

Pioneers in Engineering 2023 Presents



CARNIVAL CELEBRATION

Game Manual

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Game Summary

Carnival Celebration is a strategy robotics game played by two opposing ALLIANCES, comprising two ROBOTS each, in at most three minute ten second (3:10) MATCHES. The two ALLIANCES are the BLUE ALLIANCE and the GOLD ALLIANCE. Each ALLIANCE consists of two (2) TEAMS, which are each represented by a DRIVER, a COACH, and a ROBOT. TEAMS complete MINI-GAMES and receive PENALTIES as an ALLIANCE, not as individual TEAMS. The primary objective for *Carnival Celebration* is to collect as many carnival TICKETS as possible by playing the assigned MINI-GAME in the FIELD. TICKETS from each MINI-GAME in an ALLIANCE will be added up at the end of each MATCH. The ALLIANCE with the most TICKETS totaled from all their MINI-GAMES will be the winner of the MATCH. There are a total of four (4) MINI-GAMES.

Each MATCH consists of a thirty second (0:30) AUTONOMOUS PERIOD followed by a two-minute forty-second (2:40) TELEOPERATED PERIOD. In the AUTONOMOUS PERIOD, ROBOTS operate without DRIVER input in an attempt to prepare for the TELEOPERATED PERIOD by completing tasks and avoiding PENALTIES. In the TELEOPERATED PERIOD, DRIVERS control the ROBOTS to collect carnival TICKETS by playing MINI-GAMES.

The two MINI-GAMES played during the first MINI-GAME PERIOD will be announced at the beginning of the MATCH. The next two MINI-GAMES, played during the second MINI-GAME PERIOD, will be announced one minute and thirty seconds into the MATCH (1:30). MINI-GAMES can be played by one ROBOT or two. ROBOTS are allowed to switch MINI-GAMES throughout the MINI-GAME PERIOD. ROBOTS are not allowed to play MINI-GAMES that are not open during the MINI-GAME PERIOD.

AUTONOMOUS PERIOD

The MATCH begins with each ROBOT entirely within its STARTING ZONE, which is decided by the ALLIANCE. During the AUTONOMOUS PERIOD, ROBOTS attempt to complete actions of varying difficulty to prepare for the TELEOPERATED PERIOD.

ROBOTS are preloaded before AUTONOMOUS PERIOD begins with a POPCORN. Teams will try to place their POPCORN in the BUCKET.

At the end of the AUTONOMOUS PERIOD, teams will attempt to autonomously move their ROBOTS into the AUTONOMOUS END ZONE

AUTONOMOUS END ZONES are set in four (4) places permanently, two (2) per ALLIANCE.

The reward distribution for the AUTONOMOUS PERIOD tasks can be found in the following table:

Action Completed	Result
Leaving the STARTING ZONE (BLUE)	10 TICKETS
Ending in the AUTONOMOUS END ZONE (GOLD)	20 TICKETS
Dropping POPCORN in BUCKET	50 TICKETS

ROBOTS can also earn TICKETS by playing MINI-GAMES during the AUTONOMOUS PERIOD.

TELEOPERATED PERIOD

After the conclusion of the AUTONOMOUS PERIOD, DRIVERS will assume control of their ROBOTS, and each ALLIANCE will attempt to complete MINI-GAMES. There are four MINI-GAMES total, and two MINI-GAMES will be played at any one time. After the first round, there will be a 10 second (0:10) rest for the TRANSITION PERIOD. ALLIANCES will go head to head in each MINI-GAMES played, for example:

GAME TIME	GAME	ROBOTS
0:00 - 0:30	AUTONOMOUS PERIOD: TARGET GOLF	BLUE #1, GOLD #1
0:00 - 0:30	AUTONOMOUS PERIOD: FOOD COURT	BLUE #2, GOLD #2
0:31 - 1:30	TARGET GOLF	BLUE #1, GOLD #1
0:31 - 1:30	FOOD COURT	BLUE #2, GOLD #2
1:31 - 1:40	TRANSITION PERIOD	ALL
1:41 - 3:10	SKEE BALL	BLUE #1, GOLD #2
1:41 - 3:10	WHACK-A-MOLE	BLUE #2, GOLD #1

Note that in the above example, BLUE #1 competed with GOLD #1 during the first half of the TELEOPERATED PERIOD, but competed with GOLD #2 during the second half.

MATCH PROGRESSION

RECIPES will be declared at the beginning of the MINI-GAME period if FOOD COURT is to be played. Please refer to “Game Rules” for the full breakdown of how to progress through the MATCH.

1. PRE-MATCH SETUP (10 Seconds)
2. Start of MATCH
3. AUTONOMOUS PERIOD (Start of MINI-GAME PERIOD 1) **(0:00-0:30)**
4. (Start TELEOPERATED PERIOD) Continuation of MINI-GAME PERIOD 1
(0:31-1:30)
5. TRANSITION **(1:31 - 1:40)**
6. MINI-GAME PERIOD 2 **(1:41-3:10)**
7. End of MATCH (3:10)

Mini-Games

FOOD COURT

The objective of FOOD COURT is to complete as many SALES as possible by sequentially retrieving INGREDIENTS from the PANTRY, placing them on the DINING TABLE, and ringing the ORDER BELL. Each SALE will be displayed on the game display before the round starts. After all INGREDIENTS for the ORDER is placed in the correct DINING TABLE, you must ring the ORDER BELL to finish the ORDER. You are not required to stack the INGREDIENTS for each RECIPE but you are required to place each INGREDIENT on the table in the order the RECIPE calls for. For example, the recipe ‘Hamburger’ calls for BREAD, MEAT, CHEESE, therefore, you will need to place the BREAD on the table first, followed by MEAT, then lastly CHEESE. The number of TICKETS is awarded depending on the difficulty of the ORDER. Teams can make as many RECIPES as they can within the time limit. Robots are allowed to push their finished RECIPES towards the back of the DINING TABLE to place the next RECIPE. ALLIANCES may not interfere with the other ALLIANCE’S DINING TABLE or PANTRY in any way that may prevent the opposing ALLIANCE team from completing their ORDER(S).

Note: The pantry items are stacked from left to right in respective order: BREAD, MEAT, CHEESE.

SKEE BALL

The objective of SKEE BALL is to place BEAN BAGS, stored in STORAGE ZONES, into GOALS. BEAN BAGS are placed in the dedicated zone at the base of the RAMP. Each GOAL is worth a different amount of TICKETS. The GOALS are placed at different distances along the RAMP, which the robot must climb. GOALS that are further along the RAMP are worth more TICKETS.

WHACK-A-MOLE

To get as many WHACKS in a row as possible, called a STREAK, by hitting the lit up BUTTON. BUTTONS will light up to indicate that there is a mole. Once the lit up BUTTON is hit, another BUTTON will light up. The number of consecutive and correct BUTTON PRESSES during the MINI-GAME period is the STREAK. If an incorrect BUTTON is pressed, or if there is too long of a period (30 seconds) between BUTTON PRESSES, the STREAK is broken. The ALLIANCE may reattempt for a longer STREAK after an additional ten (10) second delay. Only the longest STREAK for the given MINI-GAME PERIOD will be considered when rewarding TICKETS.

If a team presses each BUTTON consecutively left to right (five (5) BUTTON PRESSES total), they will obtain (max one (1) per GAME per ALLIANCE) the CHEAT CODE bonus (if the robot's team has completed at least 6 coding challenges), earning 100 tickets. NOTE: The BUTTONS do not have to be lit when attempting the CHEAT CODE bonus, but the CHEAT CODE bonus must be completed entirely within one MINI GAME PERIOD, and with all other above requirements.

TARGET GOLF

To score as many BALLS, stored in STORAGE ZONES, as possible into the TARGETS in order to earn TICKETS. TARGET GOLF TARGETS are opened based upon the ALLIANCE's summed CODING CHALLENGE POINTS.

The TARGETS that are inaccessible to the playing ALLIANCE will be blocked off. The TARGETS are opened according to the following chart:

ALLIANCE's points on CODING CHALLENGE	TARGETS opened
0 POINTS	1 TARGET
5 POINTS	2 TARGET
10 POINTS	3 TARGET

TARGETS will be opened left to right.

The MINI-GAMES are summarized in the following table (location is labeled relative from the DRIVER STATION):

NAME	LOCATION	GAMEPLAY
SKEE BALL	WEST	Earn TICKETS by putting BEAN BAGS into GOALS
TARGET GOLF	EAST	Earn TICKETS by putting BALLS into activated TARGETS
FOOD COURT	NORTH	Earn TICKETS by stacking INGREDIENTS into RECIPES and SELLING FOOD
WHACK A MOLE	EAST	Earn TICKETS by WHACKING BUTTONS
POPCORN	SOUTH	Earn TICKETS during AUTONOMOUS PERIOD by placing POPCORN in BUCKET

The list of RECIPES appears in the following table, with the stack order going from bottom to top (left to right):

DIFFICULTY	RECIPE NAME	INGREDIENTS
Easy	Breadsticks	BREAD
Easy	Cold Cuts	MEAT
Easy	Cheese Crisps	CHEESE
Medium	Hot Dog	BREAD + MEAT
Medium	Grilled Cheese	BREAD + CHEESE
Medium	Chopped Cheese	MEAT + CHEESE
Hard	Cheeseburger	BREAD + CHEESE + BREAD
Hard	Flying Dutchman	MEAT + CHEESE + MEAT
Hard	Hamburger	BREAD + MEAT + CHEESE

The INGREDIENTS are described below:

Ingredient	Shape	Location in PANTRY
BREAD	Square	Left
MEAT	Circle	Middle
CHEESE	Wedge	Right

The INGREDIENTS are placed in the PANTRY.

If a ROBOT drops an INGREDIENT onto the floor (not including the DINING TABLE), the ROBOT'S ALLIANCE will be penalized by 20 TICKETS.

The following table contains the process to collect tickets for TELEOPERATED PERIOD tasks for the FOOD COURT MINI-GAME.

Action Completed	Result
Stack RECIPE on DINING TABLE	-
Press ORDER BELL	Completes ORDER and collects TICKETS

TICKET Value for MINI-GAMES

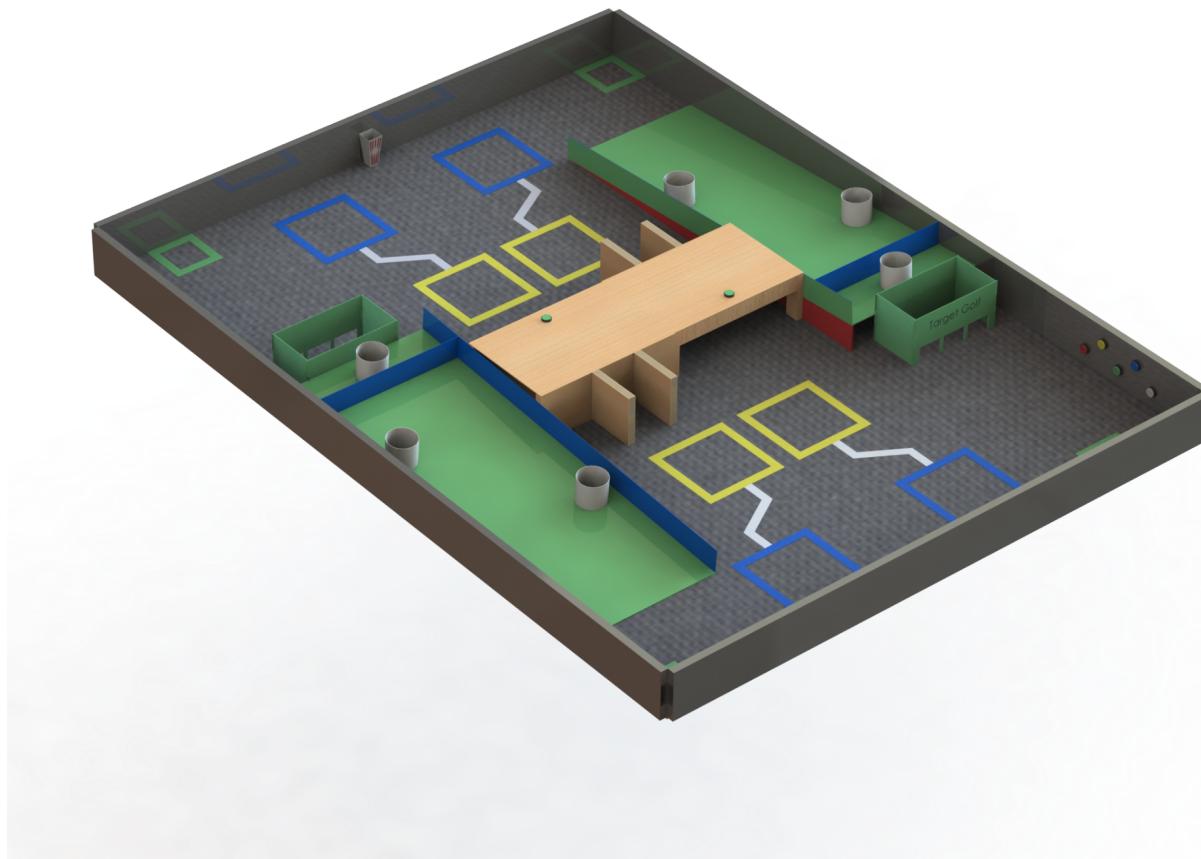
MINI-GAME	TICKET Values
FOOD COURT	1 EASY SALE = 30 TICKETS 1 MEDIUM SALE = 40 TICKETS 1 HARD SALE = 50 TICKETS Dropped INGREDIENT = -20 TICKETS
SKEE BALL	Closest GOAL = 10 TICKETS Middle GOAL = 20 TICKETS Furthest GOAL = 30 TICKETS
WHACK A MOLE	1-2 STREAK = 20 TICKETS 3-4 STREAK = 40 TICKETS 5-6 STREAK = 60 TICKETS >=7 STREAK = 80 TICKETS CHEAT CODE = 100 TICKETS
TARGET GOLF	Left TARGET = 5 TICKETS Per BALL Middle TARGET = 5 TICKETS Per BALL Right TARGET = 5 TICKETS Per BALL

Field Summary

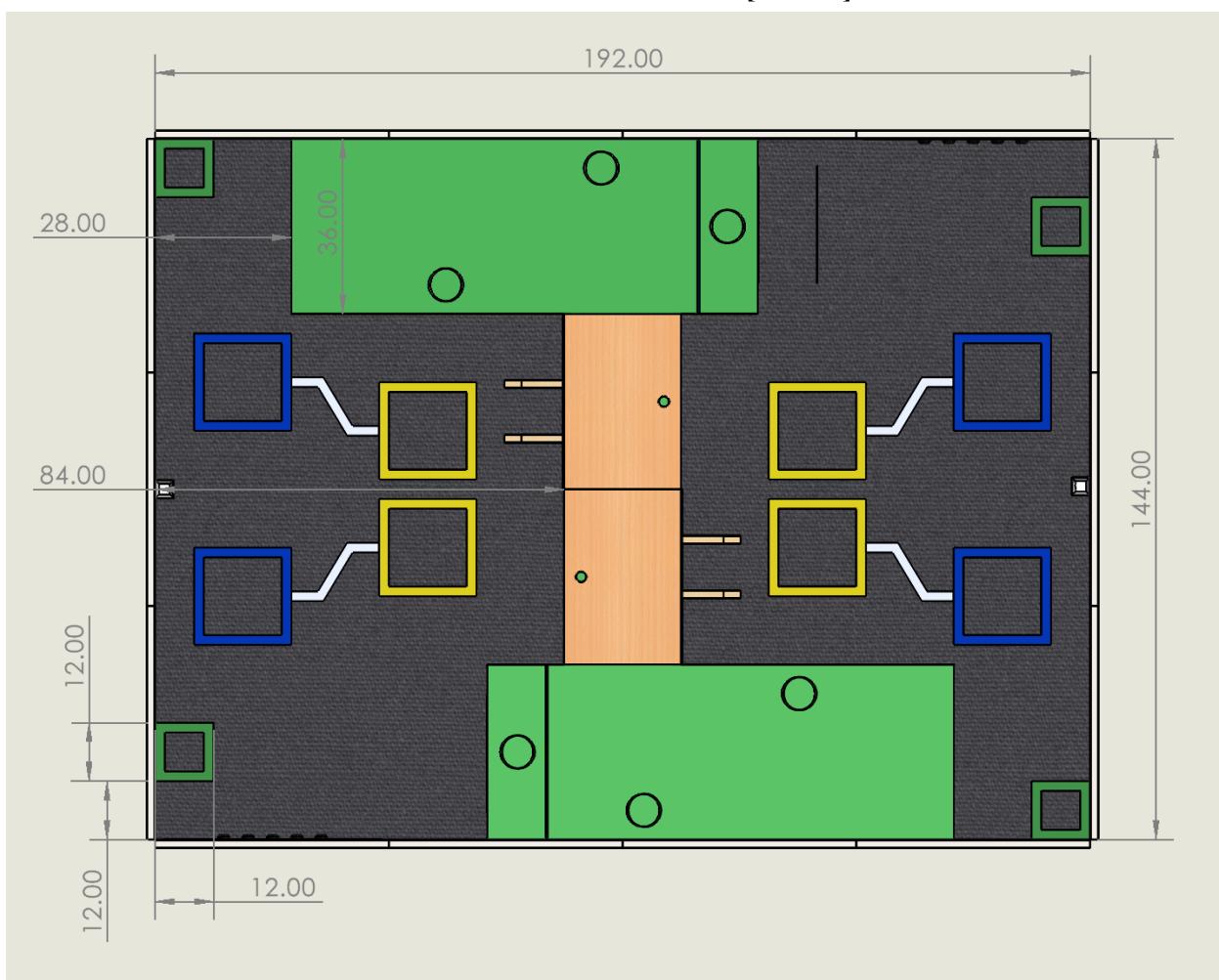
The FIELD consists of two twelve-foot by eight-foot (12' x 8') rectangular carpeted areas placed adjacent to each other, yielding a total field size of twelve-feet by sixteen-feet (12' x 16'). All carpeted areas are bordered by twelve inch (12") tall walls. The FIELD plays the same for both ALLIANCES. Explicitly, if one is on their ALLIANCE'S side of the FIELD and facing the opposing ALLIANCE then all GAME ELEMENTS will be in identical positions. Each ALLIANCE is in possession of a SKEE BALL SET, a TARGET GOLF SET, a WHACK A MOLE SET, and a FOOD COURT SET.

Drawings of the FIELD are below:

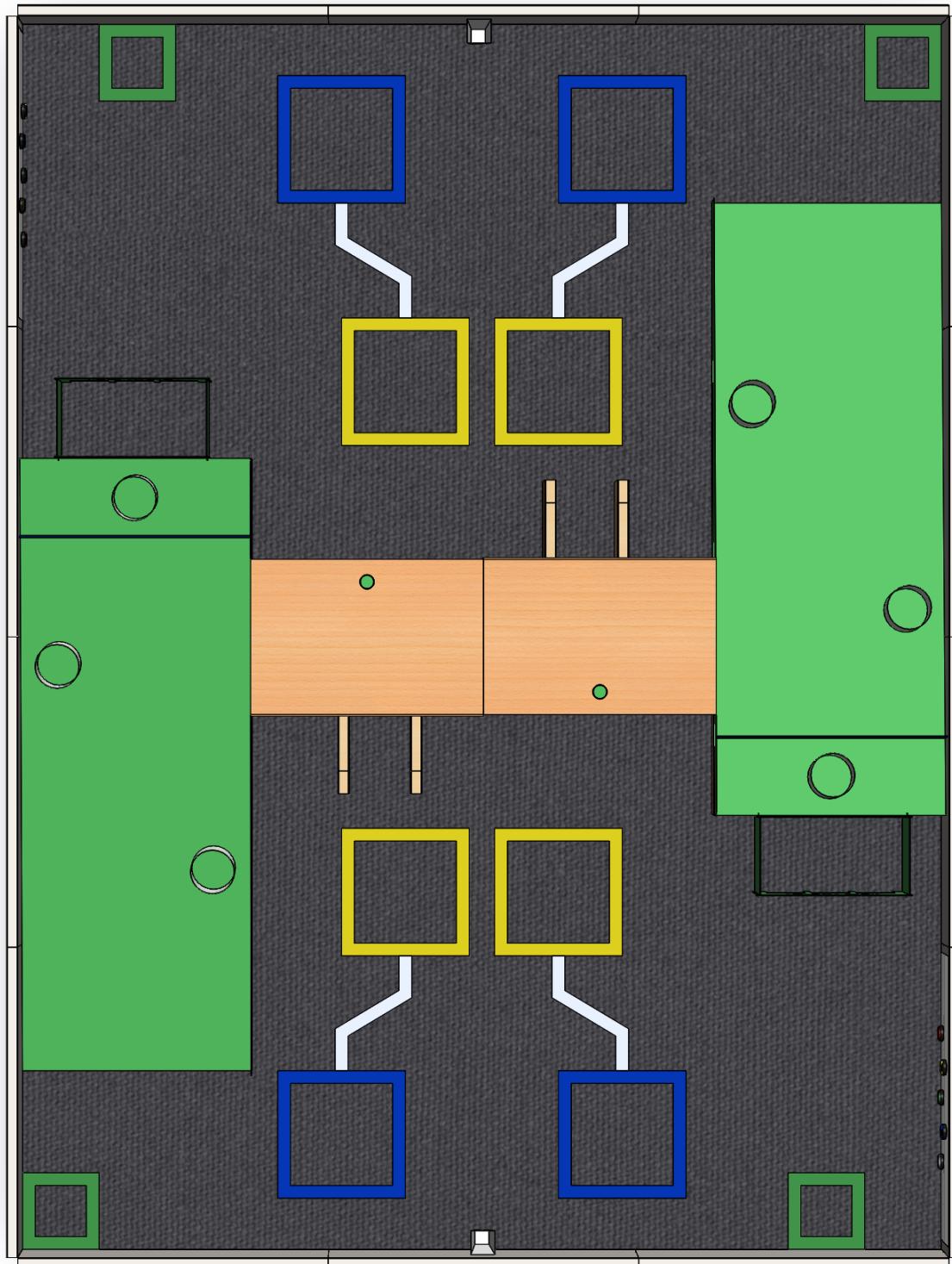
Game Field:



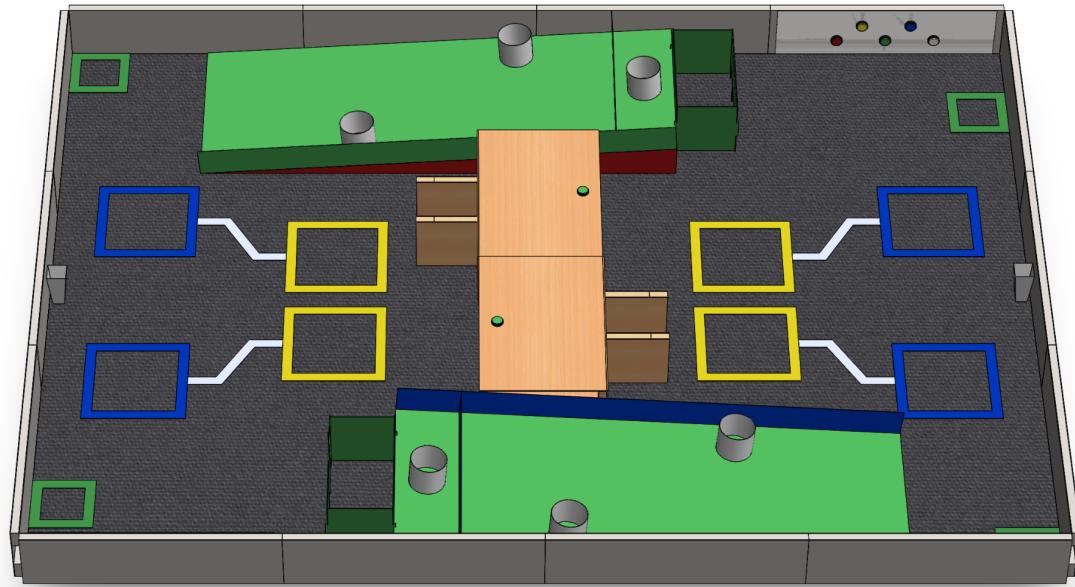
Field: Relevant Dimensions [Inches]



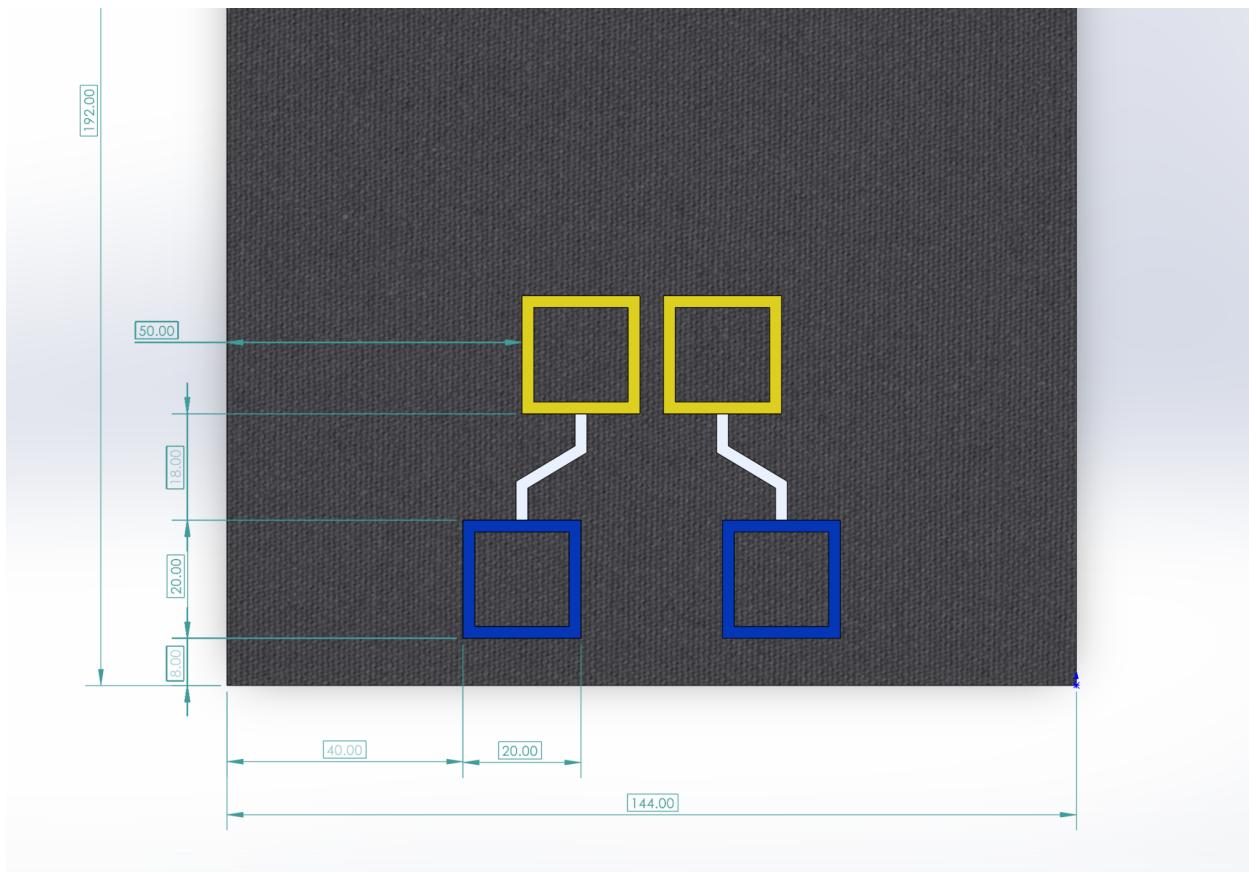
Field: North-South View



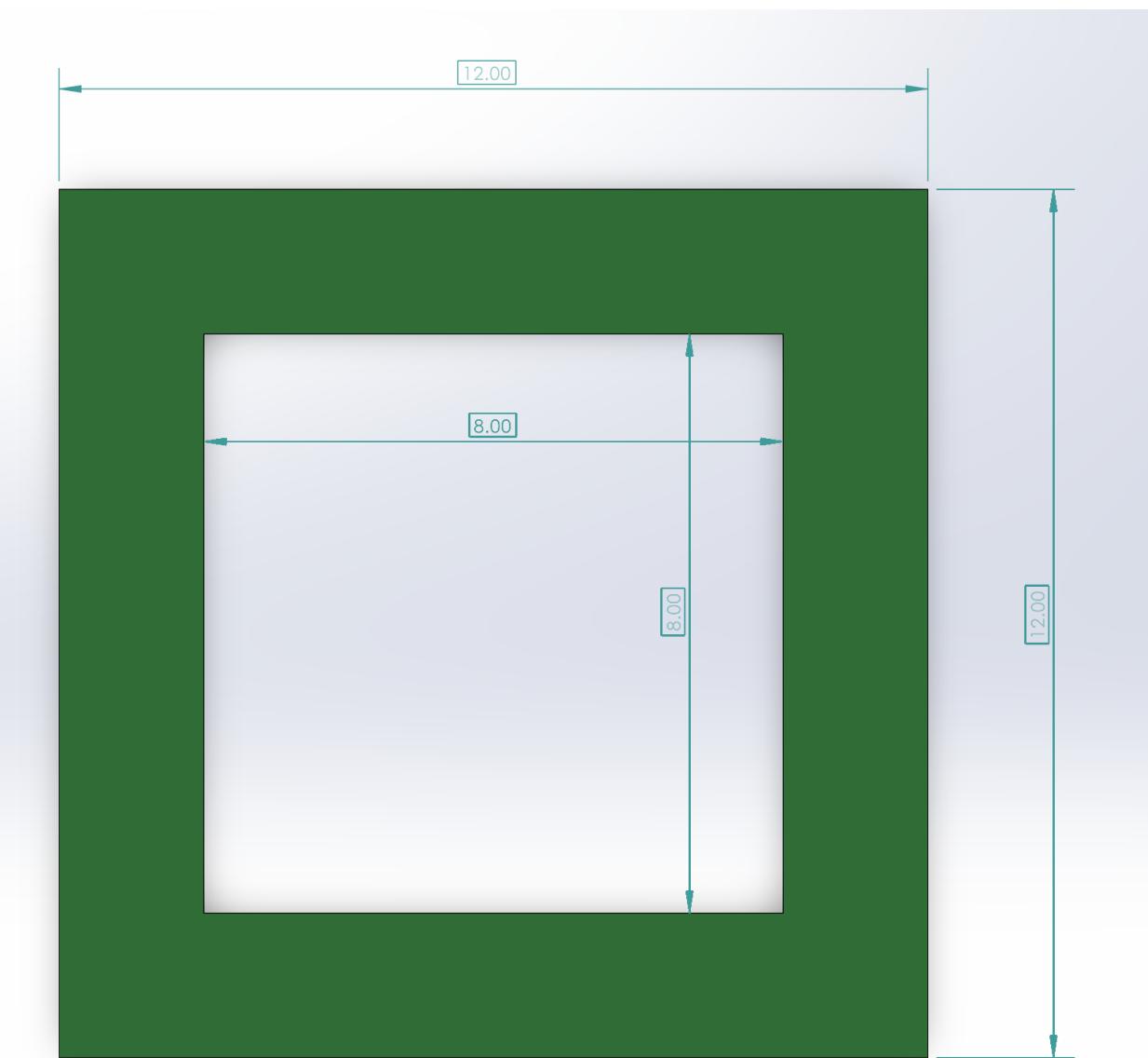
Field: Edge View



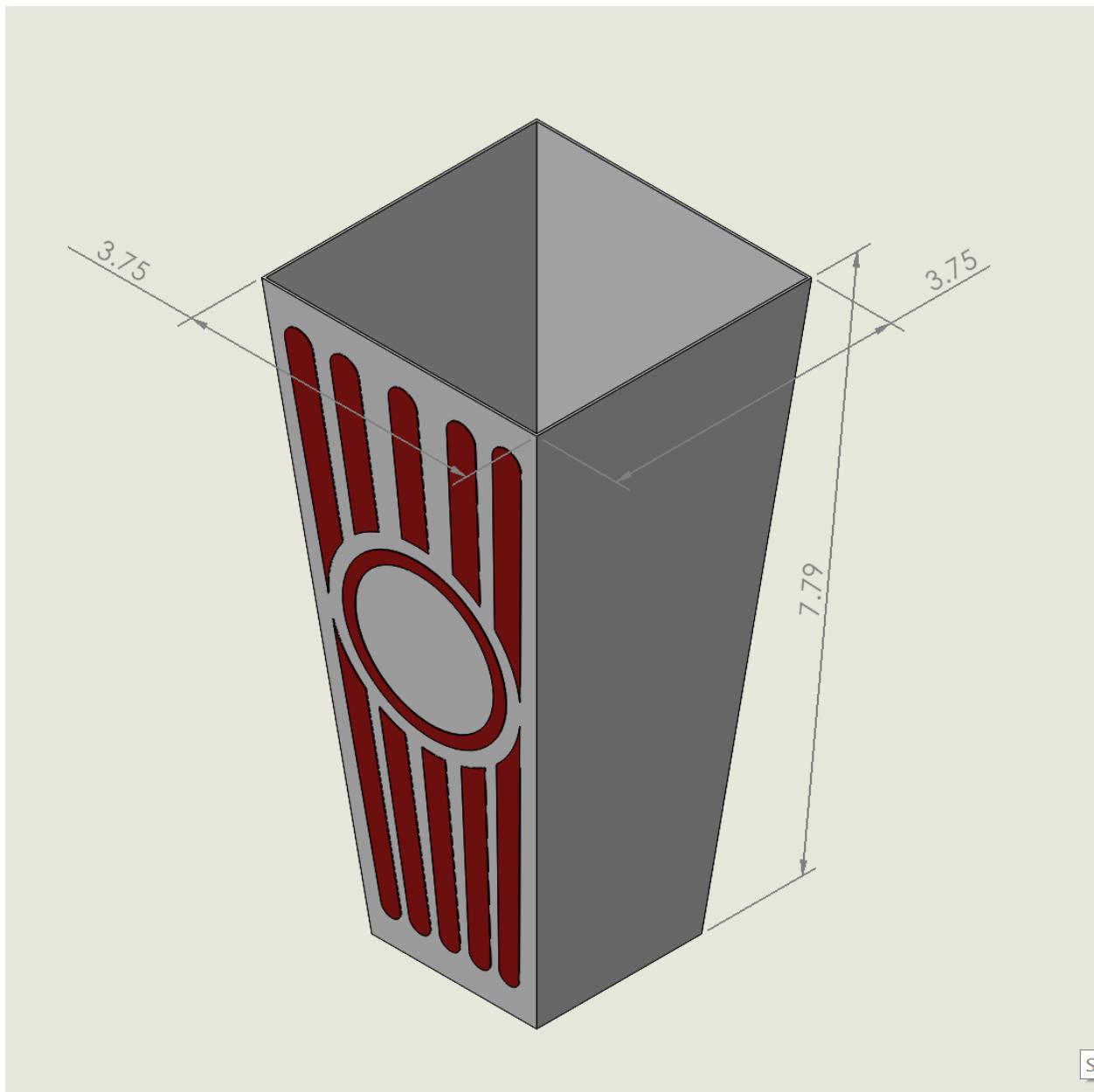
Field: Carpet Relevant Dimensions [Inches]



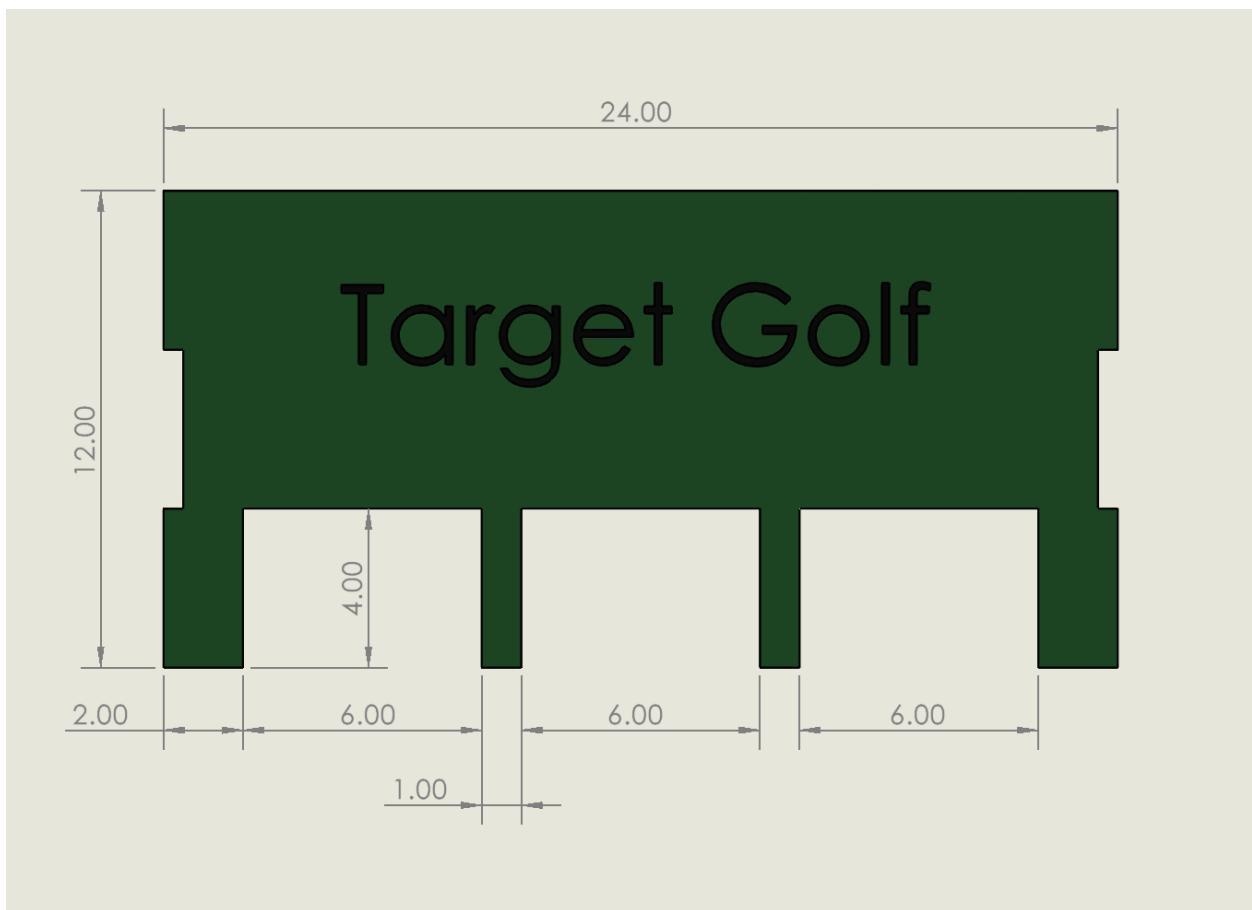
STORAGE ZONE [Inches]



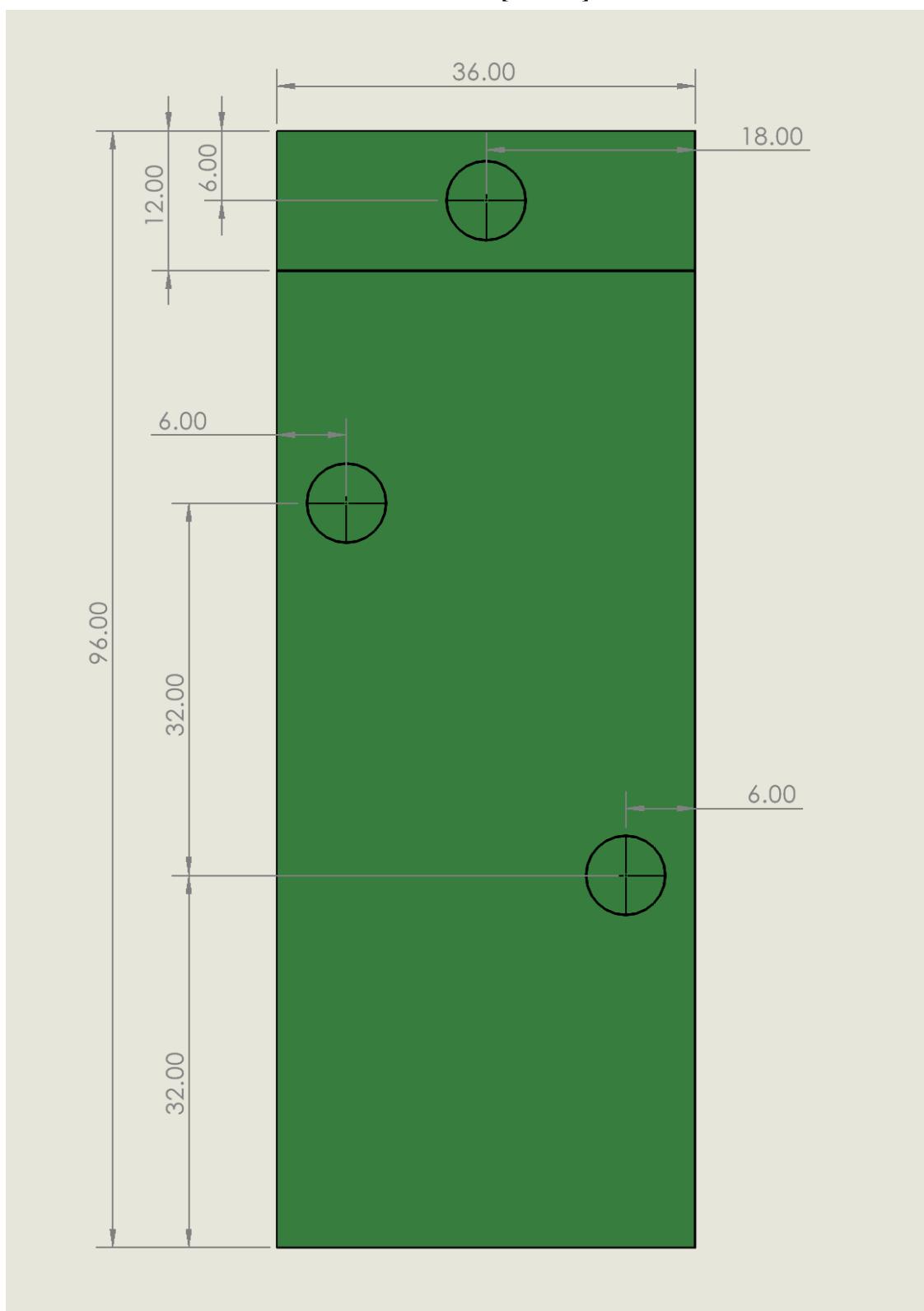
POPCORN BUCKET [Inches]



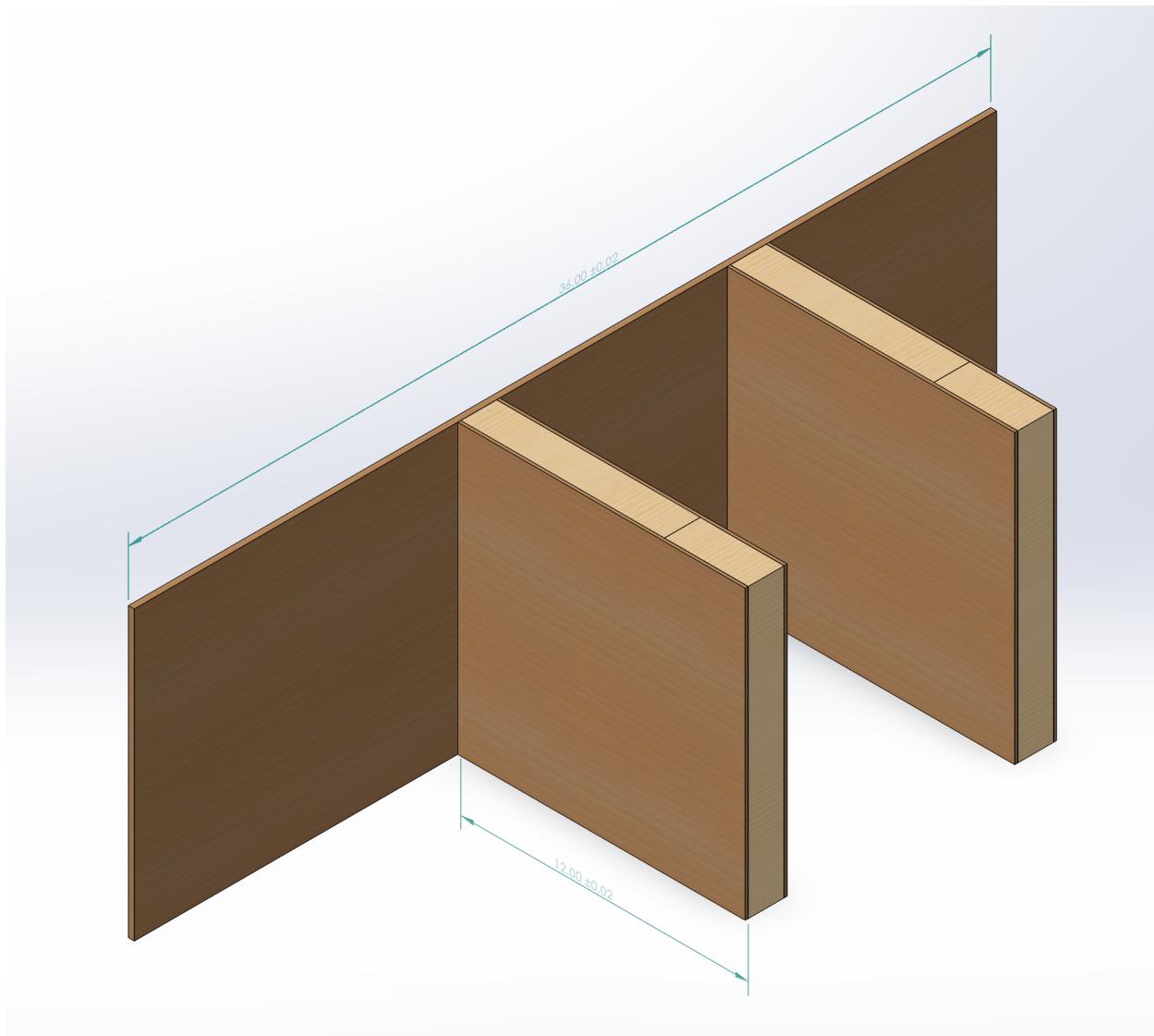
TARGET GOLF [Inches]



SKEE BALL [Inches]



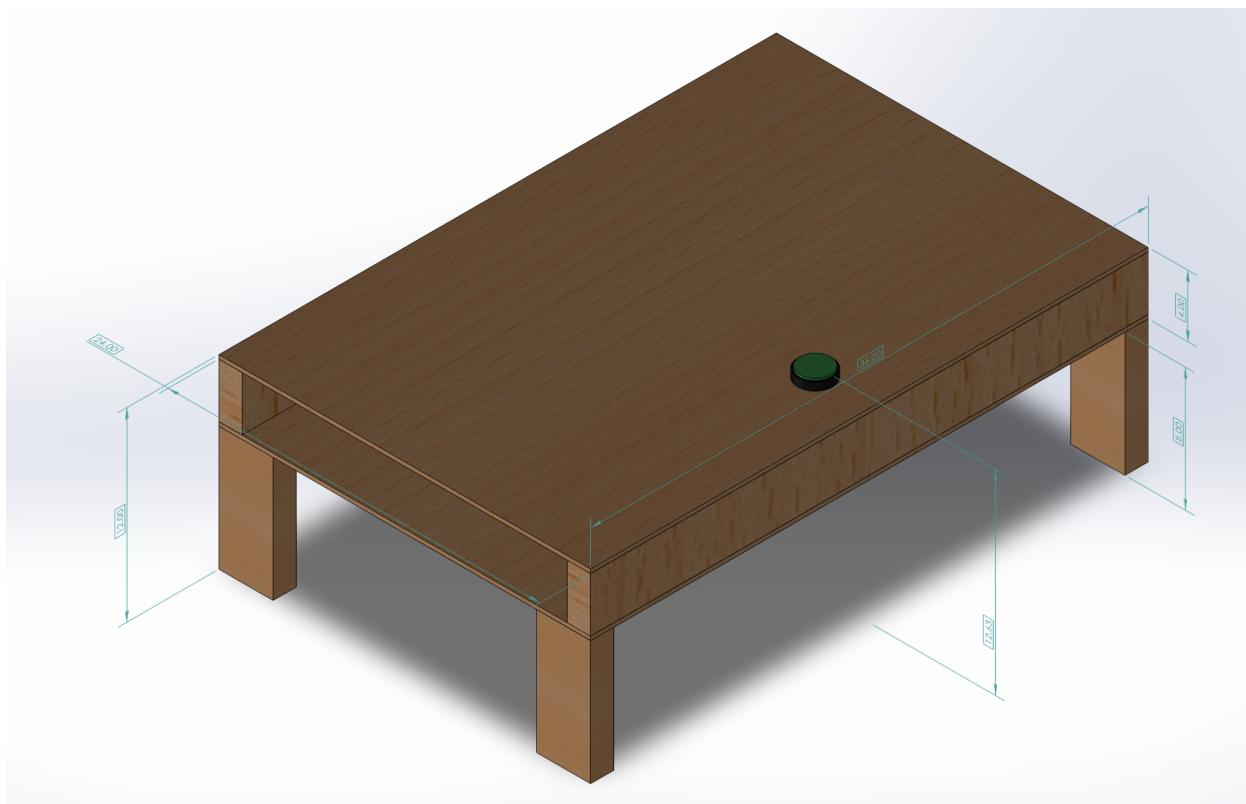
FOOD COURT: PANTRY [Inches]



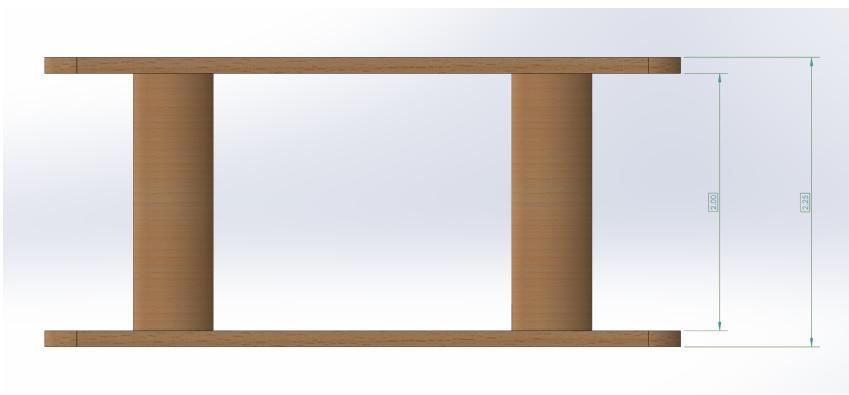
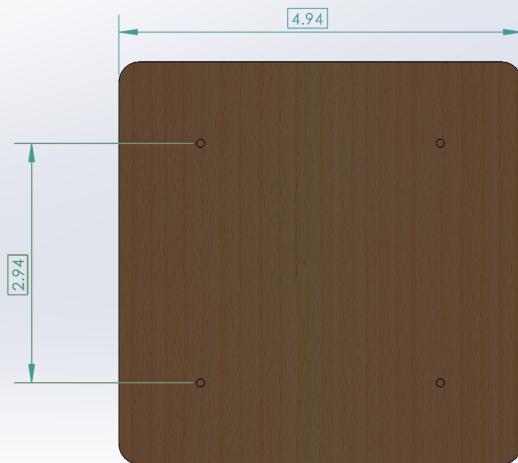
FOOD COURT: PANTRY [Inches]



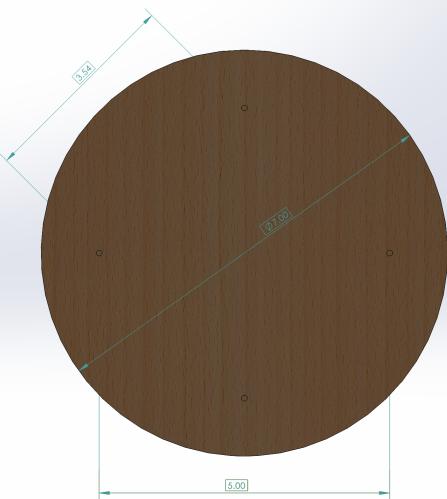
FOOD COURT: DINING TABLE [Inches]

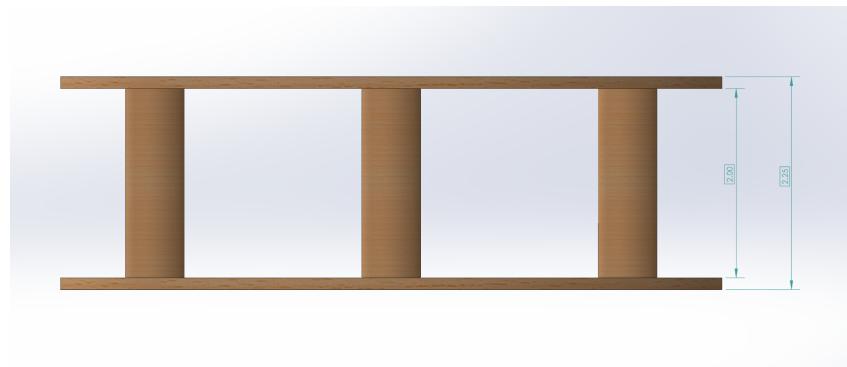


FOOD COURT: BREAD [Inches]

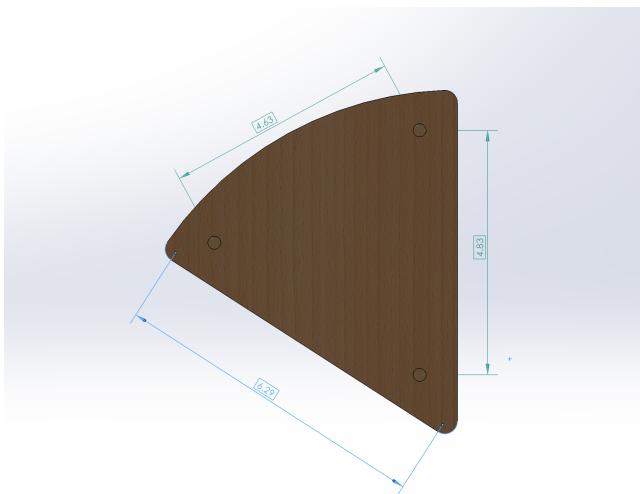


FOOD COURT: MEAT [Inches]

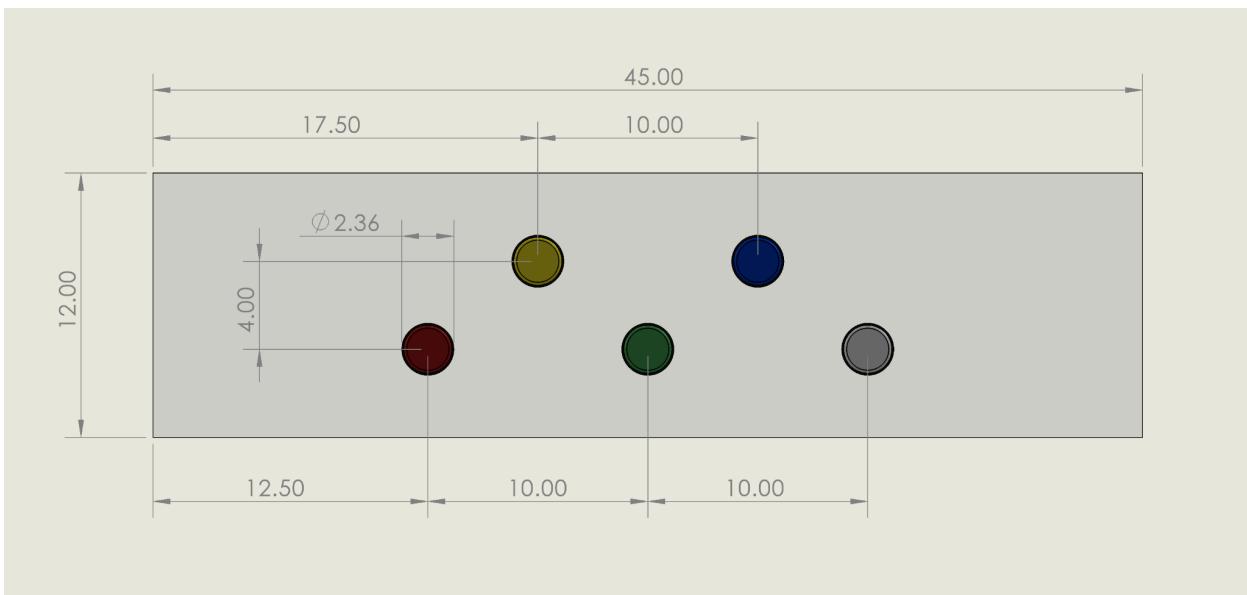




FOOD COURT: CHEESE [Inches]



WHACK A MOLE [Inches]



Game Rules

- G-01 The interpretation and execution of every Game, Robot, Safety, and Tournament Rule shall be determined by the HEAD REFEREE. The decision of the HEAD REFEREE with respect to these rules is final.
- G-02 Failure to exhibit ENGINEERING PROFESSIONALISM, good sportsmanship, proper safety protocol, and civility towards other teams and staff at any point during the COMPETITION may result in DISQUALIFICATION from a MATCH and, depending on the severity of the offense, from the COMPETITION.
- G-03 *Carnival Celebration* is played by two ALLIANCES, each composed of two (2) active TEAMS.
- G-04 ROBOTS must start entirely within their STARTING ZONES that are defined by the outside edge of colored tape. Before the MATCH starts, each ALLIANCE is encouraged to discuss starting positions. If TEAMS cannot agree on ROBOT placement within 30 seconds of the request of the REFEREES, REFEREES will decide their starting positions. If any ALLIANCE ROBOT starts outside their STARTING ZONE, that ALLIANCE shall receive at least one (1) PENALTY and possibly DISQUALIFICATION from the MATCH, depending on how egregious the violation.
- G-05 The first thirty seconds (0:30) of a MATCH is the AUTONOMOUS PERIOD. TEAMS may not touch their controller during the AUTONOMOUS PERIOD.
- G-06 The period following the AUTONOMOUS PERIOD will be at most three minutes (3:00) of gameplay consisting of two rounds of distinct MINI-GAMES, each up to one minute and thirty-seconds (1:30). This timed period is called the TELEOPERATED PERIOD and will begin at the signal of the HEAD REFEREE.
- G-07 ALLIANCE members may not interact with the ROBOT(S) of the opposing ALLIANCE during the AUTONOMOUS PERIOD or TELEOPERATED PERIOD in any way that may intend to harm the ROBOT(S) of the opposing ALLIANCE or prevent them from completing their tasks; otherwise the ROBOT that was interacted with will immediately be DISQUALIFIED.
- G-08 ALLIANCE members may not interact with their ROBOTS in any way during the AUTONOMOUS PERIOD; otherwise the ROBOT that was interacted with will immediately be DISQUALIFIED.

- G-09 The intentional removal of GAME ELEMENTS from the FIELD is not permitted unless otherwise specified by another game rule or definition. Infractions will result in one (1) PENALTY per GAME ELEMENT, and said GAME ELEMENT will be out of play for the remainder of the MATCH.
- G-10 No member of a TEAM may in any way touch any ROBOT on the FIELD at any point during the MATCH unless directed by a REFEREE. Failure to abide by this rule will result in a number of PENALTIES assessed to that TEAM'S ALLIANCE or DISQUALIFICATION for that TEAM.
- G-11 The SCOREBOARD will display the total time which has progressed in the MATCH, along with time used by each ALLIANCE in completing each RECIPE. Each alliance's total score will be displayed.
- G-12 RECIPES are not scored until the scoring criteria are subsequently satisfied:
- a. The INGREDIENTS have been stacked on the DINING TABLE in the order defined by the RECIPE.
 - b. The INGREDIENTS on the DINING TABLE complete a RECIPE.
 - c. The ORDER BELL is pressed.
 - d. The referee will remove the INGREDIENTS of the RECIPE, and the ALLIANCE may start completing the next RECIPE.
 - e. The SCOREBOARD updates as each recipe is completed.
- G-13 The INGREDIENTS are removed from the DINING TABLE once the ORDER BELL is rung and placed outside the FIELD. INGREDIENTS may not be scored more than once.
- G-14 RECIPES must be completed in the order that appears on the list of RECIPES shown from top to bottom. An ALLIANCE cannot complete a RECIPE if previous RECIPES have not been completed.
- G-15 The winner of the MATCH is determined by the number of TICKETS accumulated by both ROBOTS of the ALLIANCE from all the MINI-GAMES played and points earned during the AUTONOMOUS PERIOD. REFEREES will apply the win criteria after the match is over at three minutes and thirty seconds (3:30).
- G-16 ROBOTS may not remove GAME COMPONENTS from the opposing ALLIANCE, which will prevent the opposing ALLIANCE from completing their tasks.

- G-17 TICKETS earned from each MINI-GAME will be totaled once the MATCH timer expires and the FIELD comes to rest in order to determine a MATCH winner.
- G-18 Interpreting code is done through coding and software. More details and exact specification on how to complete the CODING CHALLENGES can be found here:
- G-19 ALLIANCES may not place any objects other than their ROBOTS on the FIELD at any point before or during the MATCH. Only PiE staff are permitted to place additional GAME ELEMENTS on the FIELD. Violations will result in a number of PENALTIES.
- G-20 If the actions of one ALLIANCE directly causes the opposing ALLIANCE into executing an action that merits a certain number of PENALTIES, said the ALLIANCE will receive said number of PENALTIES instead. This rule is applied at the discretion of the observing REFEREES.
- G-21 Only the DRIVER may operate the ROBOT during the TELEOPERATED PERIOD. Any non-DRIVER operating the ROBOT will result in DISQUALIFICATION for that TEAM. However, any member of the TEAM may press the emergency stop button at any time.
- G-22 The DRIVE TEAM may not leave the DRIVER STATION at any time during the MATCH other than for emergencies or at the discretion of the HEAD REFEREE. Violation will result in DISQUALIFICATION for that TEAM.
- G-23 Only the DRIVE TEAM is allowed within the perimeter of each of the DRIVER STATIONS at any time. Only the DRIVE TEAM may use the DRIVER STATION during MATCH. However, any member of the TEAM may press the emergency stop button at any time. Violation will result in a number of PENALTIES or DISQUALIFICATION for that TEAM dependent on the severity of the infraction.
- G-24 No member from any TEAM may be on the FIELD when placing their ROBOT or removing it from the FIELD. Violation will result in one (1) PENALTY. Unless given previous permission, only PiE staff can place and remove anything from the FIELD.
- G-25 All TEAMS and COACHES must adhere to all instructions given by PiE staff. Failure to do so can result in DISQUALIFICATION for that TEAM.
- G-26 ROBOTS may not intentionally damage any element of the FIELD or game in general, nor have mechanisms with a high risk of doing so. In the event of ROBOT-caused

destruction, one (1) PENALTY will be assessed and the team will be temporarily DISQUALIFIED from further MATCHES until the destructive mechanism is removed.

- G-27 ROBOTS that are unintentionally disabled by mechanical, electrical, or communication issues will not receive PENALTIES. However, TEAMS that intentionally disable their own ROBOTS with malicious intent are not only acting against the spirit of the game but are also not exhibiting ENGINEERING PROFESSIONALISM, and will receive all PENALTIES they would normally receive for any PENALTIES incurred.
- G-28 Behaviors aimed at the destruction, damage, tipping, or tangling of ROBOTS are forbidden. Violation will result in one (1) PENALTY and a WARNING.
- G-29 For a TEAM to purposefully act as a detriment to their ALLIANCE is not in the spirit of the game and does not exhibit ENGINEERING PROFESSIONALISM. At the discretion of the HEAD REFEREE, violation will result in a WARNING. If the TEAM does not change its course of action, the TEAM will receive a DISQUALIFICATION.
- G-30 Scoring for *Carnival Celebration* is done at the end of the MATCH by calculating TICKETS minus the PENALTIES. Scoring is shown below:

Game Action	AUTONOMOUS PERIOD	TELEOPERATED PERIOD
Leaving the STARTING ZONE	10 TICKETS	--
Failure to leave STARTING ZONE	0 TICKETS	--
Ending in the AUTONOMOUS END ZONE	20 TICKETS	--
Dropping POPCORN in BUCKET	50 TICKETS	--
Completing the easy sale	60 TICKETS	30 TICKETS
Completing the medium sale	80 TICKETS	40 TICKETS
Completing the hard sale	100 TICKETS	50 TICKETS
Dropping a FOOD ITEM	-20 TICKETS	-20 TICKETS
Scoring a BEAN BAG to the closest goal	20 TICKETS	10 TICKETS
Scoring a BEAN BAG to the middle goal	40 TICKETS	20 TICKETS
Scoring a BEAN BAG to the furthest goal	60 TICKETS	30 TICKETS

1-2 correct WHACKS	40 TICKETS	20 TICKETS
3-4 correct WHACKS	80 TICKETS	40 TICKETS
5-6 correct WHACKS	120 TICKETS	60 TICKETS
7 or more correct WHACKS	160 TICKETS	80 TICKETS
CHEAT CODE	100 TICKETS	100 TICKETS
Scoring a BALL in the left target	10 TICKETS	5 TICKETS
Scoring a BALL in the middle target	10 TICKETS	5 TICKETS
Scoring a BALL in the right target	10 TICKETS	5 TICKETS
GAME ELEMENT leaves the FIELD	-30 TICKETS	-30 TICKETS
ROBOT leaves the FIELD	-30 TICKETS	-30 TICKETS
PENALTY	-30 TICKETS	-30 TICKETS

Robot Rules

- R-01 A ROBOT is defined as an assembly consisting of a battery, mechanical parts, and a properly wired ROBOT controller and wireless radio designed to compete in the game challenge.
- R-02 ROBOTS must adhere to S-01 at all times. In addition, ROBOTS are specifically prohibited from intentionally interfering with the safe operation of other ROBOTS, including obstructing drivers' vision or electronic communications. Other items prohibited from ROBOTS for safety reasons include but are not limited to:
- a. Adhesive tape used for structural purposes
 - b. Anything that can produce hazardous inhalants (i.e. fiberglass, carbon fiber)
 - c. Cardboard used for structural purposes
 - d. Caustics
 - e. Lasers
 - f. Noxious or flammable gasses, or materials that may produce such gasses
 - g. Unsafe or unprotected Lithium Polymer batteries as specified in R-03
- R-03 ROBOT batteries must be properly cared for as follows:
- a. Battery is unplugged when power tools are in use
 - b. Battery is only plugged into the proper connector on the Power Distribution Board
 - c. Battery is not left unattended when in use or left near heat sources.
 - d. Battery is not disassembled or used with other chargers than the one provided
 - e. Battery charger is turned off when the battery is done charging.
 - f. Battery is plugged into the Battery Buzzer any time the ROBOT is on. Buzzer must be powered during this time
- R-04 ROBOTS may only use stored energy from the following sources:
- a. One of the provided Turnigy 11.1V Lithium Polymer (LiPo) batteries
 - b. Deformation of ROBOT parts (i.e. springs, bungees), as long as they can be "disarmed" without power to the robot
 - c. Change in height of ROBOT components
- R-05 No part of the ROBOT may intentionally detach at any point before or during a match. ROBOTS also may not intentionally deposit any liquid onto the FIELD (e.g. lubricants).
- R-06 ROBOT components, including electrical wiring, should not present excessive risk for entanglement. The use of netting and/or loose or dangling components will be heavily scrutinized by the robot inspectors.
- R-07 Components on the ROBOT must not interfere or impede the inspection process. All wiring should be neat and color-coded.
- R-08 ROBOTS must be able to start the match contained within an upright 20-inch cube. ROBOTS may not rely on any external support other than the ground to remain within its

starting position.

R-09 ROBOTS must not exceed 20 lbs. in weight before the beginning of any MATCH not including the weight of the battery.

R-10 ROBOTS may have multiple mechanisms that may be interchanged in between MATCHES. However, each configuration must obey all ROBOT rules and is subject to reinspection at any time.

R-11 In addition to the Kit of Parts, a team may use up to \$250 worth of additional components on the ROBOT for all configurations, provided they do not conflict with any other rule. Each team must present a Bill of Materials to the ROBOT INSPECTORS certifying their compliance with this rule in order to pass inspection. Certain parts are excluded from cost accounting for the purposes of this rule, including:

- a. Fasteners (e.g. screws, bolts, glue)
- b. Wire, connectors, and electrical housings
- c. Any individual item worth <\$1
- d. Parts supplied to teams at no charge by PiE Staff

R-12 Additional components must be accounted for at their pre-tax, pre-shipping, non-discounted price, unless the discount is available to all teams. Posting adequate information on the PiE Forum so that all teams can buy the discounted component will suffice as “available to all teams.” Components that are used with no listed price should be counted for the price of an equivalent, new item. Self-manufactured parts should be counted for the price of their raw materials.

R-13 ROBOTS must use the provided ROBOT controller, radio, and USB hubs. No other forms of remote communication equipment (e.g. radio transmitters, infrared remotes) are allowed. Additional hubs may be chained on to the given powered hubs.

R-14 All ROBOT actuator control signals (e.g. motors, servos) must originate from the provided electronics unless with express permission. Any requests must be submitted to Pioneers in Engineering staff directly.

R-15 All ROBOT wires must be those provided by Pioneers in Engineering, unless with express permission. Any requests must be submitted to Pioneers in Engineering staff directly.

R-16 ROBOTS must not have sharp edges that pose safety hazards to people or may damage the FIELD. The robot inspectors may ask teams to file down the sharp edges in order to pass ROBOT inspection.

R-17 ROBOTS must prominently display their TEAM number in a visible location on at least two opposite sides of the ROBOT. The TEAM number must be large enough to be legible at all times from the edge of the FIELD.

- R-18 ROBOTS must pass inspection in compliance with all rules before the ROBOT will be allowed to compete. ROBOTS must maintain compliance through modifications during the event and may be arbitrarily re-inspected at any time, without notice.
- R-19 All electronics must be securely mounted to the ROBOT within enclosures such that the electronics are fastened even if the ROBOT is rotated or placed in an arbitrary orientation.
- R-20 ROBOTS may not include stock parts acquired or custom assemblies fabricated before PiE 2023 Kickoff. This does not include coding, fasteners, or assorted parts worth <\$1.

Safety Rules

- S-01 ROBOTS may not have unsafe designs or operations which create undue risk of: (a) injury to participants, competition personnel, or spectators, (b) damage to the playing FIELD, or (c) damage to other ROBOTS (as deemed solely by the discretion of a ROBOT INSPECTOR or the HEAD REFEREE).
- S-02 Any ROBOT whose design is deemed unsafe (as judged by a robot inspector or the HEAD REFEREE) will not be allowed to compete until modifications are made and the ROBOT passes re-inspection.
- S-03 Any ROBOT deemed to be operating in an unsafe manner during a MATCH will be disabled and receive a PENALTY, if appropriate.
- S-04 Any ROBOT used during a MATCH must be in compliance with all ROBOT rules. A ROBOT found in violation will receive a PENALTY and a WARNING.
- S-05 ALLIANCE members may not physically contact any ROBOT at any time during a MATCH. Doing so will result in a PENALTY and the ROBOT being disabled.
- S-06 ALLIANCE members may not extend any part of their body into the FIELD during a MATCH. All personnel in DRIVER STATIONS also must be wearing safety glasses. Violation will result in a DISQUALIFICATION.
- S-07 Any ROBOT used during a MATCH must have an on-off switch that is easy to access, as determined by the HEAD REFEREE.

Tournament Rules

- T-01 The tournament is organized into two phases: QUALIFICATION rounds and ELIMINATION rounds. In the event of an uneven number of MATCHES played among ALLIANCES during the QUALIFICATION rounds, the last MATCH(ES) will be dropped to even the number of MATCHES played between ALLIANCES.
- T-02 In QUALIFICATION rounds, TEAMS play MATCHES in randomly predetermined ALLIANCES.
- T-03 Teams will be seeded by RANKING POINTS. QUALIFICATION POINTS are used to break a tie in RANKING POINTS. In the event of a tie in RANKING POINTS, the TEAM with higher QUALIFICATION POINTS is seeded higher. A win is worth two RANKING POINTS, ties are worth one RANKING POINT, and losses are worth zero RANKING POINTS.
- T-04 All TEAMS in a MATCH are awarded as many QUALIFICATION POINTS as the POINTS total of the losing ALLIANCE at the end of each MATCH.
- T-05 In the event of a tie during seed ranking when both TEAMS have equal RANKING POINTS and QUALIFICATION POINTS, the tiebreaker will be based on the best record against the other TEAM. If the records are even, then a coin flip will determine the seed.
- T-06 MATCHES in the ELIMINATION rounds will be played by permanent three-team ALLIANCES as determined during ALLIANCE SELECTION.
- T-07 ALLIANCE SELECTION will be held by the HEAD REFEREE after the conclusion of the QUALIFICATION rounds.
- T-08 The better ranked third of all seeded TEAMS will each designate one (1) TEAM member to be the ALLIANCE CAPTAIN, serving as the point of communication between the ALLIANCE and HEAD REFEREE during the ELIMINATION rounds.
- T-09 TEAMS will choose in a serpentine order to form their three-TEAM ALLIANCES. There are no restrictions on whom a TEAM may choose. TEAMS will choose their first pick in order of their seed, then their second pick in reverse order of their seed. This means the last seeded TEAM will pick twice in a row, while the first-seeded TEAM would make both the first and last picks. It is possible for the first and second seeded TEAMS to have only two TEAMS in the case of a total number of TEAMS not divisible by three (3). In the case that there are only two TEAMS on an ALLIANCE, ALLIANCES will have to play each MATCH with only one TEAM on the FIELD.
- T-10 TEAMS may decline an invitation to form an ALLIANCE; however, these TEAMS may not accept an invitation to join another ALLIANCE until all other TEAMS have been asked to join an ALLIANCE. In the event that all TEAMS decline a TEAM's invitation,

the selecting TEAM gets to choose again.

- T-11 ELIMINATION MATCHES will be played using a best 3-of-5 format and traditional bracket. Depending on the amount of teams, the top seeded TEAM(S) may receive a bye. If an ELIMINATION MATCH ends in a tie, the entire MATCH will be replayed between the two ALLIANCES.
- T-12 No TEAM may play more than two consecutive MATCHES, and no TEAM may sit out for any more than one consecutive MATCH. An empty spot on an ALLIANCE still counts as a TEAM, meaning a two-TEAM ALLIANCE would play cycles of one MATCH with two TEAMS and two MATCHES with one TEAM.
- T-13 After the quarter finals have concluded, each ALLIANCE receives one TIMEOUT. Any TIMEOUTS that may be needed before then will be granted solely at the discretion of the HEAD REFEREE.
- T-14 The ALLIANCE that wins the final best 3-of-5 round will be named the **2023 Pioneers in Engineering Robotics Competition Champion**.
- T-15 In order to challenge a call, a TEAM must send a single team member to communicate with the HEAD REFEREE. The HEAD REFEREE will then make a ruling after investigating the validity of the challenge.
- T-16 ROBOTS will remain in the custody of PiE in between the two days of the Final Competition.
- T-17 It is up to the discretion of the HEAD REFEREE as to the duration of a TEAM's DISQUALIFICATION. In the event of a DISQUALIFICATION, the TEAM will forfeit at least one MATCH; however repeated offenses may warrant a large number of MATCHES.
- T-18 Any TEAM which receives two WARNINGS will receive a DISQUALIFICATION. If only one WARNING is received, the HEAD REFEREE will take note as WARNINGS will be carried over between MATCHES.

Definitions

[GOLD // BLUE] ALLIANCE	A group of TEAMS working together during a match to play <i>Carnival Celebrations</i> against an opposing ALLIANCE. ALLIANCES are identified during the match by their assigned color, either GOLD or BLUE.
ALLIANCE CAPTAIN	A student who is the point of communication for set ALLIANCES during the ELIMINATION rounds.
ALLIANCE PARTNER	The name given to a TEAM which is chosen by the ALLIANCE CAPTAIN during ALLIANCE SELECTION.
ALLIANCE SELECTION	The process by which the ALLIANCES are selected and formed for ELIMINATION rounds.
AUTONOMOUS END ZONE	The designated zone within which a ROBOT may be located at the end of the AUTONOMOUS PERIOD to gain points. Four (4) AUTONOMOUS END ZONES, two (2) per ALLIANCE, are located on the FIELD. Ending in an AUTONOMOUS END ZONES is worth twenty (20) TICKETS. Points are given when all wheels are inside the yellow end zone box or else no points will be awarded to that team.
AUTONOMOUS PERIOD	DRIVER control of the ROBOT is not permitted during the AUTONOMOUS PERIOD. ROBOTS may react only to sensor inputs and commands programmed into the onboard control system. All ROBOT Safety Rules still apply while ROBOTS function during this period.
BALL	Nine (9) tennis ball [2.7 inches diameter] per side used for scoring in the TARGET GOLF MINI-GAME. Each side must have this amount throughout the entire game. 

BEAN BAGS	A BEAN BAG is a square bag of sand weighing 5.3 oz with dimensions of 4.5 by 4.5 by 0.5 inches used for scoring in the SKEE BALL MINI-GAME. There will be four (4) BEAN BAGS per side, and this amount must remain throughout the entire duration of the game.
	
BREAD	Square shaped INGREDIENT, placed within the left slot of the PANTRY. Each side will have four (4) BREAD throughout every MATCH.
BUCKET	2-½ quarts HDX all purpose mixing containers used for scoring BEAN BAGS. Diameter at the top is 6-½ inches and 6 inches tall.
CHEAT CODE	The process by which the ROBOTS press the WHACK-A-MOLE buttons left to right consecutively.
CHEESE	Wedge shaped INGREDIENT, placed within the right slot of the PANTRY. Each side will have four (4) CHEESE throughout every MATCH.
COACH	A student, teacher, or college mentor identified as the person wearing the designated "COACH" pin during a match. There is one (1) COACH per team.
CODING CHALLENGE	A series of pre-given coding challenges that the students are to complete. Each successful completion comes with a benefit during the game. For full documentation refer to this document .
COMPETITION	The event hosted by Pioneers in Engineering during which TEAMS play the game <i>Carnival Celebration</i> , and where a 2023 Pioneers in Engineering Robotics Competition Champion is named after the conclusion of the ELIMINATION MATCHES.

DINING TABLE	The table at the FOOD COURT which has the ORDER BELL.
DISQUALIFICATION	A team that is DISQUALIFIED will have their ROBOT disabled and receive no QUALIFICATION POINTS for the MATCH. The HEAD REFEREE can remove a TEAM from the rest of the COMPETITION in the case of repeated or egregious violations.
DRIVER	A student TEAM member responsible for operating and controlling the ROBOT. There are up to two DRIVERS per team.
DRIVER STATION	Positioned on the perimeter of the FIELD, this is where each TEAM is able to control their ROBOT.
DRIVE TEAM	A TEAM's representation in a MATCH consisting of a DRIVER and COACH.
ELIMINATION	Describes the round or set of MATCHES that have the consequence of removing the losing ALLIANCE from the COMPETITION.
ENGINEERING PROFESSIONALISM	A combination of exhibiting honesty, good sportsmanship and acting with civility towards other TEAMS, ROBOTS, and staff.
FIELD	The twelve foot by sixteen foot (12' x 16') carpeted playing area.
FOOD COURT	MINI-GAME where the ROBOTS must complete 3 different RECIPES with varying difficulty. ALLIANCE must put their completed RECIPES onto a DINING TABLE and ring the ORDER BELL.
GAME ELEMENT	Any object which ROBOTS interact with on the FIELD.
GOALS	GOALS are BUCKETS 6.5 inches in diameter and 6 inches tall. Goals are placed upon the SKEE BALL RAMP. ROBOTS score tickets by placing BEAN BAGS in GOALS. There will be 3 GOALS per ramp.
HEAD REFEREE	A member of PiE Staff that referees the matches. Similar to a sports referee, the HEAD Referee keeps track of the score, enforces rules, and clarifies the interpretation of this game manual.
INGREDIENTS	Consists of BREAD, MEAT, and CHEESE that will be used to create the different RECIPES during the FOOD COURT mini game. Throughout the duration of the entire game, each ALLIANCE must have four (4) of each FOOD item at all times.

MATCH	A period of time, up to three minutes and ten second total (3:10) in length, comprising of one (1) thirty second (0:30) AUTONOMOUS PERIOD and one (1) two minute thirty second (2:30) TELEOPERATED PERIOD in which four (4) ROBOTS are divided into two (2) ALLIANCES which play the game <i>Carnival Celebration</i> according to the rules outlined in this rulebook. The winner of a MATCH is determined by whichever ALLIANCE has the lowest total time spent on finishing the ORDERS throughout the MATCH.
MEAT	Circle shaped INGREDIENT placed within the middle slot of the PANTRY. Each side will have four (4) MEAT throughout every MATCH.
MINI-GAMES	There are 4 MINI-GAMES: FOOD COURT, BEAN BAG TOSS, WHACK A MOLE, and TARGET GOLF. Each ALLIANCE will start off with a randomized game, which will run for 1 minute 30 second (1:30) followed by a 10 second (0:10) transition period. ALLIANCES will then switch to the next MINI-GAME.
MINI-GAME PERIOD	The 1 minute 30 second period in which a MINI-GAME is played.
ORDER BELL	Button [2.25 inches diameter, 0.625 inches tall] used for FOOD COURT MINI-GAME. It will be located on the DINING TABLE, one for each ALLIANCE. It must be rung in order for the ALLIANCE to get points.
PANTRY	Area where the BREAD, MEAT, and CHEESE is placed during FOOD COURT .
PENALTY	A thirty (30) ticket fine in the ALLIANCE'S ticket count given when a violation of any corresponding rule has been identified by the HEAD REFEREE.
PERIMETER	The boundary of the ROBOT formed by the outer surface of the ROBOT.
POPCORN	Played during the AUTONOMOUS PERIOD. POPCORN [wiffle ball, 2.865 inches diameter] can be preloaded on an ALLIANCE'S ROBOT upon request and can be placed in POPCORN BUCKET for TICKETS during the AUTONOMOUS PERIOD.

	
PRE-MATCH SETUP	Ten (10) second period where MINI-GAMES are randomized for each ALLIANCE. Each ALLIANCE decided which MINI-GAME they will be playing.
SALE	Ringing ORDER BELL once a RECIPE is placed on top of the DINING TABLE.
STARTING ZONE	Four (4) zones placed permanently, two (2) per ALLIANCE, which the ALLIANCE'S ROBOTS must start on in the beginning of the MATCH. The TEAM'S within the ALLIANCE have the authority of rotating their ROBOTS before the MATCH starts, within the STARTING ZONE. Failure to leave the STARTING ZONE is defined by all wheels in the robot must not be inside the STARTING ZONE to avoid a PENALTY.
SKEE BALL	MINI-GAME where ROBOTS will place BEAN BAGS inside GOALS, earning TICKETS for their respective TEAM'S ALLIANCE. More TICKETS are earned for placing BEAN BAGS in further GOALS. Ramp is 6 degrees, and the end of the ramp is 10 inches off the ground. There must be four (4) BEAN BAGS on each side for the entire duration of the game.
RECIPES	Multiple INGREDIENTS stacked on top of eachother in the correct order (specified in the game manual recipe sheet).
ROBOT	The robot owned by the TEAM that constructed it, earning points for the ALLIANCE of the TEAM.
SALES	Event of pressing ORDER BELL after stacking RECIPE on top of DINING TABLE, earning TICKETS for a correct order, increasing in TICKETS depending on difficulty of RECIPE.

STARTING ZONE	The designated zone within which all ROBOTS must begin the MATCH. Four (4) STARTING ZONES, two (2) per ALLIANCE, are located on the FIELD.
STORAGE ZONE	Areas in which BALLS and BEAN BAGS are stored for use in playing MINI-GAMES.
TARGET	Scoring area for TARGET GOLF. There is a left, middle, and right TARGET that needs to be activated through the successful completion of coding challenges.
TARGET GOLF	MINI-GAME in which ROBOTS push balls into specific openings, earning more TICKETS for the smaller openings.
TEAM	A group of students who collectively enter one (1) ROBOT, and compete as a single entity, in the 2023 Pioneers in Engineering Robotics Competition, <i>Carnival Celebration</i> .
TELEOPERATED PERIOD	The period of the game in which DRIVERS assume control of their ROBOTS.
TICKETS	“Points” awarded for activities, and penalized for certain events. Decides at the end of the match which ALLIANCE wins.
TOURNAMENT	The portion of the COMPETITION in which ELIMINATION MATCHES take place.
TRANSITION PERIOD	A 10 second (0:10) rest between the first and second MINI-GAME.
WARNING	A statement issued by the HEAD REFEREE because of an infraction of the rules. Two (2) WARNINGS are the equivalent of a DISQUALIFICATION. WARNINGS persist between matches.
WHACK	A successful press to a WHACK A MOLE BUTTON in which signal is received by Field Control.
WHACK-A-MOLE	Buttons along the plexiglass will light up randomly and ALLIANCES will try to press as many as possible. There is also a CHEAT CODE that can be entered for bonus TICKETS, obtained by clicking the buttons left to right and right to left consecutively. ALLIANCES may only earn points by pressing buttons on their respective sides.
WHACK A MOLE BUTTON	WHACK-A-MOLE BUTTONS [2.36 inches diameter, 0.7 inches tall] are buttons that are lit up, and must be pressed by the

	ROBOTS, to earn TICKETS for their respective TEAM'S ALLIANCE during the WHACK A MOLE MINI-GAME.
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