CATAPULT DESIGN LEVEL 2(HS)-2027

OVERVIEW

Participants design and produce a working catapult, within specified guidelines, that is adjustable and propels cornhole bags (weighing about 14-16.5 oz (440-470 g) each) at a scoring target(cornhole board) between 8’ and 14’ away.



ELIGIBILITY

A. Participants are limited to three (3) teams of two (2) to four (4) individuals per chapter.
B. Each Team must have at least two(2) members present to launch the catapult.

TIME LIMITS

A. Entries must be started and completed during the current school year.
B. The catapult and design portfolio must be picked up at the designated time at the conclusion of the event.

ATTIRE

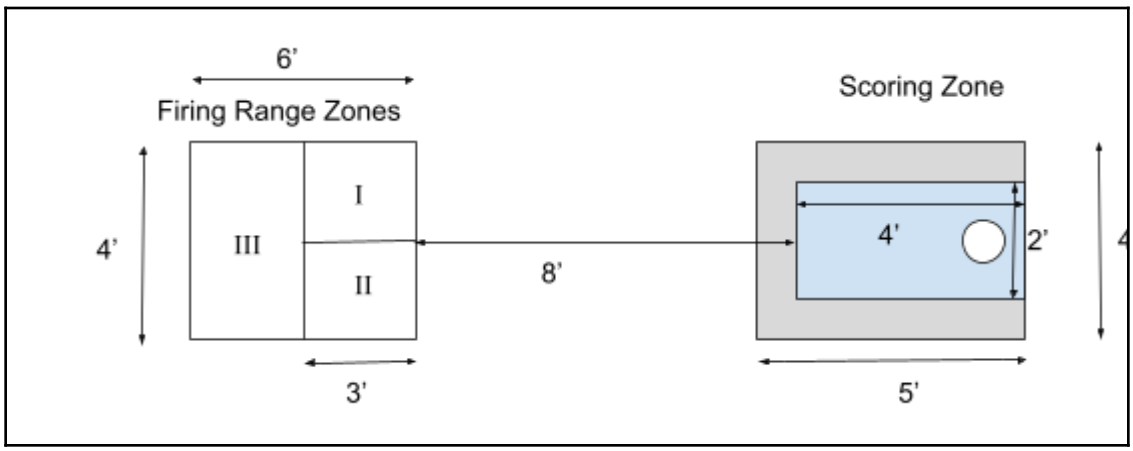
TSA competition attire, as described in the National TSA Dress Code section of this guide, is required.

PROCEDURE

PRELIMINARY ROUND

A. Participants check in their entries at the time and place stated in the conference program.
B. Catapults are inspected by evaluators to determine among other things, safety. Catapults that meet all Safety Compliance regulations will be approved for the performance stage of the event. Any unsafe devices will be disqualified. (Unsafe catapults include those with parts that detach during operation or those with a dangerous rotation or throwing motion, either of which could cause harm or damage.) Judges will make a final determination about the operational safety of a catapult.
C. A time sheet will be provided for sign up at check-in.
D. Students must be present for the performance stage of the event. Two(2) - Four(4) members per team.
E. Teams will receive eight(8) cornhole bags and one(1) double cornhole bag to score in a two minute scoring stage.
    a. Cornhole bags are square bags that measure 6"x6" (15.24 cm x 15.24 cm) with a thickness between 1.125"-1.5" (28.5-38.1 mm). The weight of the cornhole bag is regulated at between 14-16.5oz (440-470 g).
    b. For a double bag, two(2) regulation cornhole bags will be placed into a single 1 quart ziplock bag for launching.
F. Students must bring and wear safety glasses for this stage of the event.
G. One (1) team member may use a tape measure for calibrating the distance from the front of the catapult in a 8’-14’ range to the front of the cornhole board.
H. The front of the cornholeboard will be 8’ from the front of the firing line . The scoring area will consist of a 2’x4’ regulation cornhole board and 1’ perimeter on the floor around the front and sides of the cornhole board

I. **FIRING RANGE LAYOUT - HS**



J. The team will be given one(1) minute of practice to adjust its catapult for accuracy to the required distance.

K. Teams are required to fire at least one shot from each of the Firing Range Zones. The front corner(s) of the catapult must be located inside the declared zone. Other parts of the catapult may extend into other zones. Not firing from all zones will result in a disqualification.

L. Teams will position their catapult on the "firing range" and wait for the clear to “FIRE”. Students must use the >5’ launch cord and be at least 3’ from the catapult when launching. Caution must be used when loading the catapult about students leaning over the launching arm in case of a misfire.

M. When teams receive their bags and the clear to fire command is given, they will have two (2) minutes to launch the set of bags one at a time to accumulate as many points as possible in the scoring zone.
   a. The timer starts on the first launch attempt of the catapult.

N. Teams are allowed to repair a catapult malfunction, but the timer does not pause.

O. Each team must cease firing at Two (2) minutes. No shots taken after time has been called will count. A shot fired before the two(2) minutes and lands after the two minutes will still count. The amount of time left is recorded if teams finishing before the two(2) minute timer.

P. Scoring is as follows: in the hole=5 points; on the board=3 points; off the board in the marked area=1 point. A bag on the line will count as “in the marked area”(A vertical plane extends upward from the outside of the line and counts a 1 point) .
   a. **HS Multiplayer** - A single(1) double bag (two regulation cornhole bags placed together in a 1 quart ziplock bag)
      i. Final score is multiplied by the following formula. Double bag in outside zone = x2, Double bag on board = x3, Double bag in hole =x5

Q. Scores are not tabulated until the two (2) minute timer has expired. Cornhole bags are scored where they rest at the end of two (2) minutes or the team declares they are finished with their turn.

R. Ties will be broken as follows: 1) The team with the highest score with the fewest number of bags scored. 2) the team with the greatest time remaining. 3) Sudden death shootout.

S. Preliminary ranking will be determined from points earned for the 1)catapult's performance. and 2) Tie breaker rules.

T. Team members must collect all cornhole bags once judges complete recording points and return them to the firing range before leaving the event area.

SEMIFINAL ROUND

A. The top twelve(12) catapults report to the firing range at the posted time

B. The top twelve(12) compete in a head to head single elimination bracket to earn point for the finals

C. Teams will face off head to head in a one(1) minute shootout of 4 bags, one at a time on their designated cornhole board. The higher seeded team receives the choice to shoot first or second.

D. Teams will receive a one(1) minute warm-up before each round to calibrate.

E. For the semi-final round a shot must be fired from each zone.

F. Level 2(HS) will be given the multiplier bag after the one minute round completes. Teams will have 30 seconds to take the multiplier launch.

G. The team with the highest score or tie breaker will advance to the next round of the bracket.

H. Semifinal ties are broken as follows 1) The fewest number of bags to achieve a score, and/or 2) the team with the shortest time recorded to score the points. 3) Sudden death shootout(No warm-up)

I. Portfolio and materials list, are combined with bracket points to determine the final standings

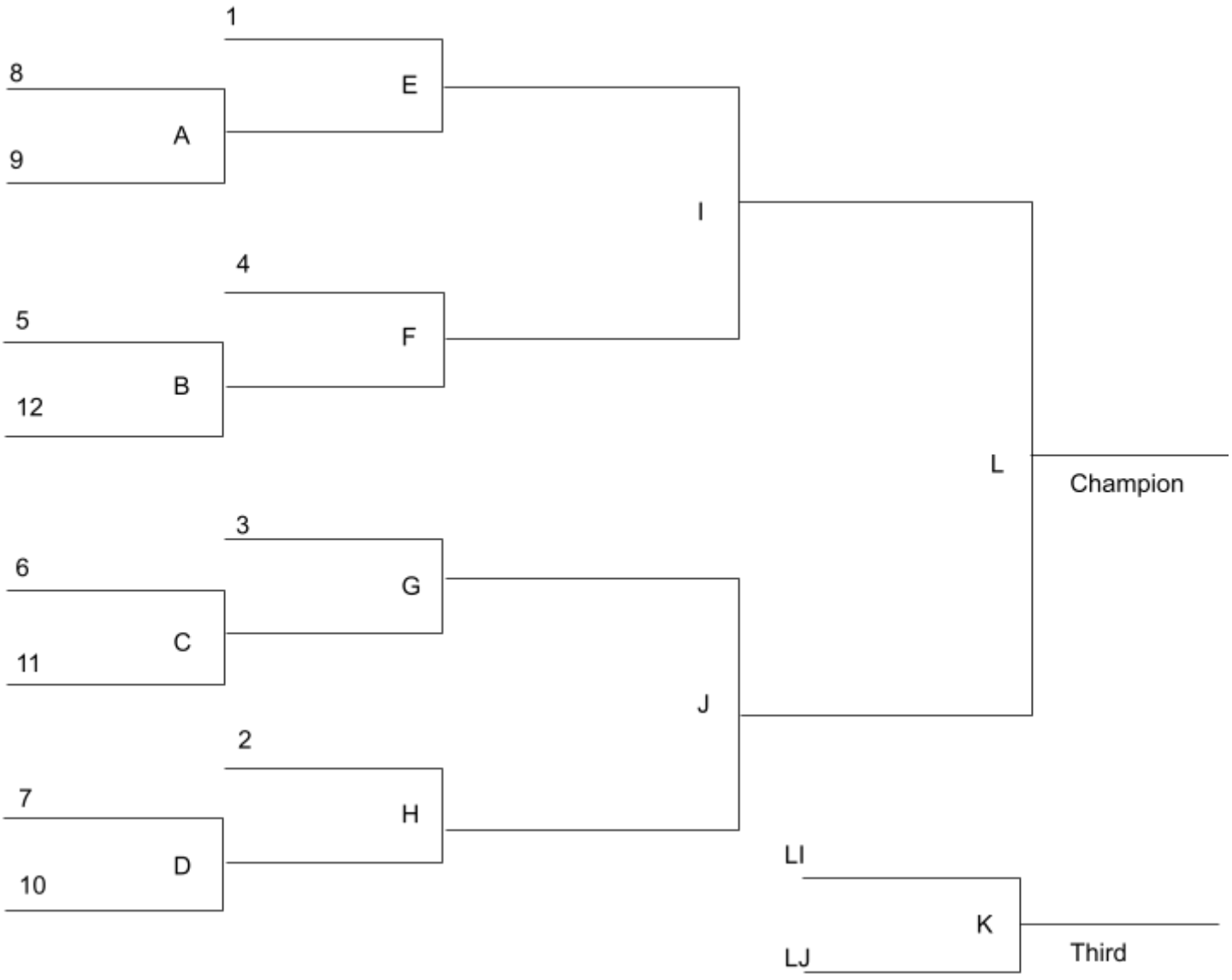
J. Following the bracket, participants pick up their entries from the display area at the time and place stated in the conference program.
.

K. Ten (10) finalists are announced during the conference award ceremony.

Semifinals 12 team single elimination bracket.

Teams seeded according to preliminary standings

Level(1 or 2)



REGULATIONS

CATAPULT CONTEST GUIDELINES

A. Participants must bring and wear safety goggles during the performance stage of the event.

B. Teams must provide their own tape measure for calibration and catapult placement (at least 25' length).

C. The catapult may be no larger than **24" tall x 24" long x 18"** wide while in the loaded position. The launch arm may extend beyond the size envelope of the catapult only while launching.

D. The base of the catapult should accommodate the provided ballast. The ballast will be two(2) 25-pound olympic plate weights, provided by TSA on site.

E. The catapult must operate completely within the given firing range area(6' deep x 4' wide).

F. The catapult may have any type of spring mechanism to power the arm, but all parts must be contained within the 24" tall x 24" long x 18" wide maximum footprint prior to launch.

G. A detachable lever may be used in loading and arming the catapult that extends outside the envelope but must be removed for inspection and to launch the catapult.

H. The catapult's total weight must not exceed fifteen (15) pounds.

I. All parts of the catapult must initiate behind the launch line, but parts may extend over the line during and after the launch.

J. The catapult cannot have wheels.

K. The catapult must be made entirely from PVC pipe(Suggested size 1"or greater. Less than 1" is susceptible to fracture), with the exception of the launch mechanism, firing mechanism, fasteners, and safety items. These items may be wood or metal and must be constructed in a safe way, so as not to damage the device, the testing area, or cause harm to others. (Sharp or metal pieces that are determined to cause injury will result in disqualification)

L. The following may not be used:

1. Glass 2. Flammable, corrosive, or explosive materials 3. Compounds that produce odors or gasses

M. The catapult must have at least a five (5)-foot pull cord to launch the catapult from a safe distance. Students must be at least three(3) feet away from catapult when launching.

N. When the catapult is on display or not in the performance stage, it must be fully disabled and unable to be readied for firing.

O. Catapult Safety Compliance. A catapult that receives a "No" answer to any of the requirements will not advance to the performance stage of the event.

1	Team Submitted Catapult Portfolio?	Yes	No
2	All team members must have and wear safety goggles.	Yes	No
3	Is the catapult within the size specifications when armed?	Yes	No
4	Is the catapult built with appropriate materials?	Yes	No
5	Does the catapult launch with a pull cord(>5')?	Yes	No
6	Does the catapult have a safe launching mechanism?	Yes	No
7	Is the catapult safe to operate?	Yes	No

CORNHOLE CATAPULT DESIGN 2027 DOCUMENTATION

A. Each team must prepare a portfolio that includes each step of the engineering design process when developing a solution to their cornhole catapult. From inception, through testing and modification—to the performance stage for competition. A complete portfolio includes sketches, pictures, and descriptions of the processes, successes, and failures related to the designed catapult.

B. Documentation Portfolio

1. Documentation portfolio is required and must be secured in a clear front report cover with the following single-sided, 81/2" x 11" pages, in this order:

   a. **Title page** The Event Title, Event Location, and Event Date.- 1 page

   b. **Table of contents** - 1 page

   c. **Materials List** - Pages as needed.

   d. **Design Verification -** Sketches, Detailed Drawings & Photos of catapult design, construction and testing. - Pages as needed.

   e. **Plan of Work log** - Pages as needed.

   f. **References, resources and releases.** - Pages as needed.

It is essential that students and advisors routinely check the TSA website (www.tsaweb.org) for updated information about TSA general rules and competitive event guidelines. This information can be found on the website under Competitions/Competition Updates. When students participate in any TSA competitive event, they are responsible for knowing of all updates, changes, and clarifications related to that event.

CATAPULT 2027 OFFICIAL RATING FORM

TEAM ID# _____

Judges: Using minimal (1-4 points), adequate (5-8 points), or exemplary (9-10 points) performance levels as a guideline in the rating form, record the scores earned for the event criteria in the column spaces to the right. The X1 or X2 notation in the criteria column is a multiplier factor or determining the points earned. (Example: an "adequate" score of 7 for an X1 criterion = 7 points; an "adequate" score of 7 for an X2 criterion = 14 points.) A score of zero (0) is acceptable if the minimal performance for any criterion is not met.

Go/No Go Specifications

- Before judging the entry, ensure that the items below are present; indicate presence with a check mark in the box.
- If an item is missing, leave the box next to the item blank and place a check mark in the box labeled ENTRY NOT EVALUATED.
- If a check mark is placed in the ENTRY NOT EVALUATED box, the entry is not to be judged.

☐ TIER 1 – Portfolio is Present
☐ TIER 2 – Passed Safety Compliance Check
☐ ENTRY NOT EVALUATED

SEMIFINAL CATAPULT LAUNCH RANKING SCORE RUBRIC TIER 2 – Tournament Bracket(60 points)						
1st 60 Points	**2nd** 50 Points	**3rd** 40 Points	**4th** 35 Points	**5th - 8th** 30 Points	**9th - 12th** 25 Points	
				LAUNCH RANKING SCORE(60 points)		

CATAPULT PORTFOLIO RUBRIC - ONLY JUDGED FOR TOP 12 TIER 1 – DOCUMENTATION PORTFOLIO (100 points)				
CRITERIA	**Minimal performance 1-4 points**	**Adequate performance 5-8 points**	**Exemplary performance 9-10 points**	**SCORE**
Portfolio Components (x1)	Portfolio is unorganized and/or is missing three (3) or more components.	Portfolio has most components and is generally organized.	Portfolio has all required components and is well organized.	
Materials List (X1)	Materials list is hand written, unorganized and missing three (3) or more noticeable components.	Materials list is present but is incomplete or unorganized. List is not clearly presented.	Thorough materials list with detailed information. List is clearly presented and easily understood.	
Design Verification (X1)	Verification is minimal or of poor quality. Drawings & Photos do not support the engineered solution.	Drawings & Photos are present Verification somewhat supports the engineered solution.	Includes Sketches, Detailed drawings and Photos. Verification is exceptional and supports the engineered solution with detail.	
Plan of Work Log (X1)	The log is poorly organized and/or incomplete.	The log is adequately detailed, organized, and contains most of the required components.	The log is detailed and contains all the required components.	
References and Resources (X1)	There are few references listed, and/or references listed show little relevance to the project's goal.	There are a sufficient number of credible references listed.	Many credible references are listed, reflecting research in the areas covered.	
Selected Solution (X1)	Solution conveys a sloppy design, and/or does not incorporate key elements in the engineering challenge; visual representations of the solutions are not appropriate or accurate and do not follow established conventions.	Solution incorporates most elements laid out in the engineering challenge; visual representations of the solutions are somewhat appropriate, accurate and loosely follow established conventions.	Solution exudes creativity and addresses all engineering challenge elements; visual representations of the solutions are appropriate, accurate and follow established conventions.	
			TIER 2 – DOCUMENTATION PORTFOLIO SUBTOTAL (60 points)	

To arrive at the TOTAL score, add any subtotals and subtract rules violation points, as necessary.	**TOTAL (120 points)**	

Comments:

Printed Name _____ Signature _____
I certify these results to be true and accurate to the best of my knowledge.

STEM INTEGRATION

This event has connections to the STEM areas noted below. Please refer to the STEM INTEGRATION section of this guide. Science, Technology, Engineering, Mathematics

COMMON CORE STATE STANDARDS (CCSS) INTEGRATION

Please refer to the Common Core State Standards (CCSS) Integration section of this guide for more information.

LEADERSHIP SKILLS

Leadership skills promoted in this event:

- Critical thinking: Students learn and use necessary skills in order to design an efficient and accurate catapult. Use leadership activities: *Guess The Famous Leader* and *Rebus Puzzles*
- Evaluation: Students improve the catapult based on testing and adjustment. Use leadership activities: *Grading the Advertisement* and *The Great "Evaluate"*
- Problem solving: Students construct a catapult that is accurate and meets all requirements. Use leadership activities: *Finding A Way* and *Resolving Conflict*

Additional leadership skills promoted in this event:

- Communication
- Team building
- Decision making
- Organization

TSA AND CAREERS

This competition has connections to one or more of the career areas featured in the TSA AND CAREERS section of this guide. Use *The 16 Career Clusters* chart and the *TSA Competitions and Career Clusters* grid as resources for information about careers.

CAREERS RELATED TO THIS EVENT

- Designer
- Industrial designer
- Industrial engineer
- Mechanical engineer
- Modeler

CATAPULT DESIGN
EVENT COORDINATOR INSTRUCTIONS

PERSONNEL

A. Event coordinator

B. Evaluators, two (2) or more

C. Assistants, two to three (2-3) to assist with check-in and management of the performance stage of the event (preferably one (1) per catapult being tested simultaneously).

MATERIALS

A. Coordinator's packet, containing:
   1. Event guidelines, one (1) copy for the coordinator and each evaluator
   2. TSA Event Coordinator Report
   3. List of evaluators/assistants
   4. Stick-on labels for identifying entries (one for the catapult and one for the design portfolio)
   5. Performance record sheet
   6. Results envelope with coordinator forms

B. Clipboard for each judge

C. Up to two(2) cornhole boards (one per catapult on the firing line at the same time)

D. Four(4) sets(four bags make a set) of different colored cornhole bags
   1. 1 qt ziploc bag to create double bag
   2. 2 cornhole bags other than the 4 sets

E. Four(4) 25 pound olympic weight plates(2 -25lb plates for each catapult)

F. Masking or duct tape to mark the firing range and one(1') foot floor scoring area

G. Two Tape measures for evaluators

H. Bathroom weight scale

I. Tables for displaying and evaluating catapults

RESPONSIBILITIES

A. Upon arrival at the conference, report to the CRC room and check the contents of the coordinator's packet. Review the event guidelines and check to see that enough evaluators/assistants have been scheduled.

B. Inspect the area(s) in which the event is to be held for appropriate set-up, including room size, chairs, tables, outlets, etc. Notify the event manager of any potential problems.

C. Check in the entries at the time stated in the conference program. Anyone reporting who is not on the entry list may check in only after official notification is received from the CRC. Late entries are considered on a case-by-case basis and only when the lateness is caused by events beyond the participant's control. Requirements for attire do NOT apply during check-in. Secure the entries in the designated area.

D. Each entry (catapult and design portfolio) must include the participant's identification number on the entry. Position entries for evaluation and viewing. Secure the entries in the designated area.

E. One (1) hour before the event is scheduled to begin, meet with evaluators/assistants to review time limits, procedures, and regulations. If questions arise that cannot be answered, speak to the event manager before the event begins.

F. Assist the evaluators as needed as they review the catapults and design portfolios.

RESPONSIBILITIES (cont.)

G. For participants who violate the rules, the decision either to
   1) deduct twenty percent (20%) of the total possible points or
   2) disqualify the entry, must be discussed and verified with the evaluators, event coordinator, and CRC manager, who all must initial either of these actions on the rating form.

H. Begin the performance stage at the posted time.
I. One assistant will manage the stop watch to begin ("Fire") the Two(2) or One(1)-minute time and to end ("Stop") the testing period.
J. Position another assistant at each target to calculate the score for each team performing.
K. Evaluators determine the twelve(12) finalists. Evaluators should break any ties, as necessary.
L. Submit the finalist results and all related forms in the results envelope to the CRC room.
M. If necessary, manage security and the removal of materials from the event area.

CATAPULT - ENTRY/SCORE SHEET

TEAM ID #		TOTAL POINTS SCORED	
		TIME REMAINING(MM:SS)	

CATAPULT DESIGN

Catapult Design Safety Compliance Go or No-Go

A catapult that is marked No-Go for any of the requirements below will not advance to the performance stage of the event.

All team members must have and wear safety goggles.	**Go**	**No-Go**
Team Submitted a Catapult Portfolio?	**Go**	**No-Go**
The catapult is the correct size. While in the loaded position. 24" tall x 24" long x 18" wide	**Go**	**No-Go**
The catapult is built with the correct materials.	**Go**	**No-Go**
The catapult launches with a pull cord with at least five(5) feet of safety distance.	**Go**	**No-Go**
The catapult has a safe launching mechanism.	**Go**	**No-Go**
The catapult is safe to operate.	**Go**	**No-Go**

SCORE SHEET - A shot attempt points may be modified if it is affected by a later shot

2026 OFFICIAL SCORING FORM - HS

Shot Attempt	zone Fired from	Missed shot 0 points	Floor Zone 1 Point	On the Board 3 Points	In the Hole 5 points	Modified Points
1						
2						
3						
4						
5						
6						
7						
8						
HS Multiplier						

- Students must use the >5' launch cord and be at least 3' from the catapult when launching.
- Caution must be used when loading the catapult about students leaning over the launching arm in case of a misfire.
- Level 2(HS): Required to fire at least one shot from each of Firing Range zones. The front corner(s) of the catapult must be located inside the declared zone. Other parts of the catapult may extend into other zones.
- **HS Multiplier:** Double bag in outside zone = x2, Double bag on board = x3, Double bag in hole =x5