Introduction

Earthquakes and other natural disasters can damage or destroy man-made structures. You and your teammates will be working for a company that specializes in building disaster-proof structures. Your team has been assigned to a building project for a skyscraper that will be built in a city where earthquakes are known to occur, or are predicted to occur.

The city planners want to see your design along with the designs of other companies. They will select the best design for the construction of the skyscraper.

Task

Each team will design, build, and test a model structure made out of uncooked spaghetti sticks. Your model will be tested on a specially built earthquake machine. This machine simulates the stresses that occur during earthquakes. Your model should be able to withstand a 10 second earthquake without collapsing. You will be competing against other companies (teams) by attempting to build the best structure**.** You and your teammates will give a brief presentation prior to the final test. In this report you will discuss your Internet research and how it helped you design your structure.

Project Procedures and Requirements

1. Select individuals from your team to fulfill each of the following roles:
   - **Architect** (responsible for making an architectural drawing of structure)
   - **Treasurer** (responsible for financial matters for the team)
   - **Technology Director** (responsible for collecting / presenting internet research data)
   - **Project Manager** (responsible for obtaining / managing building materials and clean - up.)

2. Search the Internet for information that could assist you in your project. You may use the websites listed in the ***RESOURCES*** section of this project or you can conduct your own search. You should try to find websites that provide information on building structures that are able to withstand earthquakes or other natural disasters. Search for ideas that will help you engineer and design your structure.

3. Using paper, poster board or any other available resource make an architectural drawing of your structure. Your architect will make this diagram. Your design should support an egg at the top of the structure. The bottom of the egg must be at least 40 cm. above the tabletop. Design carefully! Your structure must be strong yet flexible. Your actual structure must closely match your drawing. Only minor changes will be allowed. Use your Internet research in your design.

4. Purchase the materials needed for your structure. You may purchase the materials from the Construction Supply Company (teacher). Your treasurer must complete a purchase order and write a check for the amount of materials you need. You will be given only 3 checks and purchase orders to use. Your total budget for all materials is **$4,875.00.** You may not exceed your budget.

Special Note:

Taking on any of the roles does not mean that you do all of the work. It means that you are in charge of that responsibility. Other members of the team can help you with your responsibilities and do part of the work.

Special Note:

You must provide the name(s) or URL's of the websites that you used in your final presentation. During your presentation you must explain how the information provided helped you throughout your project and to design your structure.

5. Begin construction of your structure. ***All team members participate in the construction process.*** The project manager is responsible for storage of your structure and materials. Be careful not to waste or unnecessarily damage your materials. Clean up your area when finished.

Special Note:
*The materials you will be using are delicate and can be easily damaged during construction or while being stored. You may purchase an insurance policy to protect you from this loss. This policy will allow you to purchase an additional **$1,500.00** of materials but you have to abide by the restrictions listed below. The cost of the policy is **$500.00.** This initial cost will be taken out of your budget. You may purchase a policy from the Insurance Agent (teacher).*

Insurance Restrictions:

- *Insurance must be purchased prior to beginning of the construction of your structure. Insurance purchases will not be allowed after construction begins.*
- *You may use the policy only in the event of a catastrophic loss. (Major damage) You may not use the policy for minor breaks or loss of material. The Insurance Adjustor will make the determination regarding the severity of the damage. Decisions made by the Adjustor are final!*

6. Your group will make a presentation to the class prior to the final test. (2 to 3 min.) You should explain why you think your design will support the egg and withstand the earthquake. You must cite examples from your internet research that support your design ideas.

Project Materials

PRODUCT	COST (per item)	ITEM NUMBER
• Spaghetti sticks	$100 ea.	SPA - 1234
• Mini marshmallows	$50 ea.	MAR - 5678
• Masking tape (1x1”)	$25 ea.	TAP - 9000
• Egg (small)	1 Egg will be provided free of charge. Additional eggs are $500.00 ea.	EGG - 2016

Rules for use of materials:

- *Spaghetti sticks may not be broken into pieces smaller than one inch in length (2.5 centimeters).*
- *Marshmallows must remain intact. Do not tear or break into smaller pieces.*
- *Do not eat any of your materials.*
- *You may not tape your egg to the structure.*
- *You must use only the materials your team purchases in class. You may not bring in your own materials or use the materials from another team.*

** To purchase materials your treasurer must complete the purchase order form and write a check for the amount you are spending. The treasurer is responsible for keeping track of how much money is spent and how much money is left. Purchase order forms and checks will be provided by the Banker (Ms. Houts).

Evaluation

RUBRIC

Your grade will be based on a special grading rubric. You should thoroughly review the grading rubric before you begin. Be sure you and your teammates understand what criteria will be used to determine your grade.

Be sure to check the *SPECIAL INFORMATION* below. This section gives additional information about grading. These instructions will also tell you how the overall winner for the best structure will be determined.

SPECIAL INFORMATION

1. Twenty points will deducted from your team score if you go over your budget.
2. Individuals may lose points on their score for the following:
    - Horseplay (-3)
    - Not staying in area with team / Running around (-3)
    - Too loud (-3)
    - Not participating appropriately (-5)
    - Disturbing other groups (-5)

3. The Building Inspector (Ms. Houts) will conduct final testing. Each structure will be measured and inspected for project requirement violations. Violations will disqualify a structure from competition. The Building Inspector's decisions are final.

DETERMINING WINNERS

Class period champions and the overall grand champion will be determined by the following:

CLASS PERIOD CHAMPION

1. The winning structure from each class period will be determined by the top overall score in the class. In the event of a tie, the tiebreakers listed below will be used.

GRAND CHAMPION

1. The grand champion will be selected from the individual class winners.
2. The grand champion will be determined by the top overall score. In the event of a tie, the tie breakers listed below will be used.

TIE BREAKERS

Tie breakers will be used in the following order:

- The structure with the smallest amount of money spent will be the winner.
- Prior to the final test (earthquake) the mass of each structure will be measured. In the event of a tie the structure with the lowest mass will be declared the winner.

TEAM SCORE SHEET

Your final grade for the project will be recorded on the "Spaghetti" Earthquake Team Score Sheet. Be sure to look at both of these pages carefully. This will help you to understand the scoring process.

Conclusion

To successfully complete this project you must work together as a team. There is a lot to do and to remember. Help each other in your various roles. Double check that you have followed all of the procedures and requirements correctly.