Vcc (Vision Centric Challenge) 2020 Rules
CBC (Construction Barrel Course)

V 1.1 – International Kickoff Version for 2020 season. Each country may clarify/adapt/change rules for each country's qualifying competitions. World Championship rules will be finalized in Jan 2020.

This file can be found under the **Get Involved → Vcc** page on the website
Coaches are responsible for communicating rules updates to contestants

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

Room J233 Taubman Complex, LTU
21000 West 10 Mile Road, Southfield, MI 48075, USA

1. Playing Field & Game Synopsis
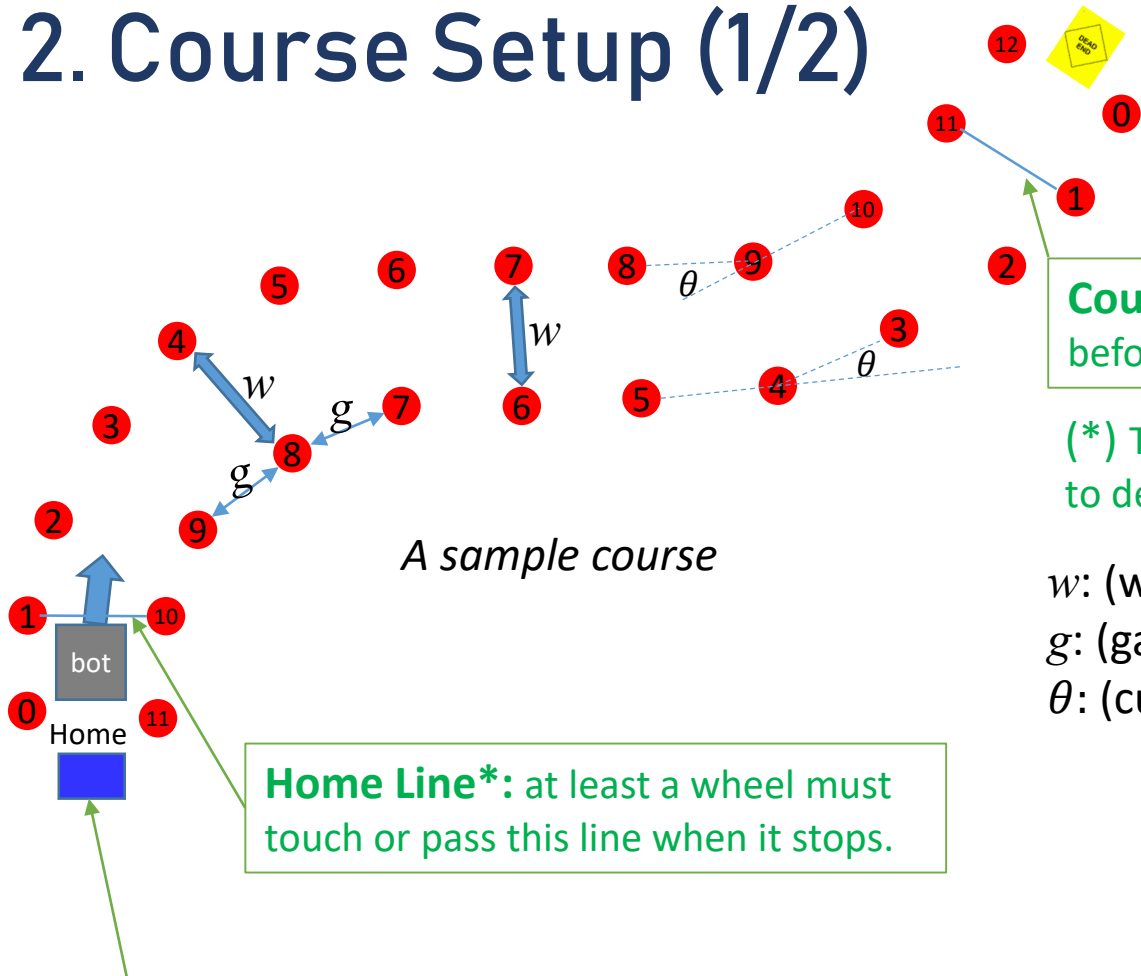

A sample course

STEM Learning Goals
- Video image processing
- Image blob detection
- Color recognition
- Vision based navigation algorithms
- Computational thinking

- Follow a lane marked by red cups. Detect a "dead-end" sign at the end of the course and come back to the start Home location. After detecting Home object, the robot must then perform an ending-task that will be unveiled. Other unknown factors that will be unveiled include: shape of the course, # of cups for the course, width of the lane, gap between cups, max curve angle, and Home object

- There will be two rounds. For each round, UTF (Unknown Task and Factors) will be unveiled 45 minutes before the impounding. One restart/reset is allowed for a run with 2 minutes.

2. Course Setup (1/2)

Dead-end sign (https://robofest.net/2020/deadEnd2.pdf) to be printed on colored paper. The color will be noticeably different from the floor and the red cup.

A sample course

Course End Line*: at least a wheel must touch or pass this line before returning back to Home.

(*) The color of the line is similar to that of the floor. Robot is supposed to detect the Dean-end sign, not this line.

w: (width of the lane): 24" ~ 27" (60.7cm ~ 68.6cm)
g: (gap between cups): 15" ~ 30" (38.1cm ~ 76.2cm)
θ: (curve angle): max. 30 degrees

Home Line*: at least a wheel must touch or pass this line when it stops.

Home Object Examples: colored paper, colored cups, boxes, cans, apples, bananas, etc. The color will be noticeably different from the floor and the red cup.

Cup - Red Solo Cup 16 oz.
https://www.amazon.com/AmazonBasics-16oz-Disposable-Plastic-Cups/dp/B072MFJ3KP

Handwritten serial number in black color

diameter: 6.4cm

Height: 12cm

diameter: 9.9cm

2. Course Setup (2/2)

- Lighting conditions on the course are unknown and possibly dynamic
- The floor color and texture are unknown. It may not be homogeneous, but color must be different from cups, dead-end sign paper, and Home object
- Unveiled on the day of competition or the beginning of practice day
- Length/Shape of course is unknown. It will be different for each round
- Same total number of cups will be used for round 1 and round 2
- The complexity and difficulty of round 1 and round 2 are similar

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3. Violations and Full Reset

When any of the following violation occurs, Judges shall stop the run immediately:

- Human touch of the robot or playing field material

- Any movement of a cup by the robot

- Robot is completely out of the course (1.5 meter away from the lane course)

- Robot turns around *before* reaching the course end line (at least a wheel must touch or pass the line)

- Illegal signal such as hand gestures or wireless control

When any of the above violations occurs, the team can request one-time "full reset" OR declare the end of the run. Time continues to run while Judges reset the table.

4. Run Procedure (1/2)

- Each team will have 2 runs (rounds)

- For each round there will be 45 minutes allotted as work-time after unveiling the UTF items as shown in slide #6. During the work-time, no adult/coach's help is allowed

- After the 45 minute work-time, all robots will be impounded before starting each round

- After all the robots are impounded, the competition course will be officially setup and double checked

- For each round, each robot has a maximum of **2** minutes to complete the run

- A team member will start the robot behind the Home Line. Any projected part of the robot cannot pass the Home Line.

- The timer will start when a Judge says "Start", in "Three", "Two", "one", "Start".

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4. Run Procedure (2/2)

- Robot travel distance is recorded by the number of cups passed. The cup passing is defined in Slide #5

- To complete a run successfully, the robot must complete the unveiled ending task and stop. Refer to slide #6

- The timer will be stopped when the robot has stopped completely

- If the robot does not stop at the end a run, then Ending Task is not completed. The timer will be stopped when a player touches the robot

- Judges will record the performance on the scoring sheet shown on Vcc page at: https://www.robofest.net/index.php/current-competitions/vision-centric-challenge

- Both elapsed time and time left in seconds will be recorded when the run has ended

5. Cup Passing –
at least a wheel must pass the imaginary Cup Passing Line

Imaginary Cup #7 Passing Line

θ = 90 degrees

Imaginary Cup #3 Passing Line

θ = 90 degrees

Home Line
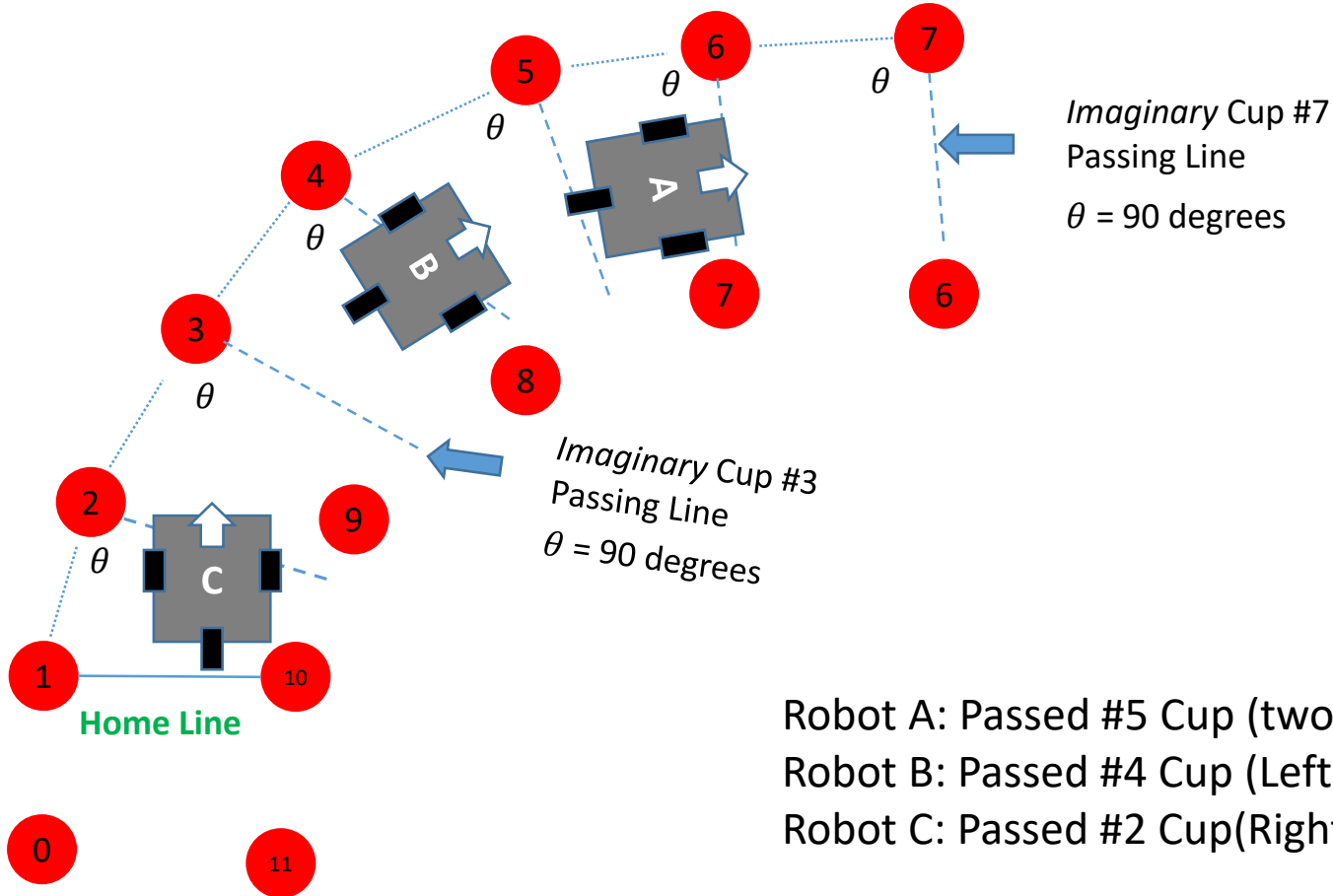
Robot A: Passed #5 Cup (two front wheels passed #5 line, not #6, yet)
Robot B: Passed #4 Cup (Left wheel is on the line or passed the line)
Robot C: Passed #2 Cup(Right wheel is on the line)

6. Example of UTF (Unknown Task and Factors) for a Round – Unveiled 45 min before impounding

Course End Line
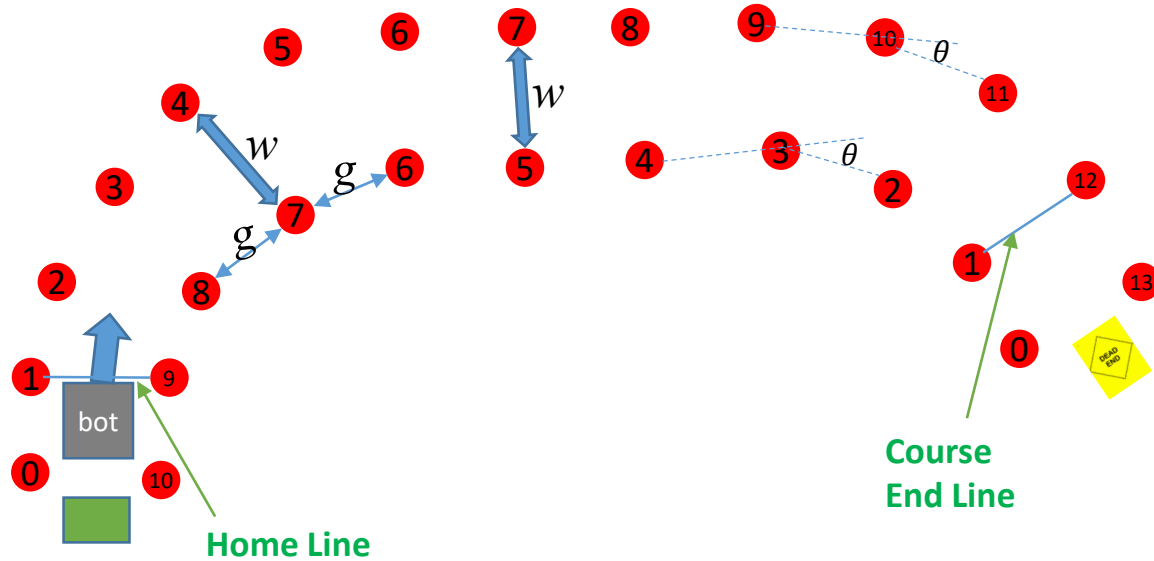
Home Line

Ending Task: After detecting the Home object (on the floor shown above), spin 360 degrees clockwise and stop. At least a wheel must touch or pass the Home Line. Cups must not be moved.

Unknown Factors	Unveild value
Shape of the Couse	See left diagram
# of cups for the left lane	14
# of cups for the right lane	11
w: (width of the lane): 24" ~ 26"	24"~25" (60.7~63.5cm)
g: (gap between cups): 15" ~ 30"	20"~21" (50.8~53.3cm)
θ: (curve angle): max. 30 degrees	Max. 20
Home object	Green paper (Letter Size)

7. Robot Specifications

- Must be completely autonomous. (Any type of remote control by a human driver or remote computer is not allowed.) The main controller can be a laptop, notebook, tablet, micro-controller, open MV, Jetson nano, or even a smart phone. The controller must be on the robot all the time

- Any robot platform with up to 2 cameras is allowed. No other external sensors are allowed. Internal encoders for motors are permitted

- Any programming language may be used

- Width must be less than 20 inches (50.8 cm)

- Length must be less than 24 inches (60.7 cm)

- Height (including camera) must be 3ft (91.4cm) or less

- Weight: no limit

- The robot may *not* automatically expand its dimension larger than the specified maximum values

- Camera angle: no restriction. You may use motors to move the camera. Wide angle lens can be used

- A Robofest team name & team ID tag as well as a label showing front on the robot are required.

8. Rules to Determine Winners & Break Ties

- Winners will be decided by average points of 2 rounds

- Tie breakers will be: (1) Best points (2) total time left in seconds, and (3) rerun

- An example:

Team	Round 1 points	Round 2 points	Average (0)	Best points* (1)	*Time left R1*	*Time left R2*	R1+R2 Time left (2)	Rank
A	20	20	20	20	5	10	15	2 (by 2)
B	17	15	16	17	7	9	16	5 (by 1)
C	20	20	20	20	4	10	14	1 (by 2)
D	20	20	20	20	10	6	16	3 (by 2)
E	20	12	16	20	10	20	30	4 (by 1)

9. Important Notes

- Teams may use similar or identical robot hardware platforms. However, source codes must be significantly different

- Teams are required to submit a hardcopy of their code when they check-in on the competition day. Teams will be disqualified if too similar codes were used. Send source code files by email at cchung@LTU.edu, if printing is needed.

- Final decisions are at the discretion of the Chief Vcc Judge

- Robofest 2020 General Rules document at robofest.net

- This CBC is only for Senior (8th-12th) division: maximum **3** members per team. Vcc college division is discontinued in 2020