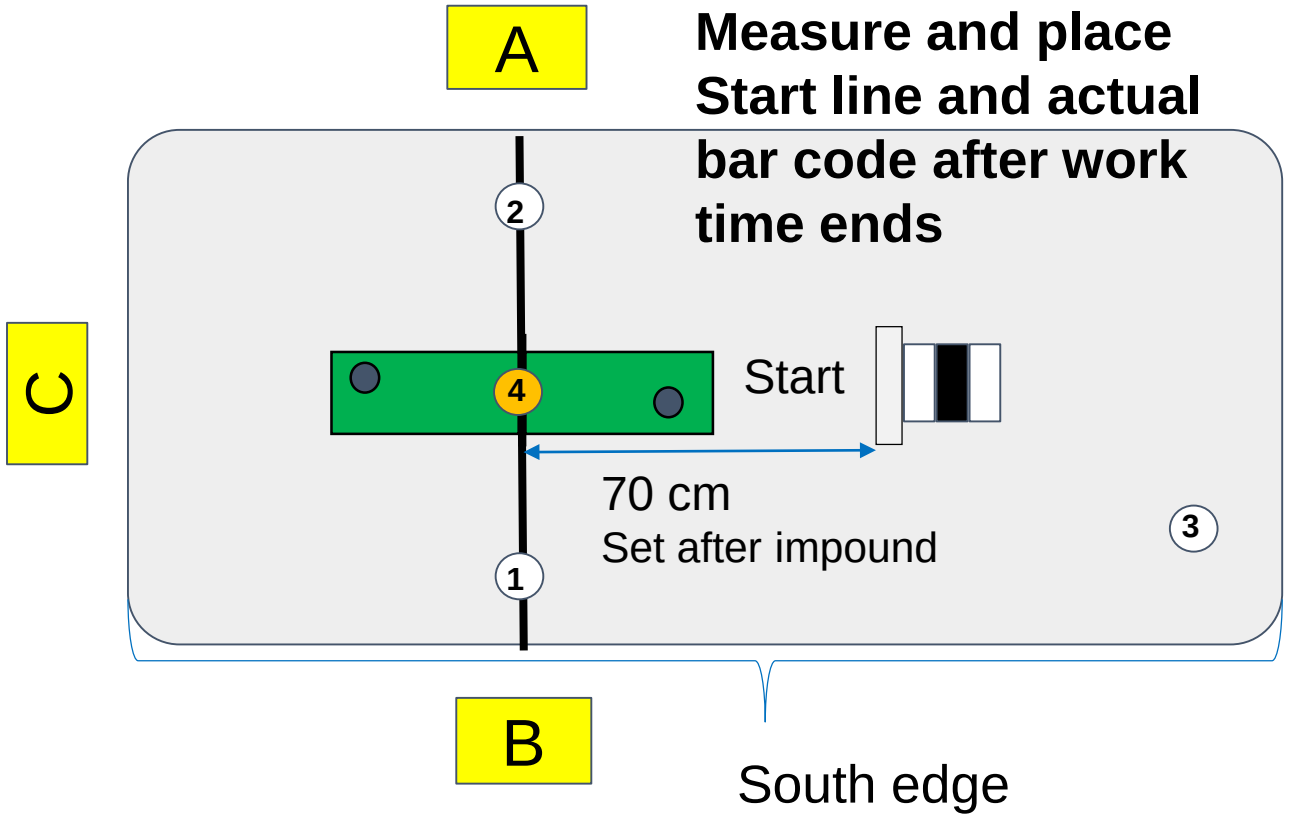
Passenger	Destination
1	C
2	A
3	?



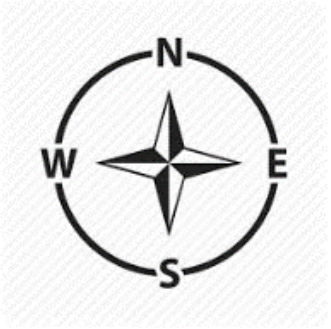
Game-Ending Task: the robot must be stopped and displaying the answer to the equation

$$\frac{\#\ white\ bits}{\#black\ bits} + 25$$

HOST: Sr Division UTF R1



Passenger	Destination
1	C
2	A
3	**A**



Game-Ending Task: the robot must be stopped and displaying the answer to the equation

$$\frac{\#\ white\ bits}{\#black\ bits} + 25$$ **ANSWER: 27**

Team Scoring

ROBOFEST

Robofest 2024

Autonomous Taxi

Qualifier: SAMPLE

Jr. Game

Final Ranking is determined by the **(Best+Average)/2** of the two rounds
*Time Left is only recorded if Round Score is 100

Display at end of event

Do Not Display

Tie breakers:
(1) best score of two rounds
(2) highest time left from best score
(3) rerun a 3rd round, if needed

Team ID	Team Name	Round 1 Score	Round 1 Achieved Unknown End Task (Y/N)	Round 1 Time Left*	Round 2 Score	Round 2 Achieved Unknown End Task (Y/N)	Round 2 Time Left*	Best Score	Average Score	Final Score (Best+Avg)/2	Rank	Place/Award	Tie Breaker Information: (1) Best Score	(2) Time for best Score	(3) 3rd Run (if needed)	Tie Calculation (determines rank in Column M)
Jr 1	Team 1	100	Y	10	52			100	76	88	1		100	10	80	76.0 1000108
Jr 2	Team 2	100	N	10	52			100	76	88	2		100	10	75	76.0 1000108
								0	0	0	3		0	0		0
								0	0	0	3		0	0		0
								0	0	0	3		0	0		0
								0	0	0	3		0	0		0
								0	0	0	3		0	0		0
								0	0	0	3		0	0		0
								0	0	0	3		0	0		0
								0	0	0	3		0	0		0
								0	0	0	3		0	0		0
								0	0	0	3		0	0		0
								0	0	0	3		0	0		0
								0	0	0	3		0	0		0
								0	0	0	3		0	0		0
								0	0	0	3		0	0		0
								0	0	0	3		0	0		0

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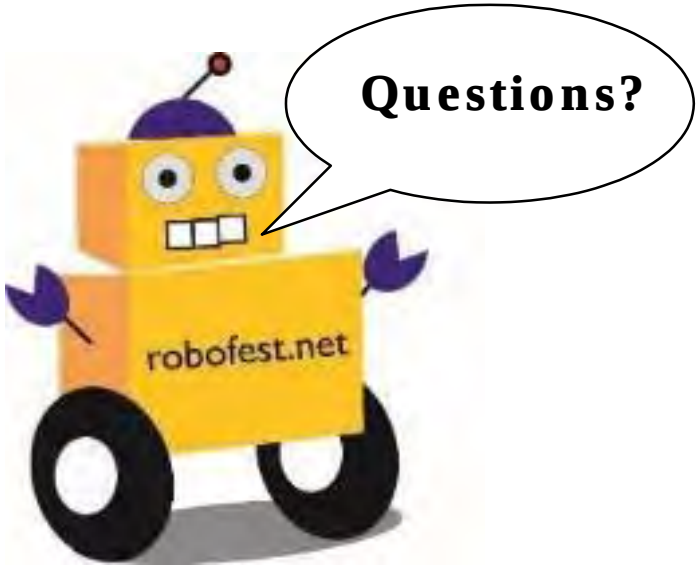
Lawrence Technological University

Rules to Determine Winners and Break Ties

- Winners in each age division will be decided by the **(Best + Average)/2** score of the 2 rounds
- Tie breakers will be: (1) best score of two rounds, (2) highest time left from best score (if 100pts), (3) rerun, if needed
- For example:

Team Name	Round 1 score	R1 time left	Round 2 score	R2 time left	**Avg. Score**	**(2) Best score**	**(1) (Best+Avg) 2 score**	**(3) Time left @ best score**	**Rank**
Team A	80		100	15	90	100	95	15	**1**
Team B	100	10	80		90	100	95	10	**2**
Team C	100	20	70		85	100	92.5		**3**
Team D	60		100	5	80	100	90		**4**
Team E	90		90		90	90	90		**5**

Little Robots, Big Missions



Game Committee Members

Prof. Elmer Santos *
John Arnold
Dr. Wisam Bukaita
Dr. Christopher Cartwright
Prof. Peter Guenther
Dr. CJ Chung

* Committee Chair

Send questions to: robofest@LTU.edu