

Thursday, Jan. 26, 2017

Sego Lily
STEM Fair

3 STEM Fair Processes to Choose From

- **The Scientific Method process:** Using this process you will: write a question; form a hypothesis; plan an experiment, write a conclusion
- **The Engineering Design process:** Using this process you will: define a need for the product; connect the need to a design goal; design and test your results, then re-design as needed, and connect to real world situations.
- **The Computer Design process:** Using this process you will: define a need for the product; connect the need to a goal, write up a series of operations, test, rewrite, then apply to a real world situation.

What is a Science Fair Experiment?

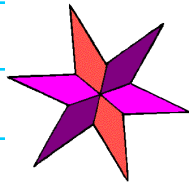
- A science fair experiment gives you the opportunity to gain hands-on experience and knowledge in an independent field of study.



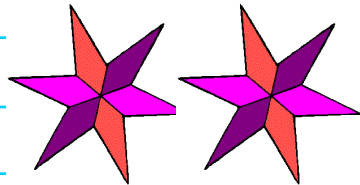
Steps in preparing a Science Fair Project

- Select a topic: Believe it or not the hardest thing you will do in preparing a science fair project is to come up with a topic.
- Come up with an idea list by doing a lot of brain storming. Think about things that you are interested in and things that you feel would be worth learning about. Be creative!
- Remember a Science Fair project is a test you do to find the answers to questions. It is an experiment. It is not just showing what you know about something.

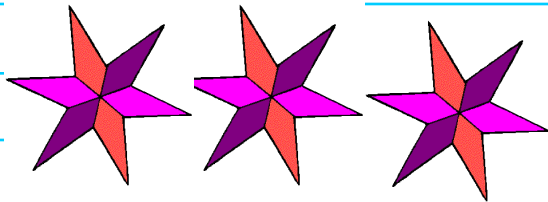
Judging: Four Star Requirements



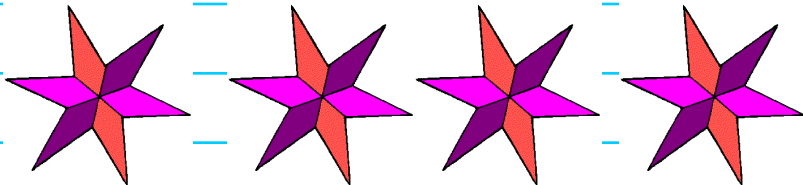
- Star 1: Project Board



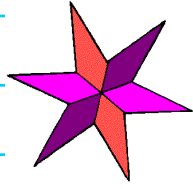
- Star 2: Science Investigation



- Star 3: Science Notebook

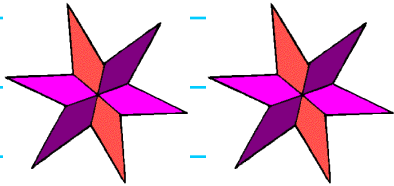


- Star 4: Data Table, Graph



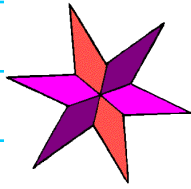
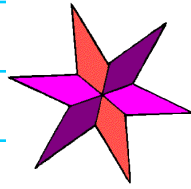
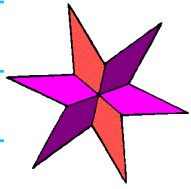
Star One

- Title
- Question
- Hypothesis
- Experiment Plan
- Controlling variables
- Results
- Conclusion



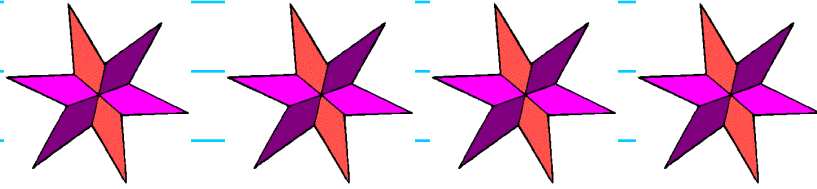
Star Two

- You should show that you have actually conducted a scientific investigation.
- You should be able to explain it to the judge.
- Follow the scientific method: question, hypothesis, steps, results, conclusion.



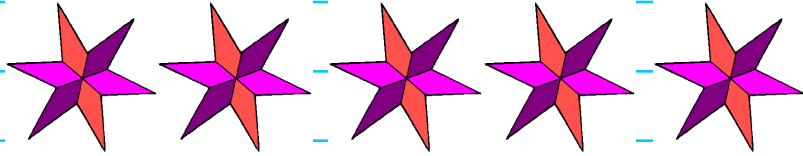
Star Three

- Follow the guidelines in your packet.
- Be sure to include your research with at least three sources or interviews
- Include your records and data.
- Bibliography



Star Four

- Include at least one data table.
- You should have at least one graph.
- These should be neatly done (computer recommended). Use your creativity!



Hint for a Great Project!

If you want an
absolutely great
project, speak to an
expert in your
project field.

Need Project Ideas?

There are many websites and books to check. Be sure your project is a little different than those you see online.

www.sciencebuddies.org

Simplicity

- Keep things as simple as possible
- Remember only one variable!
- Example: If investigating the effects of freezing temperature on plants, don't add different lighting.



Controls

- You need a standard control to see what would happen normally.
- Use this to test your experiment against.
- Example: If investigating the effects of freezing temperature on plants, keep some plants in the house, some outside to compare them to.



Sample Size

- Have “several” to experiment with.
- Don't just use “one of each” for your experiment



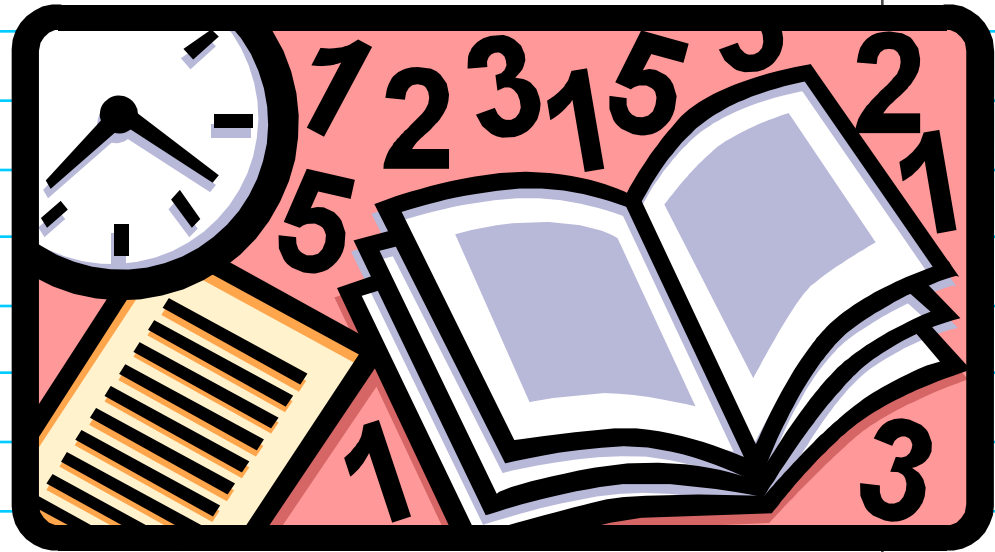
Time

- Allow enough time for your experiment to be repeated (at least three times).
- Begin as soon as possible!



Keep a detailed notebook

- Put the date on everything!
- Include all observations.
- Your journal must include more than just a copy of what is on your board.
- You must have at least 4 entries.



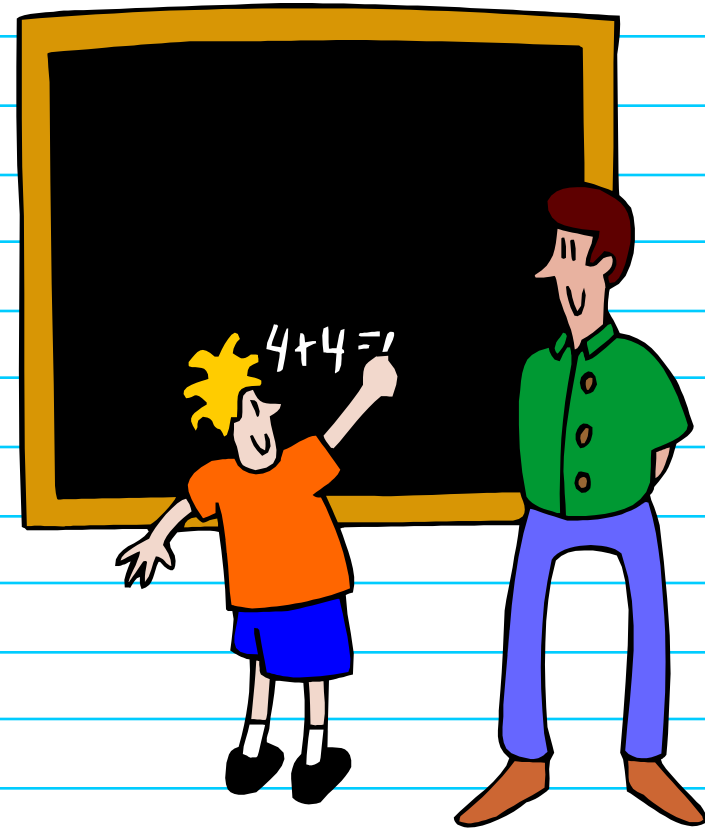
Collecting Data

- Quantify data, which means reporting things in numbers.
- Example: It bounced 25 centimeters.
- Use metric measurements
- Keep a data table



Formulating a Conclusion

- Report your findings.
- If your experiments didn't prove your hypothesis, it's still a success.
- Explain why it did or did not happen the way you expected it to.



Understanding the Scientific Method is Important

- Help yourself by understanding the scientific method. The scientific method is a set of ideas that scientists use to investigate things that they want to understand better.
- By using the scientific method you can be sure you're carrying out your project correctly.
- Know the steps in the scientific method.

The Steps of the Scientific Method are:

1. The Problem - the problem or question for which you are seeking a solution.

Research - the process by which you gather information by consulting libraries, instructors, professionals, or scientific organizations.

2. Hypothesis - an educated guess about the solution to the question which will guide your experiment.

3. Experiment Plan: Your procedure, including all steps.

4. Experiment - testing your hypothesis to see if what you thought would happen really does happen. Repeat 6 times!

5. Results: You explain what you found out.

6. Conclusion - the solution to your proposed question and proof or disproof of your hypothesis.

Gather Background Information

- Gathering information provides you with both knowledge. In your research you will have access to books, magazines or professional papers. You will have access to the most powerful form of information today in the use of the Internet. There are professionals and companies that can help you in your research.
- Make sure that you keep good notes, and write down the books, magazines and Internet sites. Providing this information will help the judges recognize what a great job you have done on the research that you did.

Gathering Research Information

- As you think about your question, think about what kind of experiment you could do. The more information you can find on your topic the better chance you have of addressing your problem with facts.
- Using your research information will help you design the type of experiment you want to conduct. It will also help you prove or disprove your hypothesis and determine variables needed in your project.

Record Research Information

- You must include a bibliography of your research. It is recommended to have at least 3 sources.
- Examples of sources:
 - Internet
 - Interview with teacher, parent, or scientist
 - Book
 - Magazine article

Your Hypothesis

- Now that you have thought about your question or problem, you need to make an educated guess as to what you think the answer to that question or problem would be by stating a *hypothesis*. The hypothesis is an educated guess that you make about your question or problem based on what you have found in your research. It should be stated as an “if ... then” statement and include “because . . .”
- Example: If the water is colder, then goldfish will be more active because fish usually live in colder water.

Using Variables and Controls

- Those items or conditions that change during an experiment are called variables. In the case of the goldfish, the variable is the temperature of the water. It is measured with a thermometer. The controls are those items or conditions that remain constant throughout the experiment. The controls in the goldfish experiment are the fish, the bowl, and the amount of water.
- Understanding your variables and controls is important in the judging of your project. This will help the judge as they look at your project to see if you understand what you have done.

The Procedure

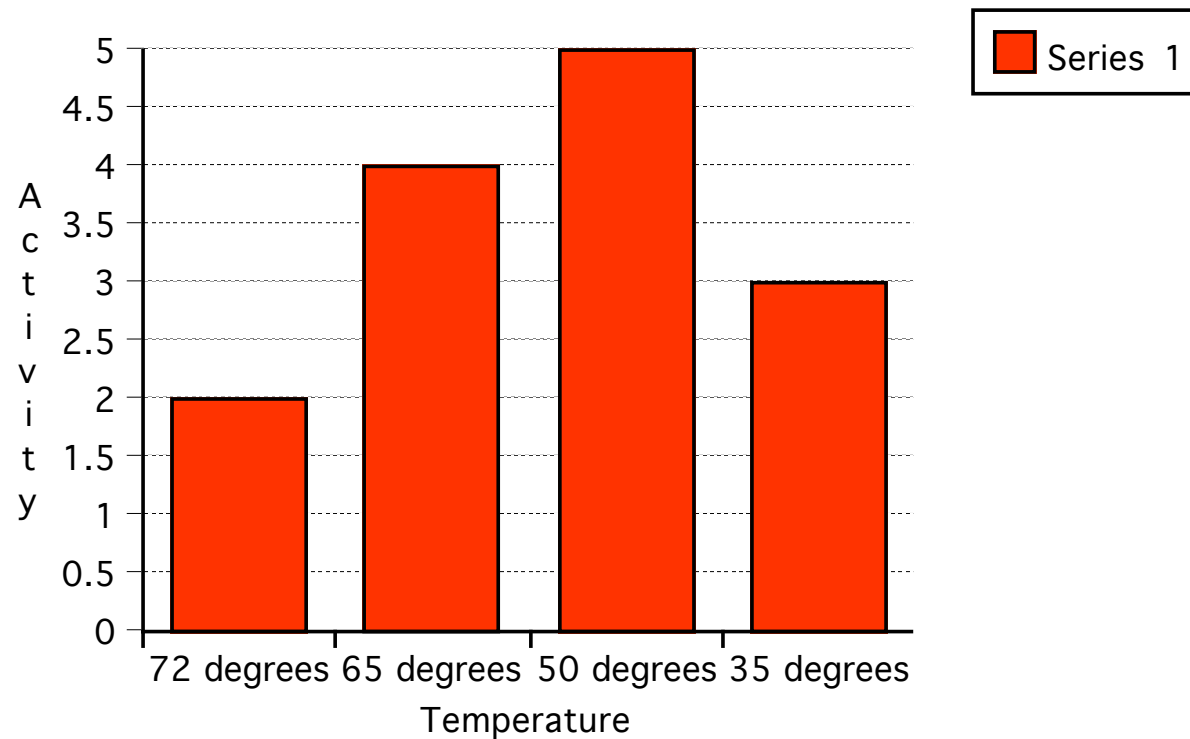
The procedure is a set of step-by-step directions to be carried out in your investigation. It is a method of obtaining data to be used to solve the problem. Going through the procedures once is called a trial. At least **three or more** trials per investigation are recommended to enhance the accuracy of the data. The values of each trial are added together and divided by the number of trials to give an average value for a set of trial runs.

The Data Collection

- These are the measurements and observations that you have collected during your research.
- In the case of the goldfish experiment you would document the water temperature with a thermometer, and then you record the fish activity that is observed at various water temperatures.
- This information should be recorded in organized charts and tables.

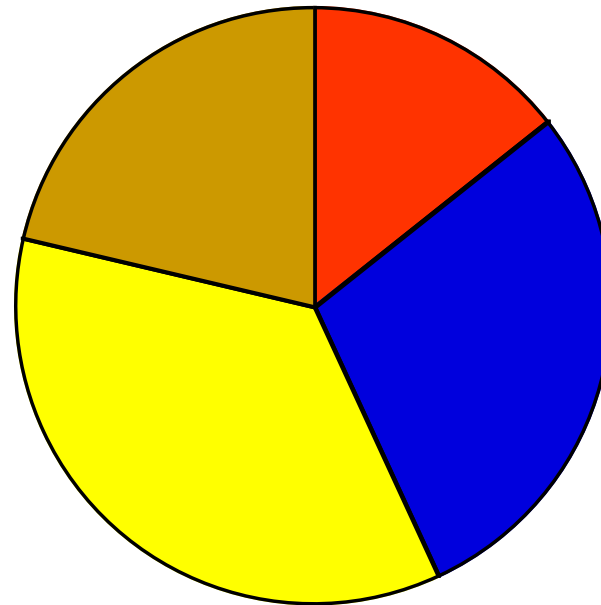
Graphs and Charts

- *What happened? Answer that question, then put the results in graphs and charts.*

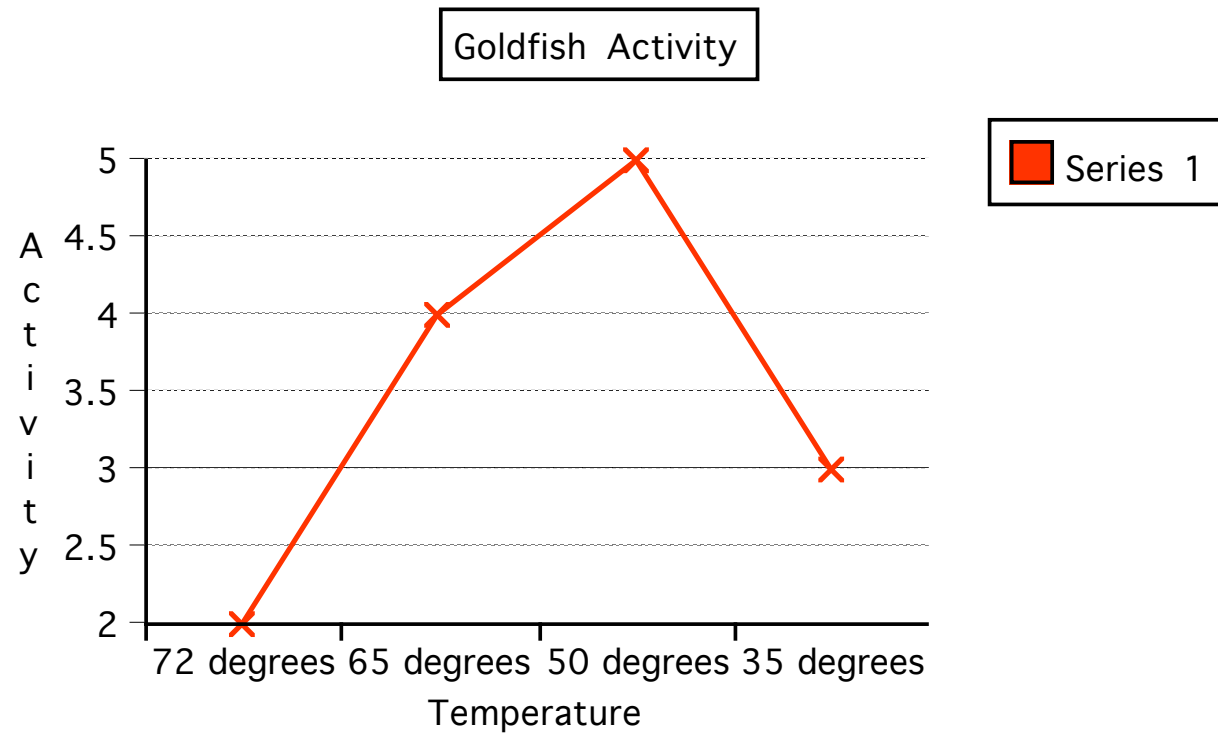


Pie Graph

Activity of Goldfish



Line Graph



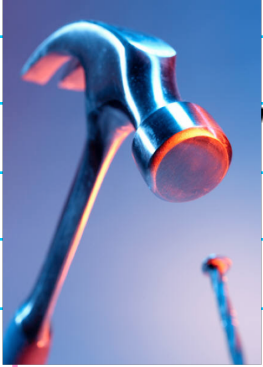
Your Results

- Your results would be what happened in your experiment which you can describe in words, display in graphs and charts, in a demonstration, or with the help of computer simulations.
- Your results are important to the judges because they want to see if you were able to answer your question. They want to know if your research supports or rejects your hypothesis and pulls it all together.


Your Conclusion

- This is an evaluation of the findings of the experiment. It may or may not support the hypothesis established earlier in your project.
- Your conclusion should give the final information on your project. **It should answer your question.**
- It should convince the judges that you have done your homework and answered your question.

Engineering Design



Engineering is the designing, building, and testing of a made-at-home product. It is the invention category of the science fair. After a prototype is built, it needs to be tested to see if it works. The data is analyzed. Adjustments are made. This process of redesigning and making adjustments continues. **The prototype cannot be made from a kit.**



What do engineers
do?



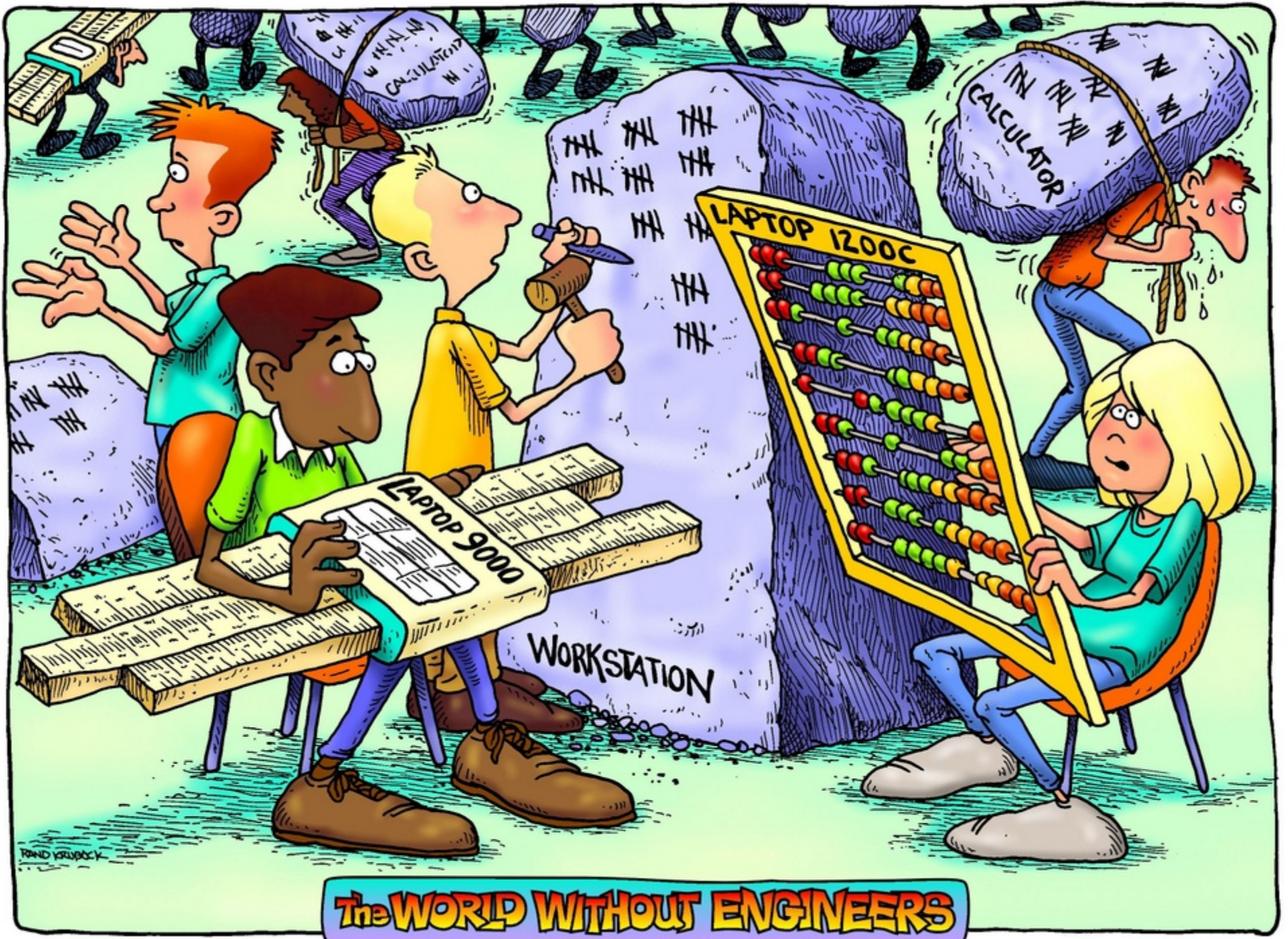
The World Without Engineers



The WORLD WITHOUT ENGINEERS



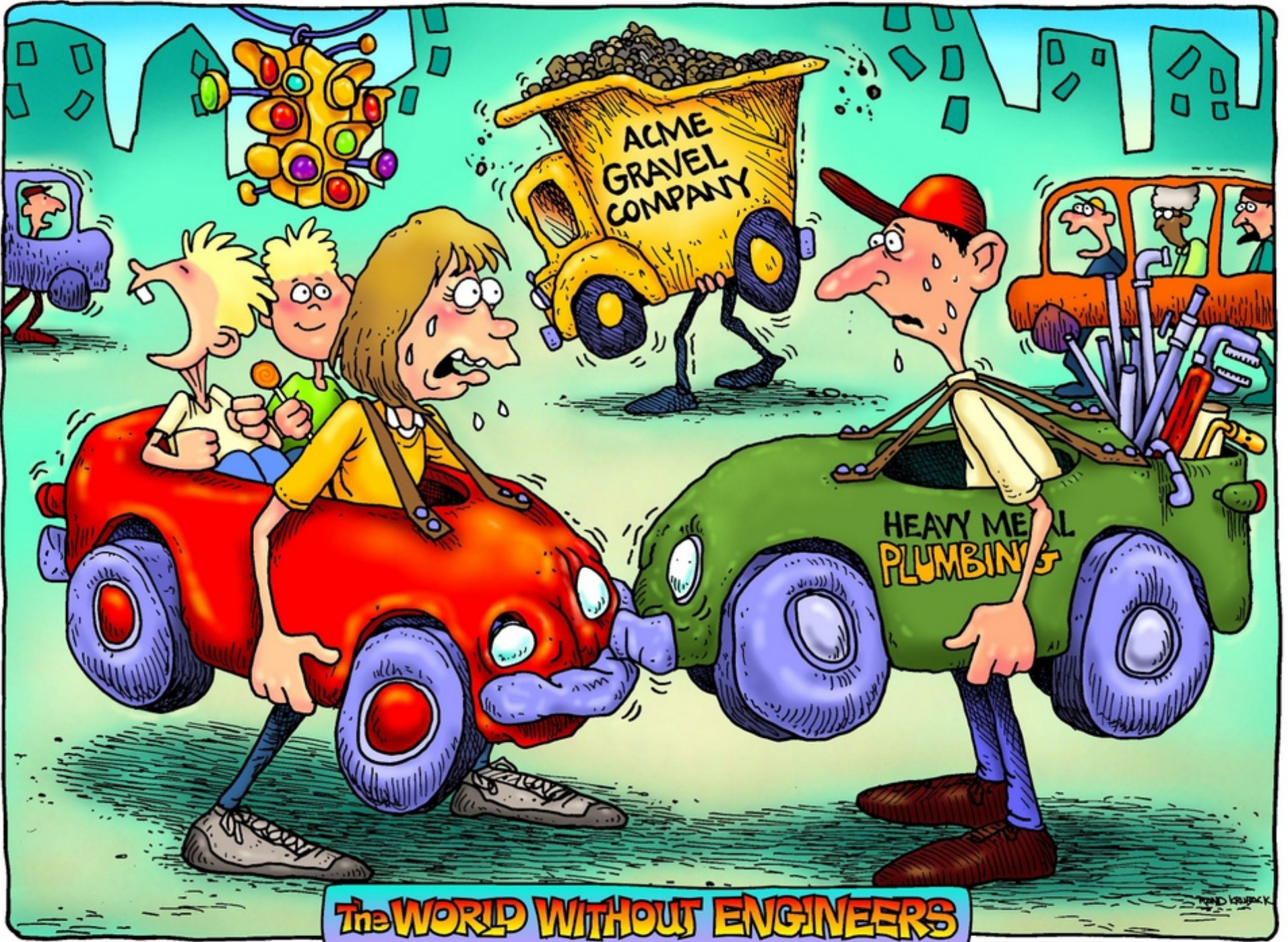
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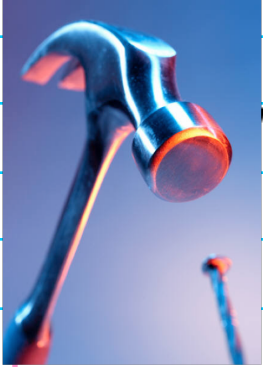
The WORLD WITHOUT ENGINEERS

Engineers are Inventors!

- Engineers use science and math to solve real world problems!
- What are some of the types of engineers you've heard of?
- Possibly:
 - Chemical, electrical, mechanical, software, civil, biomedical, and environmental. AND MANY MORE!

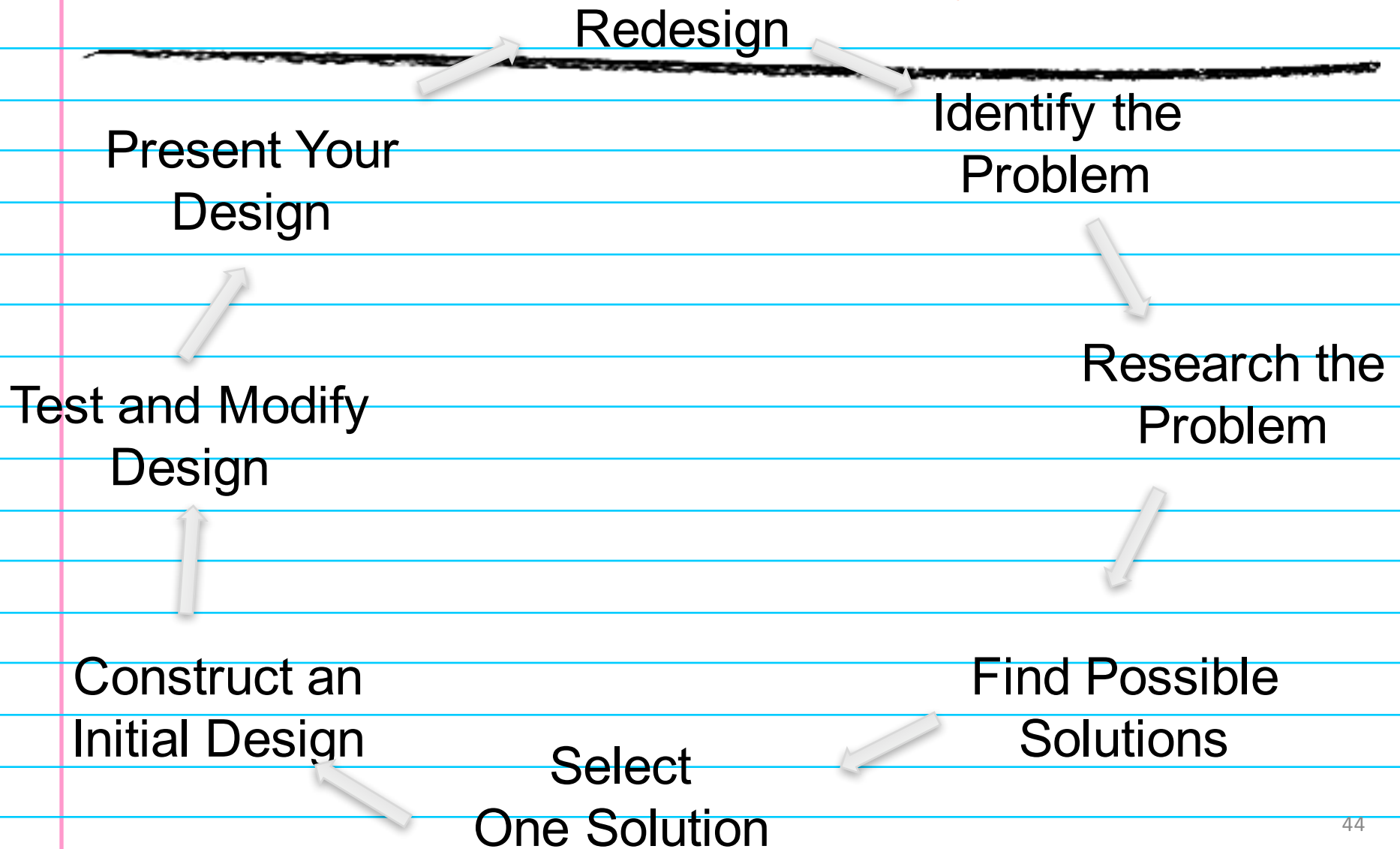
Look around you, virtually every manmade contraption you see was conceived of and created by an engineer!

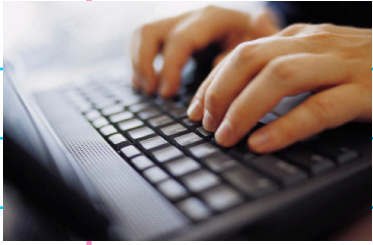
Engineering Design



- ◆ Define a Need
- ◆ Research
- ◆ Design Requirements
- ◆ Build the Prototype
- ◆ Test the Prototype
- ◆ Record the Data
- ◆ Analyze the Data
- ◆ Redesign and Retest as Necessary
- ◆ Conclusion

The Engineering Design Process Loop





Computer Design

Computer science is the designing and writing a program code for a computer. The program code is written according to the requirements set up by the student. After the program code is written, it needs to be tested to see if it works. The data is analyzed. **The program cannot be copied from another source. It has to be created by the student.**

Computer Design



- ◆ Define a Need
- ◆ Research
- ◆ Design Requirements
- ◆ Programming and Code Testing
- ◆ Record the Data
- ◆ Analyze the Data
- ◆ Redesign and Retest as Necessary
- ◆ Conclusion

Construct an Exhibit or Display

- It has to be neat. It should be typed in a legible font. Make it fun, but be sure people can understand what you did. You must show that you used the Scientific Method.
- Because of the limitations on what you can have in your project and the amount of space you have, it is very important that your project is laid out carefully on your project board.
- The appearance and organization is very important in showing your project well.