ENGINEERS AUSTRALIA

ENGINEERING GAMES

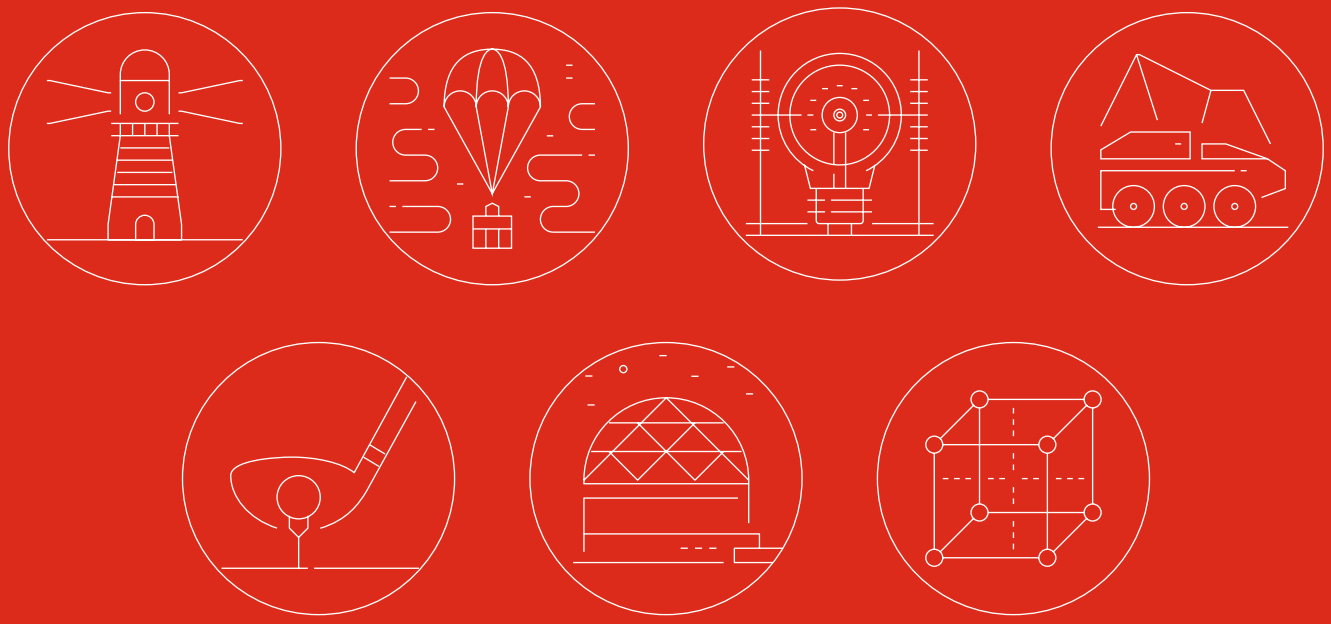
Rule Book

The engineering games provide an opportunity for students to participate in an exciting and challenging competition that demonstrates the engineering processes used in problem solving.

REGISTRATION OPENS
2 JULY 2018
9:00AM

REGISTRATION CLOSES
3 SEPTEMBER 2018
11:00AM

Event: 5 September 2018 | UNSW Canberra at ADFA, Northcott Drive, Campbell ACT 2612 | 5:30-8:00pm



REGISTER HERE

Event Contact: Kiri Robbie **Phone:** 6270 6519 **Email:** canberradivision@engineersaustralia.org.au

ENGINEERS AUSTRALIA

WIN CASH PRIZES
$
1ST - $50
2ND - $30
+ CERTIFICATE

General Information

Details: 5 September 2018 | UNSW Canberra at ADFA, Northcott Drive, Campbell ACT 2612 | 5:30-8:00pm

ENTRY CATEGORY **JP** JUNIOR PRIMARY — YEAR 1 - 4

ENTRY CATEGORY **SP** SENIOR PRIMARY — YEARS 5 - 6

ENTRY CATEGORY **S** SECONDARY YEARS — YEARS 7 - 9

ENTRY CATEGORY **SSC** SENIOR SECONDARY — YEARS 10 - 12

Entry Details:

Devices are to be made prior to the Games night.

Entries may be submitted by individuals or teams of four.

Entries are to be made via the online registration form.

Enquiries:

Phone: (02) 6270 6519
Email: canberradivision@engineersaustralia.org.au

Cash Prizes:

Cash prizes will be awarded on the night (1st - $50, 2nd - $30)

Certificates will be posted to each winner's school.

Registration:

Entries Open: 2 July 2018

Entries Close: 3 Sept 2018

Two days prior to the games. Late registrations will only be accepted if space is available.

School Entries

Schools may be asked to limit entries if a large number of entries are received. Engineers Australia may be able to assist schools if required.

Primary students may be assisted by parents such as teachers and engineers, provided the students do the bulk of the work.

Teams: Maximum 4 students per team. Submit one entry per team including names of team members. Each member will receive a certificate and equal share of prize money.

1. **Straw Tower**
2. **Hover-Craft**

JP + SP ONLY

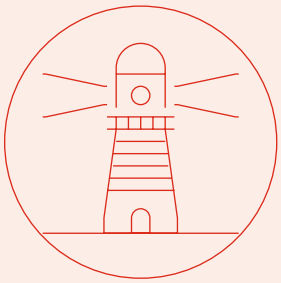
3. **Enlightened Timer**
4. **Mousetrap Racer**
5. **Putt-Putt Coding**

JP + SP + S + SSC OPEN TO ALL

6. **Geodesic Dome**
7. **Spaghetti Bridge**

SP + S + SSC ONLY

JP + SP



Straw Tower

Engineers design buildings that are strong but as light as possible. To succeed in this challenge you must build a tower that has the best load bearing ability; that is, the highest ratio of the load the tower supports to the weight of the tower.

Construction:

All Towers that enter the Games will meet the following specifications:

1. The Tower shall be constructed from standard straight plastic drinking straws - no bendy or thick McDonalds straws.
2. Straws shall be held together with 5-minute epoxy or hot-melt glue
3. Towers shall be more than 500mm in vertical height and should have a top horizontal platform no bigger than 70x70mm
4. Straws may be cut for use as struts, ribs, gussets or sleeve
5. The weight of the tower shall not exceed 60gms
6. Epoxy or glue shall only be applied to the ends of a straw or a cut straw, as shown right:

Note:

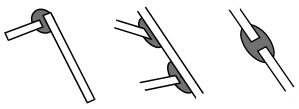
Rule 6 encourages ingenuity in design and development, since it constrains the tower's ability to carry load to the straws and not the glue, which is only meant to hold the structure together. Please observe the spirit of the game.

Towers not meeting the specifications may be disqualified. If in doubt please contact us on (02) 6270 6519.

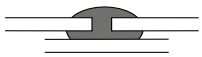
Joint Rules:

Epoxy or glue shall only be applied to the ends of a straw or a cut straw:

These joints are **ok**:



This joint is **not ok**:



Testing:

The first will require the towers will be loaded up to their point of collapse.

Competitors will be required to load their own towers with test weights.

Test weights will be provided for the games' night and will consist of metal plates 75mm square of differing thicknesses, as follows:

5 plates of 50g; 10 plates of 100g; 15 plates of 500g; 1 plate of 2kg

Competitors will be expected to start loading their towers at 2 kg.

Prizes:

First and second prize in each category will be awarded for the tower which has the highest load-to-weight ratio.

Note: For environmental reasons, this will be the last year we run this game using plastic straws

JP + SP

Hovercraft

Engineers involved in aerospace design want maximum flight performance from minimum power. The same challenge confronts you in the 'Hovercraft' competition. Hovercrafts are interesting flying machines in that they lift themselves off the ground on a cushion of air.

Object:

The object of this game is to build a craft that uses a CD as its base, is powered by a single balloon and travels the furthest distance from a launched start. In this game all the air from the balloon is used to support the hovercraft.

Testing

The test course will be one metre wide with a one metre square starting zone. The hovercraft is released from a launcher.

The distance is measured from the start line to the point where the hovercraft comes to rest. If the craft moves outside the one metre wide course the distance is measured to the point that it leaves the course.

Each hovercraft entered will be allowed one trial run and two measured test runs. If there is a tie, the heaviest machine will win.

Testing Cont.:

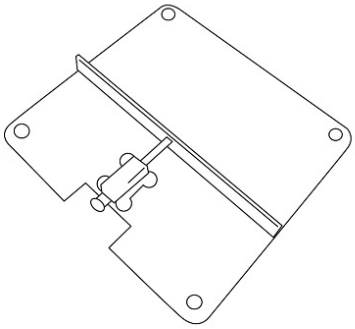
Each contestant will be provided with two balloons for use during testing.

Only one balloon can be used at a time but the balloon may be changed between test runs.

Only two balloons per entrant will be supplied so if both balloons are destroyed no further test run(s) will be possible.

Test Course:

Measurement of the launcher: 65mm wide and 30mm deep. The gap between the launcher and the floor is about 4mm.



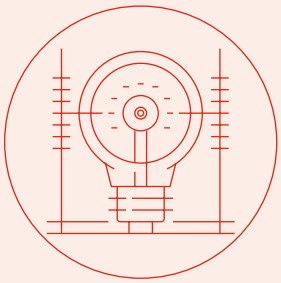
Construction:

The base of the hovercraft is to be a music or computer CD. You can use whatever other materials you wish. The hovercraft is to be powered by one standard round party balloon. Two balloons will be supplied to each entrant at the games for use during testing so your design must allow for the balloon to be easily attached.

Prizes:

1st and 2nd prize will be given for the craft that travels the longest distance from the launcher.

JP + SP + S + SSC



Enlightened Timer

The aim is to build a timer that will keep a lamp on for approximately 30 seconds. The lamp can be turned on for the start of the "thirty second" period either by the entrant throwing a switch or removing a screen, or turned on by the timer itself.

Ingenuity:

A first and second prize will be awarded to the most 'ingenious' devise that completes the task to the satisfaction of the judges.

As we are looking for ingenuity, the device cannot be wholly electronic or a simple electronic clock motor.

Construction:

1. All timers that compete in the Engineering Games must meet the following specifications.
2. The lamp (provided by each entrant) must be of the filament type and battery operated (typically as used in a torch).
3. The timer cannot be wholly electronic or a simple electric clock motor and MUST NOT be operated from the 240 volts' mains supply. It could be a mechanical, pneumatic, water flowing out of a bottle, a ball rolling down an inclined plane, or any ingenious combination of devices.
4. Once the lamp has been turned on, either by the entrant or by the timer, the entrant must not operate or adjust the timer before the lamp is turned off.

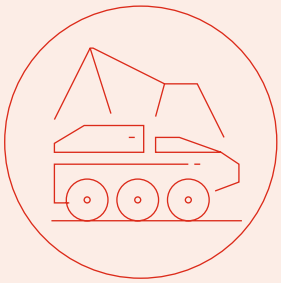
Testing:

1. A timer will measure the time between when an entrant's lamp is considered to be turned ON and when it stops emitting light.
2. Each entrant will be allowed two attempts for their timer to turn the lamp off.

Prizes:

1st and 2nd prize will be given for the most ingenious non-electronic/ electrical timer that will turn the lamp off approximately 30 seconds after it is turned on.

JP + SP + S + SSC



Mousetrap Racer

Engineers are working to make vehicles efficient, so they go as far as possible with the least use of fuel. To succeed in this challenge your racer must go as far as possible using the energy stored in the mousetrap spring.

Construction:

All mousetrap racers that compete in the Engineering Games must meet the following specifications:

1. The mousetrap (not rat-trap) must be of the "AUSTRAP" brand and have an unmodified springmechanism and plastic deck. The mousetrap's release mechanism may be removed.
2. The vehicle can be made of any material and may be a modified commercially available toy.
3. It must be propelled by energy stored in the springmechanism.
4. It must be able to start itself from rest without a push.
5. The mousetrap must be carried with the vehicle.
6. The linkage between the mousetrap mechanism and the vehicle drive mechanism is not to bemade of elastic material.
7. The vehicle may be steered during its time of travel by tapping it with a stick (Entrants to provide their own stick).
8. The vehicle is to remain in contact with the ground at all times.

If in doubt please contact
Engineers Australia, Canberra Division
Phone: (02) 6270 6519

Testing:

The speed trial and the distance trial will be conducted over a flat concrete or tiled surface inside abuilding. It may not be perfectly horizontal. There may be grooves or small gaps between tiles. The tiles may be polished.

For the speed trial, the start and finish line will be 10 metres apart and marked with tape.

The vehicle is to start from rest at the start line.

Vehicles not meeting these specifications may be disqualified.

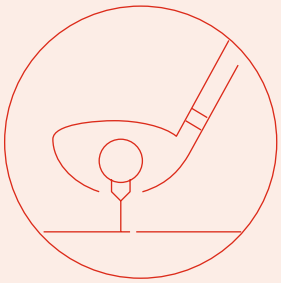
Prizes:

First and second prize in each category will be given for:

1. The vehicle taking the shortest time to reach the finish line (the fastest).
2. The vehicle that comes to rest the furthest distance from the start line (the longest).

Competitors may enter separate mousetrap racers in the speed trial and the distance trial.

JP + SP + S + SSC



Putt-Putt Coding Challenge

Due to an extreme drought event, all putting greens have been closed. To satisfy the training needs of aspiring golfers you have been tasked with generating a putting simulator.

Introduction:

The tool with which you are asked to make this simulator is:

Scratch: https://scratch.mit.edu/

This will require you to set up a scratch account with your school/personal email. Once this is done you will have access to this tool if you have access to the internet.

If you are logged into Scratch, you can begin coding by going to the "My Stuff" page available under your username.

To begin generating code a 'sprite' must first be created as each sprite has its own assigned code. In this case, we want a ball sprite to move around. Some pre-set sprites are provided and will be enough to get started.

Construction:

There are 4 main parts to the basic structure of this simulator:

1. Player Input, **2.** Movement Control, **3.** Collision Control and **4.** Ball Sinking.

Player Input:

1. To set the initial speed and direction of the ball sprite, some form of user input must be selected. This sprite must always be waiting for the user input you elect to use. A good place to start is placing the input control inside a 'forever loop.'

Movement Control:

2. A computer can simulate movement by changing the position of an object by a certain amount every cycle of a loop. Once you've figured out how to set the initial speed you need to relate that speed to the number of 'steps' the ball might move.

   A golf ball will also slow down gradually as it rolls along a putting surface. So, the speed of the ball needs to decrease (take less steps) as it rolls. The movement loop will also need to terminate once the ball speed has decreased below a discernible movement. An 'if then' loop would be good for controlling the movement.

Collision Control

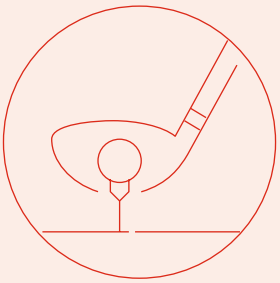
3. To make the putting more challenging obstacles can be used to obstruct a clear path to the hole. The ball will need to bounce off these object sprites by altering the direction of the ball when they are touching.

   Two simple obstacle types can be used to build more complex ones, namely vertical and horizontal walls. These will have two distinct effects on the direction of the ball. Consequently, two different rules will need to be defined for the vertical and horizontal wall bounce. Investigating how direction is defined under the motion tab will be helpful here.

Ball Sinking:

4. To complete a hole, there must be a way to discern whether the ball has been sunk. A good method to use here is comparison of the ball and hole position.

JP + SP + S + SSC



The tool with which you are asked to make this simulator is: Scratch: https://scratch.mit.edu/
There are four main parts to the basic structure of this simulator:
1 Player Input 2 Movement Control 3 Collision Control 4 Ball Sinking

Game Improvement:

After completing points 1 to 4 you should have a simple golf simulator on your hands. From here, adding features and optimising your established code will improve your chance at a prize.

Some improvements may include; adjusting the user control to make it more user friendly or adding audio to enhance the experience.

There are a multitude of options to improve your game. Use the criteria for prizes to guide your development.

Submissions:

Due: By COB 3 September 2018

Provide the online link and password (if required) of your game to the below email no later than 5pm, 3 September 2018 to allow time for judging prior to the Games.

Email: canberradivision@engineersaustralia.org.au

Prizes:

First and second prize will be announced and awarded on the day.

There will also be a 'Crowd Favourite' prize chosen from the top three games.

Criteria:

The below criteria will be used to score the games:

1. **Level Design:** The size and coherence of the game itself
2. **Gameplay Smoothness:** How reliably does the game perform as intended?
3. **Control Design:** Does the control layout make sense?
4. **Instructions:** Are instructions provided/ are they helpful?
5. **Code Complexity:** Is it conceivably over complex for the achieved result?
6. **Audio Appropriateness:** Does the audio (if provide) compliment the visual style of the game?

S + SSC

Geodesic Dome

A geodesic dome is a framed building made particularly strong by using interconnected triangles forming a sphere or partial sphere (3D arch). Your aim is to construct a geodesic dome that is as light as possible but which will still support a certain load at the top.

Construction:

All geodesic domes that enter the Games shall meet the following specifications:

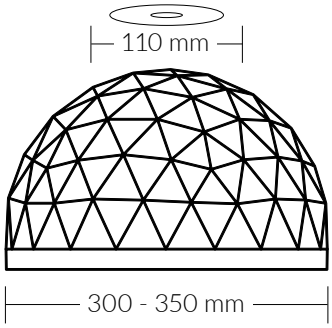
1. The dome shall be constructed from straight, plastic drinking straws - no bendy or thick McDonald's straws.
2. Straws shall be held together with 5-minute epoxy or hot-melt glue.
3. The base of the dome shall fit within circles of 300 and 350 mm diameter, touching the ground all the way round (at least in unloaded state).
4. The top of the dome can be at any height but must look dome-like and must be of such a shape as to support the applied weight.
5. Only single straws can be used for the sides of the triangles and the gaps cannot be filled in.
6. The Geodesic Dome needs to be glued at the top to a 110mm disc (CD) with liquid nails.

Testing:

The entries will be weighed and recorded by the scrutineers prior to testing.

Weights of 2kg, then (after 5 seconds) another 2kg, then 1kg, making a total of 5kg will be successively applied by a team member at the apex (TOP) of the dome.

The dome passes the successive load tests if it does not collapse within 5 seconds each time.



Prizes:

A first and second prize in each division will be given to the non-collapsing entries with the highest load to weight ratio.

If none pass the 5kg test, then the 4kg test will be used, and then 2kg. (If none pass the 2kg test, no prize will be awarded.)

Note:

For environmental reasons, this will be the last year we run this game using plastic straws

S + SSC

Spaghetti Bridge

Bridges are an important part of our roads and railways because they make it possible to cross rivers and deep valleys. A bridge has to support its own weight as well as the weight of the cars and trains that cross it so it should be as light as possible.

Games:

To win this competition you must use uncooked spaghetti and glue to build the lightest bridge that can carry the design load.

The diagram shows the arrangement that will be used to test your bridge. The bridge shown below is only an example, you can use any design you wish but your bridge MUST be 648mm long (at the bottom) and be able to support the road 102mm above the base of the bridge. The road is 80mm wide.

These dimensions are important because your bridge must fit into the 'test rig' or it will be disqualified.

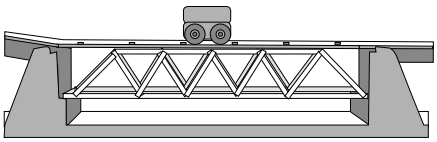
The roadway is made of aluminium, weighs 0.9kg and is hinged in 5 places across the bridge and at each end.

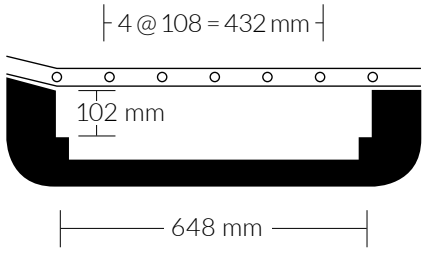
The 'car' (which also weighs 0.9kg) will be allowed to run down the small hill on the left and across the bridge. To pass the test the car must reach the other side without breaking the bridge.

Construction:

The bridge must:

1. Be 648mm long (at the bottom).
2. Support the road 102mm above the base of the bridge. The road is 80mm wide.
3. Be constructed using only thin spaghetti joined with a suitable glue.





Prizes:

First and second prize in each category will be awarded for the lightest bridge which allows the 'car' to travel across the 'river' safely.

Note:

That the bridge is supported at each end on a strip that is only 15mm wide and that the bridge length is measured to the centre of each strip.

It is important to ensure that the ends of the bridge are square to the centreline of the structure and the length at the base is very close to the nominated length of 648mm.

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AUSTRALIA

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