**Engineering Company Simulation Contest**

**Detailed Instructions:**

Students will be divided into teams of either 6/7 or 9/10 depending on how the final number of students turns out. Students will themselves decide how to divide themselves into three divisions: design, manufacturing, and quality control. They can decide how to allocate students between groups, as long as there are no more than 3 students (in the case of groups of 6/7) or 5 students (in case of groups of 9/10) in the manufacturing group. The subgroups will then divide into different rooms.

The design group will be given five small prototype structures built out of the same number of pieces (approximately 10, exact number TBD) of Lego Bricks. Their task is to create instructions (including words and pictures) of how to build these structures. Students will be given blank paper, graph paper, and pens. They can decide which structure to start with (numbered 1-5), and once the instructions are complete, the students will place the instructions in a large manila envelope, and hand it to a “runner.” The runner should probably be an LM-Post volunteer.

The runner will then deliver the instructions to the manufacturing division in an adjacent room, who will use the instructions to build the structures. The design team can immediately begin writing instructions for the next structure, and the manufacturing division can be working on several structures at once. Once the manufacturing division decides that it has finished a product, they will place it in a small cardboard box and hand it and the original instructions to a runner. This runner will deliver the structure to the quality control division.

The quality control division must inspect the product by comparing it to 3-4 printed pictures of the original structure, and if there is a defect they must determine whether the problem was in the initial instructions (the design team) or in the implementation of the instructions (the manufacturing team). Based on their findings, the quality control team will fill out an inspection form, either checking “approved” or “rejected” which specific comments as to the problem. The quality control team must then return the product with comments for how to fix it to the appropriate division for corrections. If the quality control team approves the product, then it is marked “approved” and set aside for grading.

A group of LM-Post volunteers will be in charge of marking down whenever a team hands in an approved structure. The time, team name, and structure number must be recorded. The LM-Post volunteers must determine if the structure is indeed correct. If so, the team receives one point for it, otherwise it is set aside for the case of a tie-breaker.

Throughout this project, the teams should be given as much freedom as possible. They can choose how to delegate responsibility, which order to produce products in, and whether to manufacture the products sequentially or simultaneously.

**Logistics:**

Each division must be in a separate room/space, and teams must be sufficiently separated from each other within a given room to prevent cheating. Each team will be given two runners (LM-Post volunteers) to deliver products between divisions.

**Time Table:**

10 min: Introduction and explanation of rules

5 min: Teams consult and decide how to delegate responsibilities

35 min: Competition

10 min: Discussion of problems that arose and possible solutions; simultaneous judging.

**Introductory Lecture:**

“Most training for science and engineering focuses on building or doing experiments. This is important, but in order to be a successful scientist or engineer, you must also be able to communicate with a team. The work you do and the intelligence you bring to a project are only useful if you can put them into words and drawings that others can understand. This communication has to be done clearly and efficiently, often between people who never get to meet each other in person. There are three major types of engineers in a company that creates products. These are designers, who develop ideas and plans for new products, manufacturers, who determine the best way to build the products and then produce them, and quality control teams, who examine the products created to find problems and then determine who needs to make improvements. These three teams are often located far away from each other, especially in companies that design products in the United States and manufacture them in Asia. The teams must communicate with each other by writing instructions and drawing pictures.”

“For this project, each team will be divided into three groups, a design team, a manufacturing team, and a quality control team. Your goal will be to correctly reproduce as many small Lego structures as possible in 35 minutes. You will be assigned several products made of Lego Bricks. The design team will be given product samples and the quality control team will be given pictures of the original products, but the manufacturing team will not see the products. The design team’s job is to explain on paper, with words and pictures, instructions for building the products. A runner from LM-Post will carry the instructions to the manufacturing team, who will be in another room. The manufacturing team will be given several plastic bags of Lego Bricks. Their goal will be to build the products according to the instructions. The manufacturers can choose to build products however they want – each person can build a whole product, or you can set up an assembly line to each attach a piece of the product, or you can organize in a way you think is better. Also, you can choose to have people work on different products at the same time, or to collaborate and work on one product at a time. When the manufacturing team produces a product, an LM-Post runner will take it to the quality control team. The quality control team will compare the manufactured product with the pictures of the original and see if it is correctly built. If it is, they will mark “approved” on one of the inspection sheets. If the product is not correct, the quality control team must decide if the problem is with the designers’ instructions or the manufacturers’ building. The quality control team must write instructions to fix the problem on the inspection sheet and send them back with the runner to the team that has the problem. The design team can rewrite their instructions and the manufacturers and rebuild the products as many times as it takes to make a correct product. It is important to work fast, but it is also important to be accurate and make clear instructions, or you will waste time making mistakes.”

“After 35 minutes, you will be told to stop. The team with the most correctly “approved” products will win. In the case of a tie, the team who completed their last correct structure first will be the winner. If no one correctly finishes a product, then the partially completed structures will be graded. One point will be awarded for every correct piece within a structure, and the team with the greatest total number of points will win.”

“When I say go, you need to divide your group into three teams, a design team, a manufacturing team, and a quality control team. You can divide your teams however you want, but there can be no more than \_\_\_ people in the manufacturing team. When everyone in your group has agreed to which team you are on, follow an LM-Post guide to the correct room. Now, go divide into teams!”

**Grading Instructions:**

LM-Post graders will mark the time of submission for each approved structure. They will compare the structure to their own original. If it is correct, then they will put a check mark for that team/structure on the attached “grading sheet.” If the structure is not 100% correct, they must mark the number of correct pieces.

 At the end of 35 minutes, the team with the most 100% correct structures will win. In the event of a tie, the team who completed their last correct structure first will win. If no teams have any correct structures, the winner will be the one with the highest number of correct “pieces”, each worth 1 point each.

**Materials:**

1. 6 Buckets of Lego Bricks. – Have in closet
2. 60 Small cardboard boxes (approximately 4” cubes). If this is not economical, 60 small pieces of cardboard which can be used as trays to carry the structures. – Used plastic bags last year
3. 80 pens – Have in closet
4. 1 Ream of blank paper (500 pages) – Have in closet
5. 1 Ream of graph paper (at least 300 pages) – Don’t have in closet- but can get some if needed
6. 75 one-quart Ziplock bags – Have in closet
7. 75 printed copies of attached “inspection form”

**Inspection Form**

**Team:**

**Structure (Product) Number:**

**⁭Approved ⁭Rejected**

***IF REJECTED*, send back to:**

**⁭Design ⁭Manufacturing**

**Comments:**

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**Grading Sheet**

**Write the time of completion for each structure. For a correct structure, put a check mark. For an incomplete structure, write the number of correct pieces.**

|  |  |
| --- | --- |
|  | **Structure** |
| **Team** | **1** | **2** | **3** | **4** | **5** | **6** |
| **1** |  |  |  |  |  |  |
| **2** |  |  |  |  |  |  |
| **3** |  |  |  |  |  |  |
| **4** |  |  |  |  |  |  |
| **5** |  |  |  |  |  |  |
| **6** |  |  |  |  |  |  |
| **7** |  |  |  |  |  |  |
| **8** |  |  |  |  |  |  |
| **9** |  |  |  |  |  |  |
| **10** |  |  |  |  |  |  |
| **11** |  |  |  |  |  |  |
| **12** |  |  |  |  |  |  |