

- «Cacao-Domino Machine»
- Team design

FINAL

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## Please, read it first!

Please firstly check if no pages are missing, all pages have been printed correctly and are fully readable. Find out your safety-rules sheet read it first, sign after that and give it to organizers.

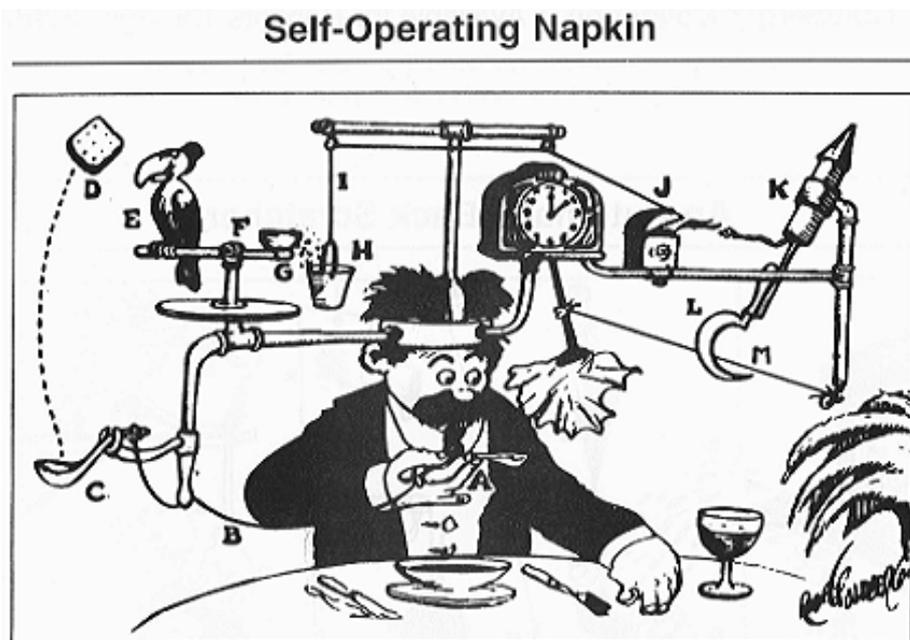
If everything is fine, please read the descriptions carefully and afterwards you can start completing your assignment.

## Introduction

The term *Rube Goldberg Machine* refers to a device, which achieves a simple task by using a complex set of actions. The machine is named so after Reuben Lucius Goldberg (1883 – 1970), a Pulitzer Prize winning cartoonist.

In his early years, Reuben Goldberg used to be an engineer, and invented some bizarre machinery, which, as he said, were a “symbol of man’s capacity for exerting maximum effort to achieve minimal results”.

The machines he drew would use simple household appliances, gadgets and even live animals, combining them in a complex and wacky way, but still having a very logical progression in the operation of the machine. One good example of such machine would be the self-operating napkin shown below.



As funny as a Rube Goldberg machine may seem, it uses advanced engineering knowledge, requires good understanding of energy storage and transfer, and demands absolute precision from its creators. Making one is a task for a real engineer.

## Objectives

The goal is to develop a machine for the preparation of cocoa\*, based on the principle of Goldberg. The machine should start its work by the collapse of several dominoes, and one of the actions necessarily should be the preparation of cocoa in a cup.

Between these actions, your machine must perform various mechanical actions on the Goldberg principle, without any human contact. You will have limited materials for making your components. During demonstration you will have a table (1500 x 3000mm) for your machine. Working of your machine can not last more than 5 minutes.

\*The hot water will be given to you.

## Missions

### Start

In fact, we did not just come up with the idea this task. Every time when the team of organizers is just going to do EBEC, we just as you, need to come up with a name for our team, but we still need to start with something. Everybody knows that it is a good idea to start with simple things. For example, with a domino!

Activate your Rube Goldberg machine manually. The time starts counting when you crash the first domino.



### Between beginning and the end

Like all our competitions, your task consists of many components, so we will force you to pass fire, water and copper pipes! You can choose between five elements: water, fire, electricity, rotation and air. Using each of these elements in your machine will allow you to score additional points. The more you use, the more additional points you receive.

## Element 1: Fire

- The element is considered completed if the fire of the candle is being used to continue some mechanical action and doesn't stop immediately afterward.
- You will get a Precision Point, if the candle goes out when the element is completed.
- The candle and the candle support will be provided by organizers and can't be damaged or modified. One candle will be provided for trial testing during working time.
- On the final test a new candle (with the same characteristics) will be provided.
- Candle, given by organization, must be situated in a certain and visible part of the device in order to be evaluated.

## Element 2: Water

- Your element is considered completed, if you add any water flow which leads to the USEFUL movement in your machine.
- You will get a Precision Point, if water doesn't get out of your stand.
- Water will be provided by organizers and can't be damaged or modified.

## Element 3: Rotation

- This element is considered completed, if you produce movement in your machine using rotating parts.
- You will get a Precision Point, if you use at least 10 seconds one part of your system rotates.

## Element 4: Electricity

- This element is considered completed if the electricity is being used to continue some mechanical action.
- You will get a Precision Point, if you use electric motor in your machine.
- The batteries will be provided by organizers and can't be damaged or modified.
- A soldering iron and solder will be provided by the organizers.

## Element 5: Air

- This element is considered completed, if one of the elements of your machine makes some movement without touching any part of your machine (in simple terms: flies).
- You will get a Precision Point, if you have TWO such elements in your machine.
- The air will be provided by university and will be equal.

## The End

Well, in the end, we thought that after a really hard day it would be nice to finish it all with a cup of good hot cacao! Well, since we made such a long way from dominoes to cacao, then we would tell you the secret that we named this task in honour of the name of our team "**Cacao-Domino**"! We worked really-really hard to meet you here and give you a chance to show the whole university, companies and most importantly yourself, that you are really cool engineers. We sincerely believe and hope that our work will not be wasted, and all of you will really like it. So forward to Victory!

## Evaluation criteria

In this table you can see how many points and for what you can get.

Criteria	Points									
	1	2	3	4	5	6	7	8	9	10
Duration of working (sec)	6	12	18	24	30	36	42	48	54	60
The highest point of the machine*(cm)	10	20	30	40	50	60	70	80	90	100
Times of the changing the type of movement	2	4	6	8	10	12	14	16	18	20
Elements used**	1	2	3	4	5	6	7	8	9	10
Creativity	1 – 10									

\*The highest point counts from the surface of the presentation table. This point can not be the first dominoes, or the elements which touch them or goes as action after them.

\*\* 5 points for elements + 5 Precision Points.

## Rules

### General Rules

- Any help from outside of the team is strictly forbidden (including communicating with other people via Internet (apart from Topic Group), mobile phones, or other means).
- You can only use tools and materials provided by the organisers.
- Your team has to respect other teams (TD and CS) and their work during all competition time.
- Please respect the schedule. You are able to work on your design only during the given time. During lunch you will have to leave the working room and you will not be allowed to work on your design.
- Using of computers, mobile phones and any internet-enabled devices is strictly forbidden during working time.
- Make sure you clean your working space before presentation.
- If you don't respect all the rules your team will be penalized.

### Materials and Shopping Procedure

- You can use any of the materials provided to you. In addition, there are certain materials, which you can acquire from the Shop.
- During the first 40 minutes of the working time, you are required to check whether you have all the materials listed in the list of materials are provided to you. Check also whether all electrical equipment works. If the checking procedure reveals that anything is missing or doesn't work, then the respective materials will be provided/changed. Any complaints after the first 40 minutes will be ignored.
- To purchase the materials from the Shop, send one team representative (with his name tag) to the Shop.
- Destroyed, used or lost materials will not be replaced for new ones under any conditions.
- All the materials provided to you and all materials available in the Shop, as well as their quantities, are listed in Annex 1.

### Tools

- You can use any of the tools provided to you. In addition, there are certain tools, which you can borrow from the Tools Shop.
- If you want to use some of the tools from the Shop, send one team representative (with his name tag) to the Shop and borrow the tool. You must return the tool within certain amount of minutes. If the tool is not available, you will be placed on the waiting list.
- Tools cannot be used as materials or damaged in any way.
- All the tools available for use are listed in Annex 2.

### Presentation Rules

- Make your presentation as creative as possible so you can get additional points for it.

## Penalties and disqualification

- If the team does not follow the rules mentioned above, the team will be penalized.
- The extent of the penalties is up to EBEC organizers and may in severe cases result in the team's disqualification at this task.
- The jury reserves the right to give extra penalties as they see fit. These penalties may have the form of disqualification of the team, the invalidation of the test or simply the deduction of points from the final score.

**For any doubts about the rules ask only EBEC organizers.**

## Final tests

For the final testing, all participating teams will be gathered in the demonstration hall, and each team will be allocated their area for assembling the Cacao-Domino Machine.

Each team has to bring all the components and any other materials that they need to assemble their Goldberg Machine to the presentation hall before the beginning of the presentation (1 hour before).

The assembly of the machines will start simultaneously for all teams. The machines need to be assembled within 60 minutes at most.

When all teams have finished assembly, the final tests start, according to the order of the teams defined in the first presentation of the topic.

The time for Testing is limited to 7 minutes at most. During this time you are allowed and required to explain to the jury how your machine is working. Jury is allowed to ask questions. This will count as your presentation of the task.

If during the First Testing you encounter some problems that require major readjustments in order to complete all the steps described in your presentation (for example, some structural part breaks), you are allowed to have the Second Testing. You will have 10 minutes at most to complete the readjustments – this time will be controlled by a referee.

Your Second Testing will take place after all teams have finished their First Testing. There will be no Third Testing.

If you make a Second Testing, then the result of the First Testing is ignored completely, even if the result of the Second Testing is worse than the result of the First Testing. This means that you should only make the Second Testing if you are sure that you are able to make improvements to your prototype. You can always abandon the Second Testing till the moment when you trigger the prototype for the Second Testing.