

RUBE GOLDBERG

MACHINE CONTEST®

2016 OFFICIAL RULE BOOK

Division I: Ages 11-14

Division II: Ages 14-18

Division III: Ages 18+



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Rube Goldberg, Inc is a 501(c)3 not-for-profit dedicated to promoting STEM & STEAM education for students of all ages. Registration fees and all contributions are tax deductible.

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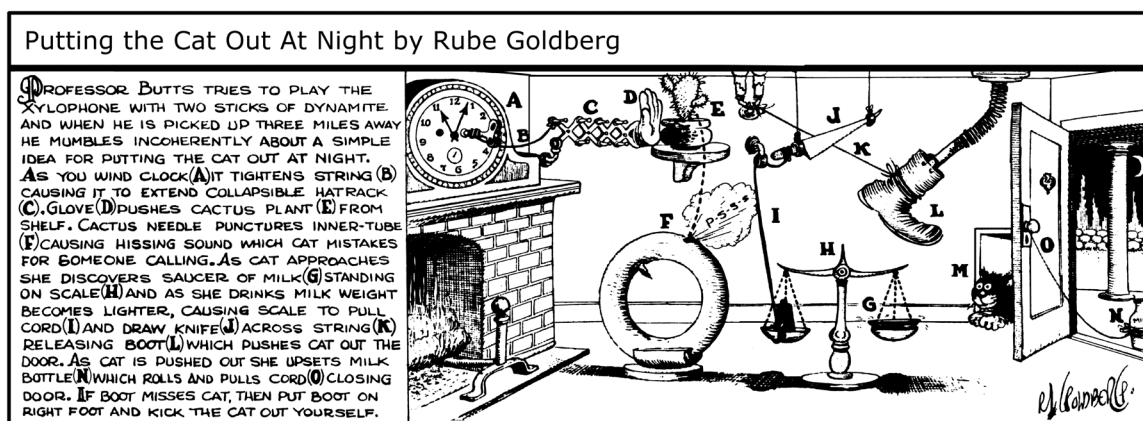
MISSION

RUBE GOLDBERG MACHINE CONTESTS® (RGMCS) are designed to encourage teamwork and out-of-the-box problem solving for students of all ages.

STEM and STEAM friendly, Rube Goldberg Machines™ tackle the most mundane tasks (see past contests, pg 4) and ask participants to create their own overly elaborate and hilariously conceived wacky contraptions in honor of the competition's founding father.

Rube Goldberg (1884-1970) was a Pulitzer Prize winning cartoonist, best known for his nutty chain reaction inventions. The popularity of these cartoons made him a cultural touchstone, an adjective in Merriam-Webster's Dictionary, and a term that today is invoked daily in American media. (If you're not familiar with Rube Goldberg's work, go to the "Gallery" section of rubegoldberg.com.)

We encourage the use of every-day objects to create your Rube Goldberg Machine™ and to integrate as many recycled items as possible. Imagine the kinetic component of everything in the world around you and put it into motion in your Rube Goldberg Machine™!



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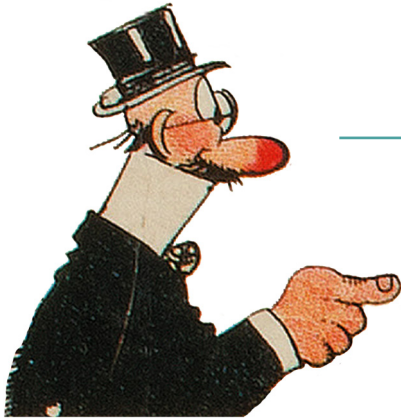
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PAST CONTEST TASKS

- 
- 2015 Erase A Chalkboard
 - 2014 Zip A Zipper
 - 2013 Hammer A Nail
 - 2012 Inflate A Balloon and Pop It!
 - 2011 Watering A Plant
 - 2010 Dispense an Appropriate Amount of Hand Sanitizer into a Hand
 - 2009 Replace an Incandescent Light Bulb with a More Energy Efficient Light Emitting Design
 - 2008 Assemble a Hamburger
 - 2007 Squeeze the Juice from an Orange
 - 2006 Shred 5 Sheets of Paper
 - 2005 Change Batteries and Turn on a 2-battery Flashlight
 - 2004 Select, Mark and Cast an Election Ballot
 - 2003 Select, Crush and Recycle and Empty Soft Drink Can
 - 2002 Select, Raise and Wave a U.S. Flag
 - 2001 Select, Clean and Peel an Apple
 - 2000 Fill and Seal a Time Capsule with 20th Century Inventions
 - 1999 Set a Golf Tee and Tee Up a Golf Ball
 - 1998 Shut Off An Alarm Clock
 - 1997 Insert and Then Play a CD Disc
 - 1996 Put Coins in a Bank
 - 1995 Turn on a Radio
 - 1994 Make Cup of Coffee
 - 1993 Screw a Light Bulb into a Socket
 - 1992 Unlock a Combination Padlock
 - 1991 Toast a Slice of Bread
 - 1990 Put the Lid on a Ball Jar
 - 1989 Sharpen a Pencil
 - 1988 Adhere a Stamp to a Letter
 - 1987 Put Toothpaste on a Toothbrush

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WHAT'S NEW!

Dear Fellow RGMC Participants,

This year we are adding a Division III Online contest and Division I Live contest.

Now, teams from every Division and from anywhere in the world can compete in either Live or Online contests to become the Rube Goldberg Machine Contest Division I, II or III Champion!

Check out page 7 to see dates and how the contests integrate.

ON OUR WEB SITE: All Teams and Hosts will create an account, log in and register. Paying with a PO, ordering additional badges...will all be done through your account.

GOOD LUCK and HAPPY RUBEING!

Sincerely,

The Rube Goldberg Team

Rube Goldberg (rōōb göld'berg), n. a comically involved, complicated invention, laboriously contrived to perform a simple operation – *Webster's New World Dictionary*



TO PARTICIPATE IN THE RUBE GOLDBERG MACHINE CONTEST

1. **Start a team** of at least 3 people

NOTE: Teams entering in DIVISION I: Ages 11-14 (Middle School) and DIVISION II: Ages 14 – 18 (High School) require a Teacher/Parent Advisor.

2. **Register a team** (Team Registration opens September 1, 2015)

- Go to rubegoldberg.com
- Click on CONTESTS
- Choose Live Contests or Online Contests
- Click on Register
- Create an account
- Follow the prompts, register and pay the fee

3. **Design and build a machine**

2016 Task - **OPEN AN UMBRELLA**

NOTE: Steps, pieces and components from previous machines may be recycled, but the RGMC relies on the ingenuity of students and teachers to create entirely new machines for each year's contest.

4. **Compete!**

- a. LIVE CONTEST: Travel to your Contest and compete.
- b. ONLINE CONTEST: Complete your online submission by April 1, 2016.

5. **Win** if the judges choose your entry.

6. **Have fun!**



RUBE GOLDBERG MACHINE CONTEST SCHEDULE

LIVE CONTESTS	ONLINE CONTESTS
Team Registration opens September 1, 2015	
<p>DIVISION I DIVISION II DIVISION III</p> <p>Create an account at rubegoldberg.com. Click on Schedules/Deadlines to find a Host site near you.</p> <p>April 11, 2016 Division I LIVE contests that are final by April 11: winners are automatically entered into Division I ONLINE FINALS if they have completed a Team Page.</p> <p>April 23, 2016 Division II FINALS Waukesha County Technical College 800 Main Street Pewaukee, WI 53072</p> <p>April 9, 2016 Division III FINALS Center of Science and Industry 333 West Broad Street Columbus, Ohio 43215</p>	<p>DIVISION I DIVISION II DIVISION III</p> <p>Create an account at rubegoldberg.com. Choose Online Contest. Register.</p> <p>March 25, 2016 Registration closes.</p> <p>April 1, 2016 Online Regional Team Page submission deadline.</p> <p>April 11, 2016 Online Regional winners announced. Division II and III winners are eligible to compete at LIVE FINALS.</p> <p>April 23, 2016 Division I Online FINALS winners announced. People's Choice voting starts for all Divisions, for all teams that have a Team Page.</p> <p>May 5, 2016 People's Choice voting ends.</p> <p>May 6, 2016 People's Choice winners announced.</p>

All Online teams must complete a Team Page.

All Live teams must complete a Team Page if they want to be included in People's Choice.

Any Division I Live team moving forward into Division I Online Finals, must have a completed Team Page.

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1. START A TEAM

All Teams

- Must be comprised of at least 3 eligible members.
- Will receive a 3" embroidered Contest Participant badge displaying the year and the task for each registered team member (up to 12). These badges will be mailed to the team Teacher/Parent Advisor/Captain at the address provided during the registration process.

Orders for additional badges are available for \$5 each. Order option appears once you register your team and input team member names.

DIVISION I: Ages 11 – 14 (Middle School) Team Eligibility

- Each team must have a Teacher/Parent Advisor who will be present at the Contest.

NOTE: All team members must be students between the ages of 11 and 14.

DIVISION II: Ages 14 – 18 (High School) Team Eligibility

- Each team must have a Teacher/Parent Advisor who will be present at the Contest.

NOTE: All team members must be students between the ages of 14 and 18.

DIVISION III: Ages 18+ (College) Team Eligibility

- Each team must have a team Captain who will be present at the Contest.
(Optional) Each team may have a faculty Advisor, whose attendance at the Contest is not required.

NOTE: All team members must be students 18 years of age or older and enrolled as undergraduate or graduate students at an accredited university.



2. REGISTER A TEAM

TEAM registration opens at rubegoldberg.com September 1, 2015.

- Go to rubegoldberg.com
- Click on CONTESTS
- Choose Live Contests or Online Contests
- Click on Register
- Create an account
- Follow the prompts, register and pay the fee*

If you need to pay by Purchase Order, that option will be available.

Registration is not complete until payment is made or PO is submitted.

NOTE: DIVISION II & III teams that are within 150 miles of a Live Contest are ineligible to compete online unless the Live Contest is full. (USA Title 1 schools are exempt.)

NOTE: A team may compete in only one Contest. However, a school may register multiple teams, each with a unique machine.

* **NOTE:** For Live Contests, the registration fee may be higher or lower depending on the host. Specific fees for your host will appear once you choose a Host site.
Some Host sites charge additional fees payable directly to them.

Entry fees are non-refundable.

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3. DESIGN AND BUILD A MACHINE

2016 Task

The task is determined by Rube Goldberg, Inc. and changes on an annual basis.
The 2016 Task is **Open An Umbrella**.

Machine Specifications & Rules

Specification	Minimum	Maximum
Complete official challenge	Required	
Steps	10 steps (DIVISION I), 20 steps (DIVISIONS II and III)	75 steps
Height	None	8' (2.4 m)
Overall Footprint Area	None	10' x 10' (3 m x 3 m)
Machine volume (Footprint Area x Height of highest point on the machine)	None	250 ft ³ (7.1 m ³)
Single run time	None	2 minutes
Machine explanation and walkthrough	None	3 minutes
Reset time	None	8 minutes
Machine noise	None	100 dB
Air compressor hoses, AC or DC power cords, and/or water hoses running to or from the machine	0	2 total
Hazardous materials, explosives, or flames	Not allowed	
Electrical arcing	Allowed with safety precautions	
Live animals	Not allowed	
Corporate logos	Allowed, with written permission from the logo owner. All responsibility for copyright permission rests with the team.	
Use of profane, indecent, or lewd expressions	Not allowed	
Objects flying beyond machine footprint	Not allowed	
Safe for participants and observers	Required	



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3. DESIGN AND BUILD A MACHINE *continued*

Calculating Machine Volume

ALL TEAMS must design their machine to fit in an overall volume of 250 cubic feet (7.1 cubic meters). The machine volume is defined as the overall footprint (area) of the machine (rounded up to the nearest foot) multiplied by the height of the tallest step.

Teams may build a machine in any shape they wish, so be creative!

How to Calculate the Volume of a Machine

1. Draw out your machine footprint on the grid on page 18. You can also calculate the volume online on your team page.

NOTE: The overall dimensions of your machine may not exceed 10' length x 10' width x 8' height (3 m x 3 m x 2.4 m). If any part of the machine enters any of the 1' x 1' (0.3 m x 0.3 m) squares (even if it does not touch the ground/table), the entire square must be counted.

2. Count the number of 1' x 1' (0.3 m x 0.3 m) squares into which the machine footprint falls. This is the *area* of the machine footprint.

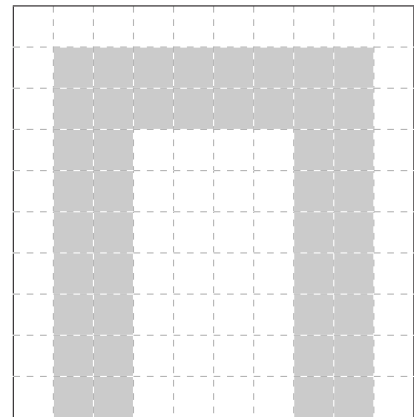
EXAMPLE: *area* = 44 squares

3. Measure from the lowest to the highest point of your machine; this is the *height* of your machine.

NOTE: If the ENTIRE machine sits on a table, the *height* of the table may be excluded from the *height* of the machine. If only ONE section of the machine uses a table, then the height of the table must be included in the height of the machine.

EXAMPLE: The tallest part of the machine is a 5' tower, so *height* = 5'

Example



4. Calculate the *Machine Volume* using the formula: *area* x *height* = *machine volume*
EXAMPLE: 44 squares (*area*) x 5' (*height*) = 220 ft³
5. Your *Machine Volume* must be equal to or less than 250 cubic feet (7.1 cubic meters)
EXAMPLE: 220 ft³ ≤ 250 ft³ (maximum) → *Machine Volume is within specifications*

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3. DESIGN AND BUILD A MACHINE *continued*

Frequently Asked Questions

Q: What kind of umbrella should we use?

A: You can use any type or size of umbrella.

Q: What is a step?

A: A step in the machine is a transfer of energy from one action to another action. Identical transfers of energy in succession should be counted as 1 step.

Example: A sequence of dominos hitting each other should be counted as 1 step.

Counting 100 dominoes as 100 steps is repetitive and not in the spirit of Rube Goldberg.

Q: What is an intervention?

A: Any physical touching or action to continue the operation of the machine through human interaction after the machine begins its Contest run.

Example: Your machine stops because one step does not trigger another. A team member interacts with the machine through a physical touch or other device to trigger any steps that follow.

Q: What is a touch?

A: Any physical touching or action to continue the operation of the machine through human intervention after the machine begins a Contest run. Multiple touches on the same step in the same Contest run count as a single touch.

Q: Can programmable logic controllers or microcontrollers be used?

A: Yes, but their use must fit within the definition of a step. Steps that use controllers should be clearly stated in the written step list and include detailed information on how the transfer of energy is accomplished. Using controllers as a fail-safe is illegal and will result in disqualification.

Example: A ball falls onto a switch connected to a controller that turns on a motor.

NO: If the ball misses the switch but the controller still starts the motor, the controller is not transferring energy from one action to another action. It is acting as a fail-safe instead of a step and is illegal.

YES: If the ball hits the switch and the controller starts the motor, the controller is transferring energy from one action to another action and is consistent with the definition of a step.

Q: Does completing the task have to be the absolute last step?

A: Any steps that occur after the task has been completed do not count. However, you are free to have steps after the task is completed, even though they do not count toward your total number of steps.

Q: Can I enter a machine that has been previously built and posted online?

A: No. All entries must be new machines built for entry into the current Contest.

Q: Where can I find answers to other frequently asked questions?

A: Visit rubegoldberg.com/contests/faqs/

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4A. COMPETING AT THE LIVE CONTEST

Prior to the Contest

- Create a Team Page (required for: All Online teams, Any team that wants to compete in People's Choice, Any Division I LIVE team that wins regionals and wants to move forward into Division I Online Finals)

Time to Contest	Event
2 hours prior	Host Site will provide participants adequate setup time in the Contest venue.
1 hour prior	Submit 10 (or other number specified by your Contest Host Site) concise, typed copies of (1) a step-by-step description of their machine, and (2) a completed machine volume worksheet to their Contest Host Site Chairperson. Diagrams and pictures may be included in this description along with typed information.
40 minutes prior	All machines must be set up and area surrounding them cleared.
30 minutes prior	Team Captains' meeting

During the Contest

- Teams will compete in a "Science Fair" format. Each machine will be assigned a judging time slot. During that slot, the teams will present their machine, commence a first run, reset their machine, and commence a second run within the required allotted time.
- In order to keep the competition action going, your contest site may have a different contest format. For example, teams may be paired into "pods" of 2 teams and alternate doing timed runs and resets.
- **There are NO VOIDED RUNS.** The entire machine presentation, first run, reset, and second run are judged.
- Teams are encouraged to run their machines and answer questions from the audience when not being judged.

Specification	Minimum	Maximum
Verbal presentation length	None	3 minutes
Team members participating during judged machine operations	None	4
Team members in contact with machine during a Contest Run	None	2 simultaneously
Reset time limit	None	8 minutes
Destructive action against other machines	Contest disqualification	

(Continued on next page)



4A. COMPETING AT THE LIVE CONTEST *continued*

After the Contest

- Machines must be removed and the area cleaned by a time determined by the Host Site Chairperson.
- Contest participation implies consent to use Contest photographs in all forms of publicity.
- For site-specific rules and processes, contact your Host Site Chairperson.

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4B. COMPETING IN THE ONLINE CONTEST

Complete your Team Page by April 1, 2016

1. On our web site: Go to Machine Contests. Go to Online Contests. Click Register Now. Create an account. Choose your Division. Fill in your team information and pay the registration fee of \$150.00 per team.
 - Information on how to set up your Team Page will be in that email.
 - You will receive an email containing links for you to download the 2016 Rule Book and the Official Poster.
 - Division I registrants will also get a link for the 2016 Certificate of Ingenuity.
2. Follow the directions on your Team Page to submit the following required information by April 1, 2016:
 - School, teacher and team information
 - **OUR STEP LIST:** A Step list (3 pages maximum).
 - **OUR MACHINE VOLUME WORKSHEET:** The Machine Volume Worksheet.
 - **OUR CLOSE-UPS: PHOTOS:** A maximum of 3 close-ups (scanned diagrams, photos).
 - **OUR CLOSE-UPS: FAVORITE STEP:** A close-up video of your favorite step sequence.
 - **OUR CLOSE-UPS: TASK COMPLETION:** A close-up video of your final step(s) completing the task.
 - **OUR MACHINE EXPLANATION AND WALKTHROUGH:** A video explanation of the machine and step walkthrough (3 minutes maximum)
 - **OUR MACHINE RUN VIDEO #1**
OUR MACHINE RUN VIDEO #2
TWO videos of the entire machine running (2 minutes maximum each).

NOTE: This video must be a single continuous view with the machine in view at all times and no video editing or breaks. Any evidence of editing will result in disqualification.

You can also add a team logo and further customize your Team page (optional).

Your Team page will only be editable until April 1, 2016.

BE ADVISED: All DIVISION II & III winning teams that advance to the FINALS are required to abide by the Live Contest **COMPETING** requirements (see page 10). Teams should always design and build their machines to compete Live. Good Luck!



2016 RUBE GOLDBERG MACHINE CONTEST JUDGING CRITERIA (ALL CONTESTS)

TEAM NAME: _____

100 Points Total Judging will be based on a 100-point scale broken down into the following categories:

MACHINE DESIGN (39 points) Are all steps visible and watchable by the judges and audience?

Everyday Items (0 to 5 points)_____

Does the machine re-purpose everyday items?

Laugh Barometer (0 to 5 points)_____

How funny and whimsical is the machine?

Theme or Story (0 to 5 points)_____

Does the machine tell a story?

Artistry and Construction (0 to 5 points)_____

How artistic and well-constructed is the machine?

Are all steps visible and watchable?

Absurd Complexity (0 to 19 points)_____

Minimum # steps:

DIVISION I: 10 steps; DIVISION II/III: 20 steps

less than minimum # steps: 0 points

minimum # - 25 steps: 3 points

26 - 44 steps: 7 points

45 - 59 steps: 11 points

60 - 69 steps: 15 points

70 - 75 steps: 19 points

TOTAL POINTS MACHINE DESIGN.....

MACHINE RUNS (46 points)

Reliability of the Machine (0 to 10 points for each run)

Run 1 (10 points, -2 points per step touched)_____

Run 2 (10 points, -2 points per step touched)_____

Repeatability of the Machine (0 to 10 points)

0 points (machine seemed to fail in random places) to

10 points (machine was mostly or totally consistent and successful) across both runs

Repeatability score _____

Task Completion (0, 8, or 16 points)_____

Task was not completed in either run.
(0 points)

Task was successfully completed in one run.
(8 points)

Task was successfully completed in both runs.
(16 points)

TOTAL POINTS MACHINE RUNS.....

COMMUNICATION AND TEAMWORK (15 points)

Team Chemistry (0 to 5 points)_____

How well did the team communicate, work together, and use checklists?

Step List and Machine Volume Worksheet (0 to 5 points)_____

How clear, concise, and creative is the written explanation of the machine?

How well was the Machine Volume Worksheet completed??

Machine Explanation (0 to 5 points)_____

How clear, concise, and creative is the the live/video explanation of the machine?

TOTAL POINTS COMMUNICATION AND TEAMWORK

PENALTIES (up to -30 points)

Rule Violations (up to -15 points)_____

Did any aspect of the machine or presentation violate the rules?

Out of Bounds Objects (up to -15 points)_____

-5 point deduction for each object that exits the machine boundaries.

TOTAL POINTS PENALTIES

TOTAL MACHINE SCORE.....

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6. WIN!

All Contests

- All entries will be judged and individual feedback provided by a panel of experts.

LIVE Contests - Division I

- There are no additional fees to compete in Finals.
- Winners from each Division I Live regional contest that has completed by April 11, are automatically entered into Division I ONLINE FINALS if they have completed a Team Page.

LIVE Contests - Division II and III

- There are no additional fees to compete in Finals.
- For every 20 teams in a Regional, 1 team may attend Finals.
For every additional 20 teams in a Regional, 1 additional team may attend Finals. (e.g., 21 – 40 = 2 teams advancing).
- After the winners of a Regional are announced, teams advancing to Finals have 1 week to email rubegoldberg.com whether or not they plan to participate in Finals.
- If an advancing team from a Regional is unable to participate in a Finals, the next highest scoring team from that Regional may choose to participate in place of the advancing team.

All ONLINE Contests

- Registration deadline is March 25, 2016, 11:59 PM EST.
- Team Pages close for editing April 1, 2016, 11:59 PM EST.
- Regional winners will be announced on April 11, 2016 on rubegoldberg.com.
- The 1st place team from Division II and III are eligible to compete in the LIVE Finals
- Online team pages of all Divisions will be made public on April 23, 2016 at rubegoldberg.com for People's Choice Award voting. Any team that has a TEAM PAGE can compete in People's Choice.

There will be a People's Choice winner for Divisions I II III

Voting closes on May 5, 2016, 11:59 PM EST.

People's Choice winners announced for all Divisions on May 6, 2016.

LIVE FINALS

Division II

April 23, 2016

Waukesha County Technical College
800 Main Street
Pewaukee, WI 53072

Division III

April 9, 2016

Center of Science and Industry
333 West Broad Street
Columbus, Ohio, 43215



MACHINE CONTEST®

MACHINE VOLUME WORKSHEET

(Official Team Submission Sheet)

Team Name: _____

School: _____

Division: I II III (circle one)

Maximum machine dimensions:
10' L x 10' W x 8' H

STEP 1: Draw the footprint of your machine

NOTE: If any part of the machine falls within a square, you must count the entire square.

STEP 2: Count the number of footprint squares

NOTE: Each square is 1' x 1' (0.3 m x 0.3 m)

AREA: _____ (choose one: ft² or m²)

STEP 3: Measure the height of your machine.

NOTE: The maximum height is 8' (2.4 m)

HEIGHT: _____ (choose one: ft or m) Note: Each square is 1' x 1' (0.3 m x 0.3 m)

NOTE: If your ENTIRE machine sits on a table, the height of the table may be subtracted from the height of the machine. If only PART of the machine sits on a table, the table height must be included in the height of the machine.

STEP 4: Calculate the volume of your machine

_____ X _____ = _____

AREA (ft² or m²) X HEIGHT (ft or m) = VOLUME (ft³ or m³)

STEP 5: Verify machine volume equal to or less than 250 ft³ (7.1 m³)

YOUR MACHINE VOLUME (ft³ or m³) ≤ 250 ft³ (7.1 m³)

_____ (ft³ or m³) ≤ 250 ft³ (7.1 m³)

We hereby confirm our calculations are correct. We understand at the time of the Contest, our machine may be measured by an RGMC official to confirm our submitted calculations. Deviations beyond the maximum allowed footprint and/or volume will result in Contest disqualification.

Team Advisor/Captain Signature _____ Date _____



CONTEST CONTACT INFORMATION

Executive Director: Kathleen Felix
rubegoldberg.com
Phone: 203-227-0818

Education Outreach Director: Shawn Jordan, Ph.D

Assistant Education Outreach Director: Drew Wischer

"To invent, you need a good imagination and a pile of junk."
– Thomas Edison