LAWRENCE TECHNOLOGICAL UNIVERSITY
ROBOFEST®

BOTTLESumo

BottleSumo

Push the Bottle Off the Table or be the Last Robot Remaining

V 2.2 Final Version for 2023 Season

(Changes from 10/1 version in RED)
This file can be found under the **Get Involved / BottleSumo** page on the website
Coaches are responsible for communicating rules updates to participants

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1. BottleSumo Overview

Learning Objectives

- STEAM subjects including physics
- Autonomous navigation
- Computer programming logic
- Edge detection
- Object detection
- Autonomous search algorithms
- Adjusting to environmental conditions
- Problem solving

Synopsis

- An Open Category competition, which will take place at the World Robofest Championship
- Local events may host BottleSumo, but there are no qualifying competitions. (Teams must re-register for World Championship event)
- The objective of BottleSumo to EITHER
  - be the first robot to intentionally push a two-liter bottle off the table
  OR
  - be the last robot remaining on the table

2. Age Divisions and Team Size

- Three Divisions
  - Junior Division (Grades 5-8)
  - Senior Classic Division (Grades 9-12)
  - Senior Unlimited Division (Grades 9-12)
- Team Size: Maximum three (3) members
- Team Registration Fee: $75 at the World Championship (Registration fee at local event may be different)
- Related important document - 2023 General Rules on the robofest.net website
- Each team member must bring the signed Robofest Consent and Release Form on the day of the event, if not completed on-line

BottleSumo 2023 Rules

3. Robot Requirements (1/2)

- Robot must be fully-constructed upon arrival to the competition
- Robot must be fully autonomous. No human control, signal, or remote computer control (tele-op)
- One robot per team (same robot must be used for entire tournament)
- Robots must have labels clearly indicating their team ID number and FRONT of robot (side with sensors)
- Teams will need to bring laptop computers to modify their programs for unknown starting task and to adjust for conditions that are unknown until the competition day

	Junior Division	Senior Classic	Senior Unlimited
Maximum robot weight	0.9 Kg	1.5 Kg	3 Kg
Robot Brain	LEGO NXT, LEGO EV3, LEGO Spike Prime/Robot Inventor or VEX IQ		Any
Robot Battery	Voltage is limited to <= 9.0v		No limit
Maximum robot width, length, and height	Must fit in **21x21x21**cm box. Robots may **NOT** expand their dimensions during the game.	Must fit in **30x30x30**cm box. Robots **may expand** their dimensions, but the maximum dimensions allowable is **35x35x35**cm.	
# of robot brains per robot	One brain only	Any	
Traditional sensor types	Any unless it can be harmful to humans		

3. Robot Requirements (2/2)

	Junior Division	Senior Classic	Senior Unlimited
On-board vision sensor system	**NOT** allowed	Examples of allowed vision sensors: • NXTcam: • Pixicam: • Others such as smart phone vision:	
Number of sensors	At least one sensor that can detect dark/light contrast on the plane of the table AND at least one sensor that can detect objects in front. These may be needed for unknown start		
	Maximum 4 sensors (Sensor Multiplexer NOT allowed)		Unlimited (Sensor Multiplexers ALLOWED)
Number of motors	Maximum 3		Unlimited
Motor types	LEGO NXT (9842), LEGO EV3 (455202), LEGO Spike Prime (45602,45603) or VEX IQ (228-2560) only. Voltage altering over default voltage is **NOT** allowed. Other motors such as LEGO Power Function and EV3 medium motors **NOT** allowed		Any
Wheels, treads, or legs (the parts driven by motors which touch the ground)	Must be standard, unmodified LEGO or VEX IQ parts. Vacuum or sticky material **NOT** allowed		Vacuum or sticky material **NOT** allowed
Robot Shape	Ramps not allowed. Front, rear, and sides of robot (outer envelope of the robot, 25mm or lower from the ground) cannot be sloped or horizontal		
Other Material	Any. You may use tape, glue, rubber bands, etc. to construct the robot		
Programming language	Any		

4. BottleSumo Playing Field Table(s) (1/2)

- Competition tables are 30in x72in (actual size is about 75cm x 182cm) plastic folding tables

- The recommended brand is "Lifetime" which can be found at

https://www.lifetime.com/lifetime-2901g-6-foot-folding-table-commercial

- The four corners of the table are rounded. The radius of the corner circle is 4cm ~ 7cm

- Table thickness is about 4.5cm

- Table surface is light in color, for example, almond, tan, or gray

- Exact size, color, brightness, and edge shape are unknown until the day of the competition

- The table(s) are placed on a dark colored floor with the legs folded under and raised up with rolls of packing tape, (a stack of three recommended)
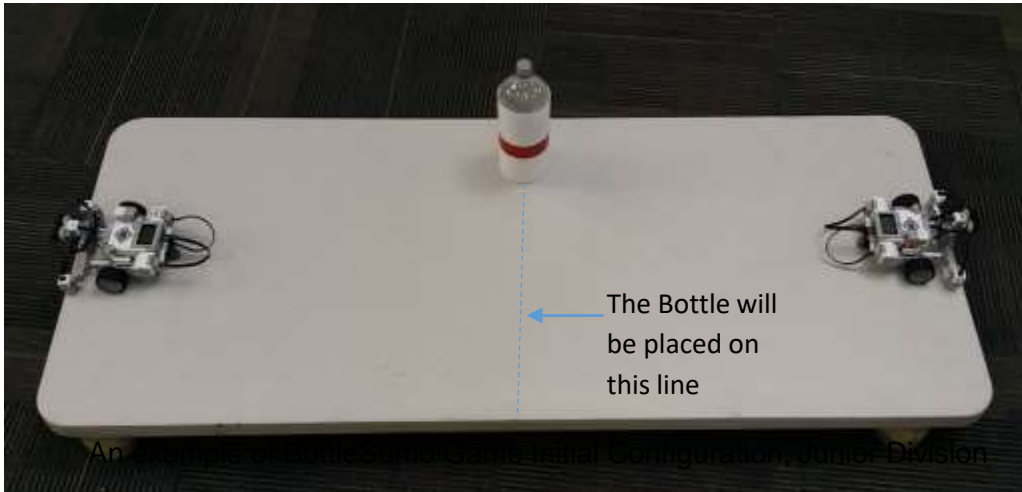

12.75 cm
3 stacked packaging tapes

Raised Table Setup for all Divisions

4. BottleSumo Playing Fields (2/2)

- **Junior Division**: Made up of one table

The Bottle will be placed on this line

An example of BottleSumo Game Initial Configuration, Junior Division

- **Senior Division** : Made up of two tables (configuration will be unveiled)

The Bottle will be placed on this line

Connect tables with tape of a matching color

5. Bottle Specification

- A two-liter bottle is covered with legal size (8.5in x14in) white paper

- Red electrical tape or color paper is used to create a 3.8cm red stripe as shown 8cm from the bottom of the bottle

- The exact color of the red tape or paper is unknown until the competition day

- Bottle is filled with 1 liter of water

- If the two-liter bottle shown right is not available, a slimmer bottle may be modified by using materials like *yoga mats or sponge sheets*. You may also use the thin bottle as is

21.6cm (8.5")

3.8 cm

8 cm
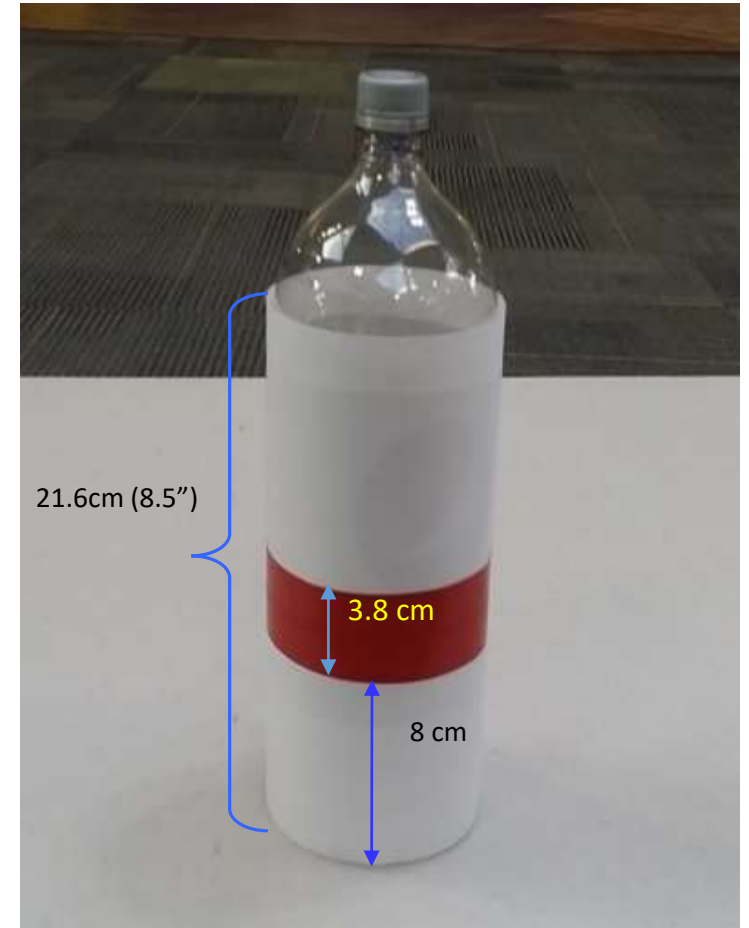
Bottle Dimensions

6. Unknown Start Task – Example

- The way to start the robot moving is an **Unknown Task** that is unveiled 20 minutes prior to impounding robots

- The same unknown task will be required for the Time Trials and the Elimination Tournament

- *Unknown Task Example:*
  - *Robot will flash an LED for 1 second after the Judge states "GO" then wait 5 seconds. Judge will place a bottle on the table approximately equidistant from each robot during the 5 second period*

- *Additional examples can be found at* robofest.net

2/28/2023

7. Competition Procedures (1/2)

- BottleSumo competition has two sessions:
  - Time Trial to rank robots and seed a tournament bracket
  - Single elimination tournament with "head to head" games
- Definitions:
  - Game: a single head to head round
  - Match: a series of two or more games to determine which team advances in the tournament
  - Match Winner: the first team to win two games

BottleSumo 2023 Rules

7. Competition Procedures (2/2)

- Only participants are allowed to access the pit area, team tables, practice fields and official game fields throughout the competition day including setup time before opening ceremony, work time, and breaks

- Immediately after the opening ceremonies, the Unknown Task is unveiled. A 20-minutes timer will start for teams to work on their robots

- After the 20 minute work period, all the robots will be impounded

- During impound, the robot will be inspected for size, weight, and labels. Judges will also inspect the robot for any illegal materials

- Battery charging is not allowed in impound

- Participants should not pick up their robot until instructed by a Judge

8. Time Trial Round (1/2)

- The bottle locations for the time trial will be announced after impound

- Judge will measure the time taken for each robot (one per table) to push 2 bottles (Jr. Division) or 3 bottles (Sr. Divisions) off the table, then stop after the last bottle is knocked off

- Maximum time given is 2 minutes

- Unknown Task must be used to initiate the robot or it will be penalized and *not allowed to continue*

- Time will be recorded to 1/100 of a second

- If a robot commits "Sumocide" by falling off the table, survival time and number of bottles pushed off the table will be recorded. (See penalty points on next page and examples in section #9)

- Robot must remain on the table for at least 3 seconds after any bottle is pushed off or it will be penalized (See next page & section #9).

- For robots that push off all the bottles and survive, time will continue to be counted until the robot comes to a complete stop for at least 10 seconds. The robot must stay stopped for at least 10 seconds to indicate it is done, but the 10 seconds will not be included in the "completion time"

8. Time Trial Round (2/2)

- After all teams have completed the time trial, teams will have an additional 20 minutes to modify robot or program.

- During this time, a single elimination seeded tournament bracket will be created based on the rankings from the time trials. (See http://www.printyourbrackets.com)

- Teams will be seeded based on the following: **1) Unknown task completion, 2) Number of bottles, 3) Staying on the table for at least 3 sec after any bottle off, 4) Completion Time**

- The following penalties apply:

  - Unknown task not completed (Time will be **1000 sec**)

  - Bottles left on table (Time will be **250 sec** per bottle, plus any other penalties)

  - Robot does not remain on table for 3 sec after any bottle (Time will be **250 sec**-survival time, plus any other penalties)

  - Robot does not stop after pushing off all the bottles (Time will be **240 sec**-survival time)

  - See Section 9 for scoring examples

9. Time Trial Score Sheet

BottleSumo Time Trial Scoresheet

Division (circle one)	Team ID _____		Round (circle one)
Jr Sr	Team Name _____		1 2

Unknown Start was Correct?			Y	N	

Number of Bottles pushed off	0	1	2	3 (Sr Only)	

Did the robot stay on the table for 3 sec after last bottle?   Y   N

CHECK ONE BELOW

____**Completion Time** (if all bottles off and robot on table and robot stopped for at least 10 sec; do not include 10 sec after stop)

Elapsed (from Zero)	Remaining (from 120 sec)

Record BOTH times

OR

____**Survival time** (if bottles left, robot falls off table or robot still moving)

Judge's Initials   _____

Team Member's Initials   _____

9. Time Trial Ranking Examples

	Score	Note	Rank
Team 1	1000	Failed unknown task	12
Team 2	131	Last bottle off at 118s, sumocide at 119s. (250-119)	5
Team 3	250	Robot survives on the table at the end; One bottle on the table	8
Team 4	500	Robot survives on the table at the end; Two bottles on the table (250+250)	10
Team 5	120	120s Completion time (Last bottle off at 60s, but robot did not stop)	3
Team 6	50	50s Completion time*	1

	Score	Note	Rank
Team 7	100.5	100.5s Completion time*	2
Team 8	470	Sumocide at 30s; one bottle on the table (250-30+250)	9
Team 9	140	Last bottle off at 109s, Sumocide at 110s (250-110)	6
Team 10	740	Sumocide at 10s; Two bottle on the table (250-10+250+250)	11
Team 11	130	Last bottle off at 120s, sumocide at 123s (250-120)	4
Team 12	180	Last bottle off at 30s, Robot survived for 3 sec but sumocide at 60 s (240-60)	7

(*) Note that the completion time does not include the 10 second stop time

Note that Team 11 had a better score than Team 2 and Team 9 because it survived for a longer time

10. Game (Head to Head) Rules

A.   A maximum of 2 minutes is given for each game

B.   At the start of each game, the Judge will announce (a) the location on the table and (b) orientation of the robots on the table (For examples, see section # 4)

C.   Teams will place their robots on the field according to the Judge's instructions

D.   The Unknown Task must be used to start the robot

E.   If the robot fails to move, the robot automatically loses the game, unless the other robot also fails to move, in which case it is a tie

F.   If the robot fails the unknown starting requirement, the robot automatically loses the game, unless the other robot also fails the unknown starting requirement, in which case it is a tie

G.   The bottle is placed at an unknown location equidistant from the two robots. The bottle location can be different for each game

H.   After the start, students/Judges must move at least 1 meter away from the table edges until after the end of the game

I.   If the bottle is pushed off the table unintentionally, the game continues with head-to-head sumo wrestling

J.   If any piece/part of the robot comes off the robot, and subsequently falls on the floor, the opposing robot will be IMMEDIATELY declared the winner

K.   One battery change is allowed during the head to head matches

11. Determining the Winner of a Game

- A robot is declared the winner of a game if one of the following criteria is met:
    - It intentionally (see sections #12 & #13) pushes the **bottle** off the table and then remains intact and on the table for at least 3 seconds
    - It intentionally or unintentionally pushes the opponent off the table and then remains intact and on the table for at least 3 seconds
    - It remains intact and on the table for at least 3 seconds after the opponent has committed "Sumocide" by falling off the table
    - If its opponent first pushes the bottle off the table but then commits "Sumocide" before the judge reaches the end of the 3 second count, the robot must remain intact and on the table for an additional 3 seconds to win the game
    - If the result is unclear, the game will be declared a tie and replayed

- **NOTE:** Judge must use a timing device such as the display timer, cell phone app, or stopwatch to insure time requirement has been met before declaring a winner

12. Game-Intentional Push Definition
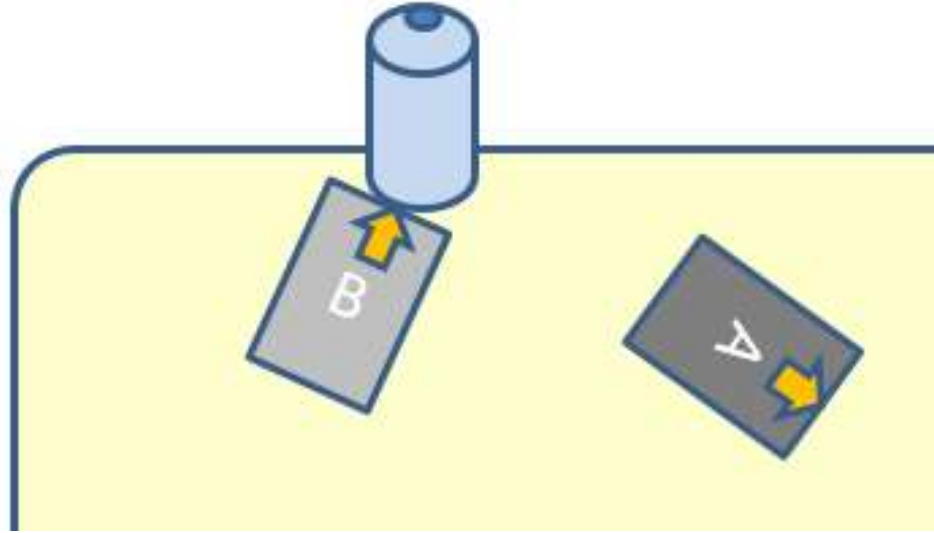
Intentionally pushing the bottle off the table is defined as "the robot pushes the bottle off the table with any side of the robot that has a sensor, while neither the robot nor the bottle is in contact with the second robot". In figure above, Robot A is not in contact with B or bottle

13. Game-Unintentional Push Definition

Unintentionally pushing the bottle off the table is defined as "when the bottle falls off the table while both robots are in contact with each other" [see (a) and (b) below], or "when a robot pushes the bottle off the table with a side that does not have a sensor," as in the case when a robot is spinning [see (c) below]

(a)   (b)   (c)   (d)
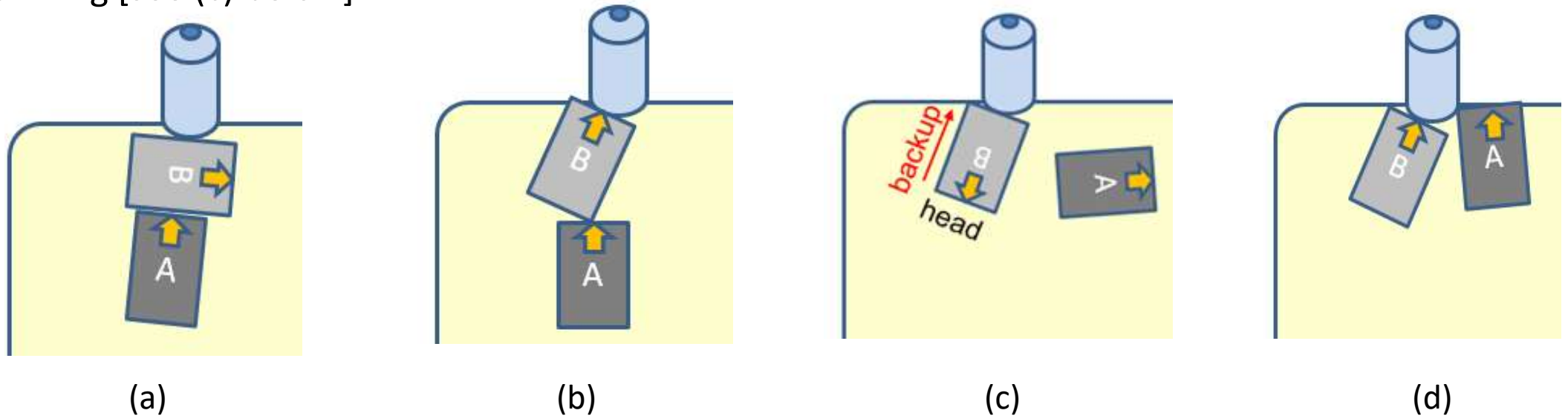
In figure (d) above, suppose B pushed the bottle off the table. It is an unintentional (not a clean) push, since robot A was also touching the bottle

BottleSumo 2023 Rules

14. Game Rules-Ties

- A tie game will be declared if the judge determines that:
    - Both robots at the same moment have any of their parts touch the floor (except in the case of a piece of the robot falling on the floor, See section 10 rule J)
    - The robots both fall off the table within three seconds of each other
    - NO progress is being made for 20 seconds at Judge's discretion
    - BOTH robots fail to start (do not move)
    - BOTH robots fail the unknown starting requirement
    - One robot fails to start (does not move) and the other robot fails the unknown starting requirement
    - There is no winner after two minutes
    - The result is unclear or too close to call

- If the match is a tie, the teams will keep playing additional games until one team wins two games

- The Judge will use his/her discretion to make any decisions for the situations not documented in these rules. The Judges' rulings are final

15. FAQ (Frequently Asked Questions)

- Can a robot have multiple programs to select from when a game is started? Yes. However, the selection must be done quickly. Teams will not have maintenance time between games.

- If robot A intentionally pushes the bottle off the table, but it fell off the table before the 3 seconds, then the opponent B survives at least 3 seconds after the A's fall. Who is the winner? B is the winner.

- If robot A pushes robot B off the table, but A fell off the table too before the 3 seconds. Who is the winner? Tie Game.

- If robot A intentionally pushes the bottle off the table, but it fell off the table before the 3 seconds, then the opponent B committed "Sumocide" without surviving 3 seconds after the A's fall. Who is the winner? Tie Game.

- Robot A failed the unknown start. Robot B was successful and survived on the table at least 3 seconds. B is the winner.

- Both robots failed the unknown start. Tie Game.

- My start button was not pressed correctly. Can I touch the robot after the game started? No in general, but up to the Judge's discretion.

15. FAQ (Frequently Asked Questions)

- During the Time Trial, If team A knocks all the bottles off in 30 seconds and meets all of the rules, their score is 250-30=220. If Team B knocks all 3 of in 40 seconds your scoring system awards team B 250 - 40, or 210, a lower score, and they win. This doesn't make sense. Common sense says team A wins because they accomplished their task faster. The (250 seconds minus survival time) penalty only comes into play if the robot does not survive for 3 sec after pushing off the last bottle. In the example given, the faster robot would be ranked higher, Team A (30s) ranked ahead of Team B (40s). The logic behind the penalty is that if neither robot survives, the robot which survived longer is ranked higher. Going back to the example, but assuming each robot fell off the table right after pushing off the last bottle, Team B (250-40=210) would be ranked ahead of Team A (250-30=220) because it survived for longer.

- During the Time Trial, What if robot pushes off all the bottles in 20 seconds, but does not stop (still moving at the end of round? It will be scored as 120 sec survival time.

- During the Time Trial, How is a robot that pushes all the bottles off in 20 seconds but does not stop ranked against a robot that pushes off all the bottles in 100 seconds but does not stop. They would be tied at 120 sec survival time.

- During the Time Trial, What if a robot stops for 10 seconds (indicating it is done) then starts moving again. If all of the bottles are pushed off, the round is still considered completed. If there are still bottles on the table, the robot is allowed to continue.

- Do VEX IQ Touch LEDs count as sensors (for Jr and Sr Classic sensor limits)? If the Touch LED is used as an output (light) it will not count against the 4 sensor limit. However, it will count if used as a touch sensor.

- Is the work period 20 minutes or 30 minutes? Both work periods (after unknown is unveiled and between the time trial and head to head) are 20 minutes.