

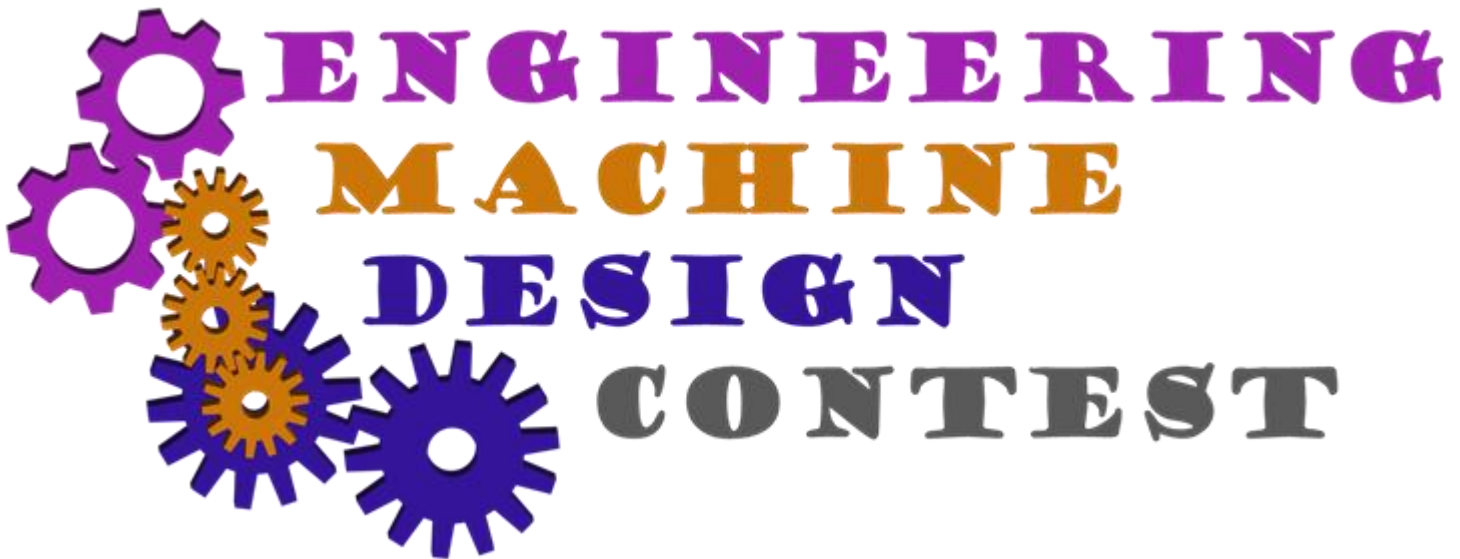


**MINNESOTA STATE**

Engineering Center of Excellence

2018 Engineering Machine Design Contest

# Official Handbook



**Friday, March 2, 2018**

Centennial Student Union Ballroom  
Minnesota State University, Mankato

[mnceme.mnsu.edu/stem-outreach/2018-engineering-machine-design-contest/](http://mnceme.mnsu.edu/stem-outreach/2018-engineering-machine-design-contest/)

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## I. Overview

You are challenged to design, engineer, and build your own machine. A good machine incorporates everyday devices and objects and connects them in unique ways. It is your mission to construct a machine that uses multiple steps to complete an assigned task, which varies from year to year.

Your machine may take some time to put together. Many machines undergo a couple months of strategy and planning; others are put together in a few days.

The machines that will likely do best at competition are those that arrive at the contest site as nearly intact as possible. The less work needed to assemble your machine at the site on contest day, the better. Too often, things that work perfectly in the workshop break down during the trip to the contest site. A platform should be constructed for the machine using a simple and secure way to fasten it together; typical sturdy platforms are made of plywood and two-by-fours. Each team plans its machine's construction in its own way. Some teams try to plan their whole design before starting to build it; others just start building and see what evolves. Maybe the best way is to use a little of each approach.

Each team may wish to seek the assistance of a mentor along with the help of a teacher. This mentor should be a technical professional or post-secondary student, preferably with an engineering or science background. The mentor should provide technical leadership and assistance whenever it may be needed. The assistance of a mentor is strongly recommended, but no penalty applies for the absence of a mentor.

The materials you use are the most important components of the machine. See what you have around the house; raid your old toy chest, pick up odds and ends from broken appliances. Most importantly, USE THEM. Anything goes when you are designing, engineering, and building a machine. Follow the adage "Nothing is impossible if you try." Your imagination is your only limit.

Your machine should also have a theme. Come up with your own creative or fun theme when you design your machine. Try to use objects and steps that conform to your theme. Keep in mind that your theme should be apparent in how you design the steps and in how you make them work together to accomplish the task.

## II. This Year's Challenge

This year's challenge is to...

# WEIGH IT!

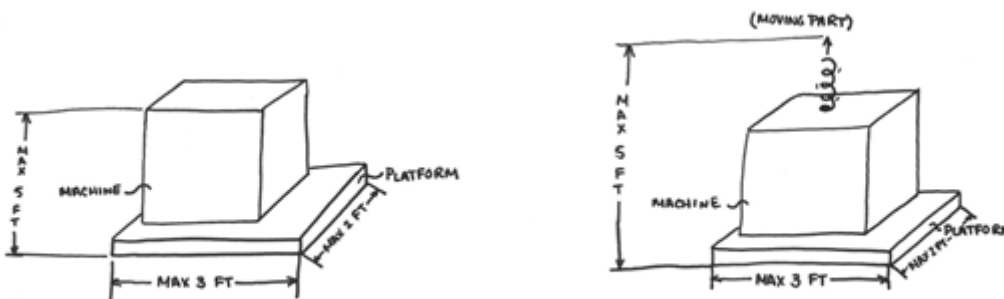
What does "WEIGH IT!" mean? The machine task is to "WEIGH IT!". The machine should weigh something, the "it" is up to the team. Page 19 of the Handbook outlines the points associated with the successful completion of the task.

### Scoring

See Score Sheet 2, Machine Operation Score Sheet, in Appendix B for details on how the task and your machine will be judged.

### Specifications

The finished machine should, at maximum, have dimensions of 5 feet by 3 feet by 2 feet. This means that the entire machine, while operating, shall fit and remain completely within an imaginary box whose dimensions are 5 feet by 3 feet by 2 feet. The platform will be included in the dimensions, along with any moving parts that exceed the dimensions of the machine at rest. Build your machine so you can reach all the crucial parts. At the contest, your machine will be set on a table top. Some examples are shown below of how the machine will be measured.



Each machine must take at least 30 seconds to run completely through its steps and should not run longer than two (2) minutes. During the contest, you will be required to run your machine completely through its steps (in at least 30 seconds and at most 2 minutes), reset your machine, and then run it through its steps again (in at least 30 seconds and at most 2 minutes). Your reset must be less than four (4) minutes. Any machine that is determined by the judges to require the delays associated with the use of human interventions in order to meet the 30 second minimum time limit will be penalized 5 points for not meeting the minimum time limit.

If your machine should fail during its operation, you may decide whether to continue the run by helping a step along (see Machine Operation Score Sheet for penalty deduction) or to give up on the run and call a restart. All restarts carry a 5-point deduction. The restart must be called by a team member before the machine completes its final step and can only be called when the machine is stalled. The team shall identify the machine's final step to the judges during the opening presentation to avoid confusion during the machine operation. Once the final step has been completed, the machine run is deemed final and no restart may be taken. If the team calls a restart, any interventions that occurred during the initial run will not be penalized because the initial run will be replaced by

the restart run. Any interventions that occur after the restart will be penalized. Only one (1) restart will be allowed per run during the contest.

The majority of the steps should apply general laws of physics, relying on kinetic and potential energy, gravity, centripetal or centrifugal forces, etc. to complete the task. The use of live animals and/or plug-in electrical equipment is not permitted. Teams are encouraged to use as many mechanical principles in their design as possible. The use of batteries is allowed; however, teams relying completely on mechanical motion rather than battery-powered motion will receive more points on the Machine Operation Score Sheet.

## Judging

The Engineering Machine Design Contest judges will be responsible for scoring the verbal presentations and machine operation. Oversight will be provided by the Engineering Machine Design Contest Judging Committee. The Judging Committee may consult with judging teams to resolve disputes and to clarify rules and specifications of the Engineering Machine Design Contest Handbook. The decisions of the Judging Committee are final.

## Special Awards Judging

Special Awards judging (e.g., Best Use of Gravity, Best Presentation) will be done on contest day separately from the operations judging for score. Special Awards judging will occur at specified times in the morning. The machines should be set up and the team members present for the Special Awards judging. Each team should make sure they have enough supplies for Special Awards judging in addition to the supplies needed for operations judging. Note: Costumes, cheers, jokes, music, acting, etc. that goes with the theme of the machine are allowed for special awards judging, as long as it does not disrupt the competition (no loud noises allowed), but no additional decorations or additions outside the boundaries of the machine are allowed during any part of the contest.

### III. Contest Outline

#### Conceptual Design Proposal

The conceptual design proposal contains an illustrative drawing or drawings of your ideas for your machine. The drawing will not have to match the actual machine that you create. The proposal should contain high level information on how the machine will accomplish the task, but does not need detail on each individual step. Each drawing must be no larger than 8.5 inches by 11 inches. The Conceptual Design Form will be available online and must be submitted electronically on or before the due date (see Section V) to receive full credit. If the design proposal form (see appendix A) is incomplete you will not receive credit.

**On-time:** on or before due date (see Section V)

**Late:** after due date but before Photographic Progress Report 1 due date (see Section V)

**No credit:** on or after Photographic Progress Report 1 due date (see Section V)

#### Photographic Progress Reports

Three photographic progress reports are required. Each report should include a picture or two of the machine's evolution since its design or previous progress report. Each report should include a description of changes since the previous report. Each report should include information on steps that gave the team trouble, ideas that did not work, and improvements to the reliability of the machine. Any innovative scientific/engineering applications should also be highlighted. Photographic progress report forms will be available online and must be submitted electronically on or before the due dates (see Section V) to receive full credit. If a photographic progress report form (see appendix A) is incomplete or does not accompany photographic progress reports, the team will not receive credit.

##### Photographic Progress Report 1

**On-time:** on or before due date (see Section V)

**Late:** after due date but before Photographic Progress Report 2 due date (see Section V)

**No credit:** on or after Photographic Progress Report 2 due date (see Section V)

##### Photographic Progress Report 2

**On-time:** on or before due date (see Section V)

**Late:** after due date but before Photographic Progress Report 3 due date (see Section V)

**No credit:** on or after Photographic Progress Report 3 due date (see Section V)

##### Photographic Progress Report 3

**On-time:** on or before due date (see Section V)

**Late:** after due date but before Image Release Waiver due date the contest (see Section V)

**No credit:** after Image Release Waiver due date the day prior to the contest (see Section V)

#### Contest Day Deliverables

A list of steps, percent of recycled/scavenged materials, total value of materials and a printed photograph of the machine are required to be turned in on Contest Day. This information should match the machine as it appears on Contest Day. **See appendix A for the appropriate form.** Two points will be deducted for failure to submit these items at the registration table on Contest Day. Be sure to include the school name on every page submitted and on the photograph.

## Verbal Presentation

The verbal presentation takes place during the actual contest. Each team of up to four (4) students will have a maximum of five (5) minutes to introduce themselves and explain their machine to a group of judges prior to actually running the machine. After the verbal presentation, judges will ask questions of the students that will count towards the overall scoring of the verbal presentation. Only the judges may ask questions of the four member student teams and only the four students presenting the machine may answer. Scoring for the verbal presentation will be in accordance with the score sheets in Appendix B.

## Machine Operation

The machine operation will be judged following the completion of the verbal presentation. In any round, you will be required to operate the machine twice with a reset between those runs. You may be asked to run your machine up to eight (8) times by judges on contest day; however, you should plan to have enough materials (anything that must be replaced before running your machine) on hand to run your machine more than eight times in case of restarts, test runs, demonstrations for spectators, etc. Scoring for the machine operation will be in accordance with the score sheets in Appendix B.

## Rounds

The contest will consist of a preliminary and a final round. All teams will compete in the preliminary round, with rules as shown in items 1 through 5 above and in Section IV. All teams will be randomly split into groups of schools for preliminary round judging. Each group will be judged by a separate judging team. Scores from all items (1 through 5 above) will be included in the preliminary round judging to tally the total score.

Up to eight (8) teams will be included in the final round. The top-scoring team from each preliminary round group will advance to the final round and any remaining slots will be filled by the highest remaining total scores from the preliminary round. All finalist teams may be sequestered prior to and after presenting to the finalist judges. Finalists will present their machine and will operate their machine, as outlined in items 4 and 5 above. Final scores will be based ONLY on the final round presentations and the final round machine operation (pre-contest and preliminary round scores will not be taken into account in the final round scores).

## Awards

Prizes will be awarded to the four official student team members of the top three teams, based on final round scores. The top three teams will also receive a trophy for the school. All teams competing on contest day will be eligible for numerous Special Awards.

## Scoring

<b>Point Summary</b>		<b>Sr. Div.</b>	<b>Jr. Div.</b>
1.	Design Proposal	5	5
2.	Photographic Progress Reports:		
	Photographic Progress Report 1	2	2
	Photographic Progress Report 2	2	2
	Photographic Progress Report 3	6	6
3.	Verbal Presentation	25	25
4.	Machine Operation	110	105
<b>Total Points Possible:</b>		<b>150</b>	<b>145</b>

## Penalty Deductions

Human intervention during machine operation	3-point deduction per intervention (except for runs replaced by a restart run)
Unintentionally causing a loose or flying object to go outside the set boundaries of the machine	2-point deduction
Failing to turn in a list of steps, list of materials and a photograph at the registration table on Contest Day	2-point deduction
Failing to turn in an Image Release Waiver for each team member by due date (see Section V)	10-point deduction
Resetting the machine in more than 4 minutes	5-point deduction
Restarting the machine	5-point deduction per restart
Requiring human intervention delays to meet 30-second minimum run time	5-point deduction
Exceeding the dimensional limits	10-point deduction
Coaching by team's teacher, mentor, a parent or a student not in the 4-person team	10-point deduction
Unsportsmanlike conduct by team members or guests	20-point deduction
Unsafe machine or intentionally causing loose or flying objects to go outside the set boundaries of the machine	Disqualification
Damaging another team's machine	Disqualification



## IV. Rules

### Rule #1

1. Judging will be based on the rules, specifications and scoring as defined in this handbook.

### Teams

2. Teams will enter in either the Junior Division (6<sup>th</sup>-8<sup>th</sup> grade) or the Senior Division (9<sup>th</sup>-12<sup>th</sup> grade). Each division will be judged separately following the same process. If a single team has students spanning both grade divisions, than that team shall enter the Senior Division.
3. The team representing the machine on contest day must consist of at most four students. More than four students may work on the machine, but those students will not be eligible for individual prizes. Each school may register ~~additional teams for the contest per division~~ any number of teams. An individual student may participate on one machine team. ~~The number of these additional registered teams that can participate on contest day will be determined based on available space in the contest venue. If necessary, these available spaces will be determined by random selection of registered additional teams. Schools with more teams building machines than allocated spaces must select which team(s) will represent their school at the contest.~~ Registration of teams is on a first come basis. Only one team per school can compete in the final round of the contest, ~~unless there are not enough schools to fill available slots~~. In the case that the additional team meets the qualifications for the finals, the team with the highest preliminary round score will move on.
4. Teams from conventional high schools, charter schools, technical schools and home schools may participate. If necessary, the team may be made by combining students across multiple charter and/or home schools.
5. Each team must complete machine preparation and set up by their assigned time on the contest day. Note: No tools, extension cords, supplies, clean-up materials, etc. will be provided for the team's use. Set up time is for assembling the pre-constructed machine parts and any repairs due to transportation. New construction is not permitted at the contest site.

### Machine Design and Contest

6. The judges will inspect the machine, deem it safe, and assess any rules infractions. All decisions made by the Judging Committee are final.
7. The machine must complete the challenge assigned by the Judges Committee. This year's specific task and year-specific rules are provided in Section II.
8. The finished machine should, at maximum, have dimensions of 5 feet by 3 feet by 2 feet. This means that the entire machine while operating shall fit and remain completely within an imaginary box whose dimensions are 5 feet by 3 feet by 2 feet. The platform will be included in the machine's dimensions. See Section II for samples of how the machines will be measured.
9. The machine must complete the challenge in 20 steps or more for Senior Division teams and 15 steps or more for Junior Division team.
10. A step is defined as an action that results in another action working towards the final goal of the machine. For example, the act of tipping over a block of wood with a rolling ball is a step. The actual tipping motion of the block is not a step, unless it causes another action to occur. A series of the same actions repeated (such as dominoes knocking each other over or a ball hitting another ball) are considered to be one step.
11. Each step shall be marked (numbered or lettered consecutively) on the machine and a written summary of each step shall be provided to the officials at the registration table on the day of the contest.
12. New materials are those materials that are purchased or donated in new condition. Used materials are those that are being recycled and/or scavenged for use on the machine. Fair market price should be used when determining the value of donated new materials (i.e., Home Depot prices); actual price should be used to



determine the value of purchased materials. A reasonable assessment of the value of recycled/scavenged materials should be used (i.e., Goodwill/yard sale prices).

13. The team must be able to run its machine completely through its steps once, reset it and run it completely through its steps again. A complete run of the machine through its steps once should take at least 30 seconds and at most two (2) minutes. The reset can take four (4) minutes at most. A team member must tell the judging team when the machine is done with each run.
14. Human intervention will not be allowed once the machine is in motion unless the machine is stalled and requires assistance. At most, one human intervention will be assessed for each step of the machine that requires a team member to intervene to complete the step in a given run. If a restart is called after interventions have occurred, the interventions will not count. Any interventions after the restart will be penalized.
15. Any loose or flying objects must remain within the set boundaries of the machine. If a loose or flying object intentionally exceeds the set boundaries of the machine, the machine will be disqualified for safety reasons.
16. Live animals and plug-in electrical appliances are not permitted. Combustible fluids, explosives, open flames, or hazardous materials are not permitted.
17. The machine must not imply profane, indecent, or lewd expressions.
18. Final scores will be based ONLY on the final round presentations and machine operation. Pre-contest and preliminary round scores will not be taken into account.
19. The top-scoring team from each preliminary round group will advance to the final round, along with additional teams (chosen based upon highest total score and as space is available) to fill up to eight (8) final round spots.
20. A restart is defined as a team member telling the judges that they will be discontinuing the machine's operation, resetting the machine and then rerunning it. The restart must be called by a team member before the machine completes its final step and can only be called while the machine is stalled. The team shall identify the machine's final step to the judges during the opening presentation to avoid confusion during the machine operation. Once the final step has been completed, the machine run is deemed final and no restart may be taken.
21. Intentional destructive action against other machines is cause for disqualification.
22. Contestants are responsible for removing their machine and debris immediately following the contest.
23. The contest will not be postponed due to inclement weather.
24. Teachers, mentors, and spectators shall not coach or ask questions of the team during the presentation or in the presence of the judges. Anyone asking questions of the team, or interacting with the team after the judges have arrived or before the judges have vacated the area, will be removed.

## V. Important Dates

<b>Date</b>	<b>Form</b>
January 8 <sup>th</sup> , 2018	Registration Deadline
January 8 <sup>th</sup> , 2018	Conceptual Design Proposal Deadline
January 22 <sup>nd</sup> , 2018	Photographic Progress Report #1 Deadline
February 5 <sup>th</sup> , 2018	Image Release Waiver Deadline
February 5 <sup>th</sup> , 2018	Photographic Progress Report #2 Deadline
February 23 <sup>rd</sup> , 2018	Photographic Progress Report #3 Deadline

	<b>Contest</b>
March 2, 2018	Junior and Senior Engineering Machine Design Contest

## Appendix A: Forms

All forms are accessible at: [mnceme.mnsu.edu/stem-outreach/2018-engineering-machine-design-contest/](http://mnceme.mnsu.edu/stem-outreach/2018-engineering-machine-design-contest/)

## Conceptual Design Form

The Conceptual Design Form will be accessible online at [mnceme.mnsu.edu/stem-outreach/2018-engineering-machine-design-contest/](http://mnceme.mnsu.edu/stem-outreach/2018-engineering-machine-design-contest/) and require the following information:

- Machine Name
- School Name, Address, Phone, and Fax
- Teacher's Name and Email
- Number of Students Involved
- Student Team Leader(s) Name(s) and Email(s)
- Mentor (Optional) Name and Email
- Visual drawing or depiction of machine design concept
- Short description of design concept (i.e. theme, innovative scientific/engineering applications, key step ideas, expected challenges, risks, etc.)

## Photographic Progress Report Forms

The Photographic Progress Report Forms will be accessible online at [mnceme.mnsu.edu/stem-outreach/2018-engineering-machine-design-contest/](http://mnceme.mnsu.edu/stem-outreach/2018-engineering-machine-design-contest/) and require the following information:

- Machine Name
- School Name, Address, Phone, and Fax
- Teacher's Name and Email
- Number of Students Involved
- Student Team Leader(s) Name(s) and Email(s)
- Mentor (Optional) Name and Email
- One or two pictures of machine design in progress
- Summary of activity since last report (i.e. changes in status, information on steps that gave the team trouble, ideas that did not work, improvements to the reliability, innovative scientific/engineering applications.)

## Image Release and Waiver

Please Read Carefully:

I hereby grant the Board of Trustees of the Minnesota State Colleges and Universities permission to reproduce my name, likeness, identity, voice, photographic image, videographic image and oral or recorded statements (hereinafter "Recording") in any publication of the Board of Trustees of the Minnesota State Colleges and Universities intended for research, educational, promotional, fund-raising or other related use, including webpages and web-based publications, associated with Minnesota State University, Mankato.

By signing this form, I waive and release the Board of Trustees of the Minnesota State Colleges and Universities and its officers, agents and employees, from any claim or liability relating to the use of my name, likeness, identity, voice, photographic image, videographic image and oral or recorded statements. I hereby waive any right that I may have to inspect or approve the finished Recording. I understand that the Recording and copyright will be the sole property of the Board of Trustees of the Minnesota State Colleges and Universities.

I acknowledge that the Board of Trustees of the Minnesota State Colleges and Universities will rely on this waiver and release in producing, broadcasting, and distributing materials containing my name, likeness, identity, voice, photographic image, videographic image or oral or recorded statements, and that I will receive no money or remuneration of any kind from the Board of Trustees of the Minnesota State Colleges and Universities related to this waiver and release or the materials covered by this waiver and release.

I further consent to the public release of the Recording for the above-stated purposes, pursuant to the consent provisions of the Family Educational Rights and Privacy Act, 20 U.S.C. 1232 et seq.

I am 18 years of age or older and have read this release before signing below. (If not at least 18, must have the signature of a parent or guardian.) I fully understand the contents, meaning, and impact of this waiver and release.

**Name** (please print) \_\_\_\_\_

**Signature** \_\_\_\_\_ **Date** \_\_\_\_\_

**Address** \_\_\_\_\_ **Phone** \_\_\_\_\_

**City** \_\_\_\_\_ **State** \_\_\_\_\_ **Zip** \_\_\_\_\_

**Project/Event Date** \_\_\_\_\_

**If not at least 18:**

**Signature of Parent/Guardian** \_\_\_\_\_ **Date** \_\_\_\_\_

**Name** (please print) \_\_\_\_\_



## Contest Day Submittals

Machine Name:

School Name:

### *Description of Final Steps (Senior Division – 20+ Steps; Junior Division – 15+ Steps)*

Step 1.	<input type="text"/>
Step 2.	<input type="text"/>
Step 3.	<input type="text"/>
Step 4.	<input type="text"/>
Step 5.	<input type="text"/>
Step 6.	<input type="text"/>
Step 7.	<input type="text"/>
Step 8.	<input type="text"/>
Step 9.	<input type="text"/>
Step 10.	<input type="text"/>
Step 11.	<input type="text"/>
Step 12.	<input type="text"/>
Step 13.	<input type="text"/>
Step 14.	<input type="text"/>
Step 15.	<input type="text"/>
Step 16.	<input type="text"/>
Step 17.	<input type="text"/>
Step 18.	<input type="text"/>
Step 19.	<input type="text"/>
Step 20.	<input type="text"/>

*To list more steps, please add additional lines.*

### **Final Machine Materials**

% of materials in machine that are recycled or scavenged:	<input type="text"/>
Total assessed cost of machine materials:	<input type="text"/>

### **Final Machine Photograph**

*Please attach a photograph of the machine to this sheet.*

## Appendix B: Score Sheets



## Score Sheet 1: Presentation

The verbal presentation takes place during the actual contest. Each team will have a maximum of five (5) minutes to introduce themselves and explain their Engineering Machine Design to a group of judges prior to actually running the machine. Students will then be asked several questions by the judges.

### Sample Questions

---

1. What did this project teach you about science and engineering?
2. How would you make your machine more reliable and efficient?
3. Did all members contribute to the overall completion of the machine?
4. What steps gave you the most trouble?
5. Were there any ideas you tried that did not work?
6. How did you decide upon your theme?

### Presentation Score Sheet

---

1. <b>Engineering</b>	Comments:
How well did the students describe the application of the engineering design process (ask, imagine, plan, create, and improve) to the development of their machine? (Judges enter a score anywhere between 0 and 5 points. Guidelines: Excellent is 5 points; Good is 3 points; Poor is 0 points.)	Score: <input type="text"/>
2. <b>Knowledge</b>	Comments:
How well did the students describe the STEM (science, engineering, technology, and math) principles used in, and answer questions about, their machine? (Judges enter a score anywhere between 0 and 5 points. Guidelines: Excellent is 5 points; Good is 3 points; Poor is 0 points.)	Score: <input type="text"/>
3. <b>Cooperation</b>	Comments:
How well did the students work as a team? (Judges enter a score anywhere between 0 and 5 points. Guidelines: Excellent is 5 points; Good is 3 points; Poor is 0 points.)	Score: <input type="text"/>
4. <b>Overall Presentation</b>	Comments:
How well did the students present their machine to the judges? (Judges enter a score anywhere between 0 and 10 points. Guidelines: Excellent is 10 points; Very Good is 7 points; Good is 4 points; Poor is 0 points.)	Score: <input type="text"/>
<b>Total Presentation Score (0-25 points):</b> <input type="text"/>	

## Score Sheet 2: Machine Operation - Part 1

### Machine steps:

1.	How many steps does the machine have? (Lead Judge enters number of steps. Each step equals 1 point up to a maximum of 20 (Sr. Div.) / 15 (Jr. Div.) points.)	Score: <input type="text"/>
2.	Are the steps labeled on the machine? (Lead Judge circles Y (yes) or N (no). Y = 2 points; N = 0 points.)	Y    N

### First Run Time:

3.	Minimum Run Time – Did the machine operation complete in 30 seconds or more? (Lead Judge enters Y (yes) or N (no). Y = 5 points; N = 0 points.)	Y    N
4.	Maximum Run Time – Did the machine operation complete in less than 2 minutes? (Lead Judge enters Y (yes) or N (no). Y = 5 points; N = 0 points.)	Y    N

### Second Run Time:

5.	Minimum Run Time – Did the machine operation complete in 30 seconds or more? (Lead Judge enters Y (yes) or N (no). Y = 5 points; N = 0 points.)	Y    N
6.	Maximum Run Time – Did the machine operation complete in less than 2 minutes? (Lead Judge enters Y (yes) or N (no). Y = 5 points; N = 0 points.)	Y    N

### Deductions:

		1 <sup>st</sup> run	2 <sup>nd</sup> run
7.	How many human interventions occurred? (Lead Judge enters number of interventions. 3-point deduction per intervention.)	Score: <input type="text"/>	Score: <input type="text"/>
8.	How many restarts occurred? (Lead Judge enters number of restarts. 5-point deduction per restart.)	Score: <input type="text"/>	Score: <input type="text"/>
9.	Did the reset take more than 4 minutes? (Lead Judge enters Y (yes) or N (no). Y = 5-point deduction; N = no deduction.)	Y    N	
10.	Did a loose or flying object unintentionally leave the set boundary of the machine? (Lead Judge enters Y (yes) or N (no). Y = 2-point deduction; N = no deduction.)	Y    N	
11.	Did the machine require human intervention delays to meet the 30-second minimum run time? (Lead Judge enters Y (yes) or N (no). Y = 5-point deduction; N = no deduction.)	Y    N	
12.	Did a teacher, mentor, parent or student outside the 4-person team provide coaching during the run or presentation? (Lead Judge enters Y (yes) or N (no). Y = 10-point deduction; N = no deduction.)	Y    N	

**Sub-Total 1: Machine Operation (Sr. Div: 0-42 points / Jr. Div. 0-37):**

## Score Sheet 2: Machine Operation - Part 2

### Engineering

Question 16 is worth a maximum of 15 points.

13. How much of the machine relies on mechanical (not battery-operated) power?  
(Judges enter a score anywhere between 0 and 15 points.  
Guidelines: 0 points for all battery-powered steps; 8 points if batteries power half the steps; 15 points if no batteries are used.)
- Score:

### Variety of building materials

Question 17 is worth a maximum of 10 points.

14. How much of the machine consists of used/recycled rather than new donated or purchased materials?  
(Judges enter a score anywhere between 0 and 10 points.  
Guidelines: 0 points if no items are used/recycled; 5 points if half the items are used/recycled; 10 points if all of the items are used/recycled.)
- Score:

### Theme of machine

Question 18 is worth a maximum of 4 points.

15. How well is a centralized theme incorporated within the machine?  
(Judges enter a score anywhere between 0 and 4 points.  
Guidelines: 0 points for no centralized theme; 4 points for a well-developed and well-executed centralized theme.)
- Score:

### Machine reset

Question 19 is worth a maximum of 4 points.

16. How efficiently is the machine reset and how well does the team work together to reset the machine?  
(Judges enter a score anywhere between 0 and 4 points.  
Guidelines: 0 points is for an inefficient reset with no teamwork; 4 points is for a very efficient reset with coordinated teamwork.)
- Score:

### Successful completion of task

Questions 20 and 21 are worth a maximum of 20 points.

17. How well does the machine complete the requirements of the task?  
(Judges enter a score between 0 and 10 points.  
Guidelines: 0 points if the task was completed poorly or unsuccessfully; 10 points if the task was completed extraordinarily well.)
- Score:
18. How unique and creative is the approach to achieving the task?  
(Judges enter a score anywhere between 0 and 10 points.  
Guidelines: 0 points if approach to achieving the task is not unique or creative at all; 10 points if the approach to achieving the task is very unique and creative.
- Score:

### Engineering creativity

Question 22 is worth a maximum of 15 points.

19. How creative is the engineering design of the machine?  
(Judges enter a score anywhere between 0 and 15 points.  
Guidelines: 0 points if the machine had no engineering creativity; 15 points if sophisticated engineering creativity was used.)
- Score:

**Sub-Total: 2 Machine Operation (0-68 points):**

## Score Sheet 2: Judges' Comments

What did this team do well?

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In what areas could this team improve its performance?

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General Comments:

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### Score Sheet 3: Score Sheet Summary

This score sheet will be filled out by the Judging Committee.

Score:

1.	<b>Design of Engineering Design Machine (on time: 0-5 points, late: 0-3 points, none: 0 points)</b>	<input type="text"/>
2.	<b>Failing to turn in Image Release Waiver for each team member by due date: 10-point deduction</b>	<input type="text"/>
3.	<b>Photographic Progress Report 1 (on time: 2 points, late: 1 point, none: 0 points)</b>	<input type="text"/>
4.	<b>Photographic Progress Report 2 (on time: 2 points, late: 1 point, none: 0 points)</b>	<input type="text"/>
5.	<b>Photographic Progress Report 3 (on time: 6 points, late: 3 points, none: 0 points)</b>	<input type="text"/>
6.	<b>Failing to turn in Contest Day submittals (step, materials and a photograph) at the registration table on Contest Day: 2-point deduction</b>	<input type="text"/>
7.	<b>Exceeding the dimensional limits: 10-point deduction</b>	<input type="text"/>
8.	<b>Unsportsmanlike conduct by team members: 20-point deduction</b>	<input type="text"/>
9.	<b>Damaging another team's machine or safety infraction: Disqualification</b>	<input type="text"/>
10.	<b>Unsafe machine or intentionally causing loose or flying objects to go outside the set boundaries of the machine: Disqualification</b>	<input type="text"/>
11.	<b>Presentation (0-25 points)</b>	<input type="text"/>
12.	<b>Machine Operation (Sr. Div.: 0-110 points / Jr. Div.: 0-105 points)</b>	<input type="text"/>
<b>TOTAL:</b>		<input type="text"/>